Radio World®

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USA Digital Radio Takes Vegas by Storm

by Thomas R. McGinley

LAS VEGAS Team USA Digital Radio put it all together at NAB '95 and unveiled the long-awaited mobile demonstration of both the AM and FM in-band, on-channel (IBOC) digital audio broadcast transmission systems. A stationary demonstration was also available at the company's booth near the exhibit floor (see **RW**, May 3).

Even system skeptics and critics had to admit that the systems pressed the envelope to make its proposed systems perform very impressively in the almost-real world of a developmental mobile receiver traveling the side streets of the Las Vegas strip.

However, before seriously pursuing system implementation, USA Digital Radio must secure FCC selection after the EIA tests and National Radio Systems Committee (NRSC) recommendations are completed later this summer. Assuming it is chosen, the company will then begin licensing consumer electronics companies to manufacture receivers and start working with transmission system designers and manufacturers to further refine and implement system requirements.

USA Digital Radio achieves 20 kHz CD-quality audio by using MUSICAM audio coding up to 256 kilobits per second (kbps) plus ancillary data capacity up to 64 kbps. Important improvements in the IBOC FM DAB system since it was last shown include the development of variable music coding rate based on source demands, as well as a soft failure mechanism for graceful audio degradation under severely impaired channel conditions.

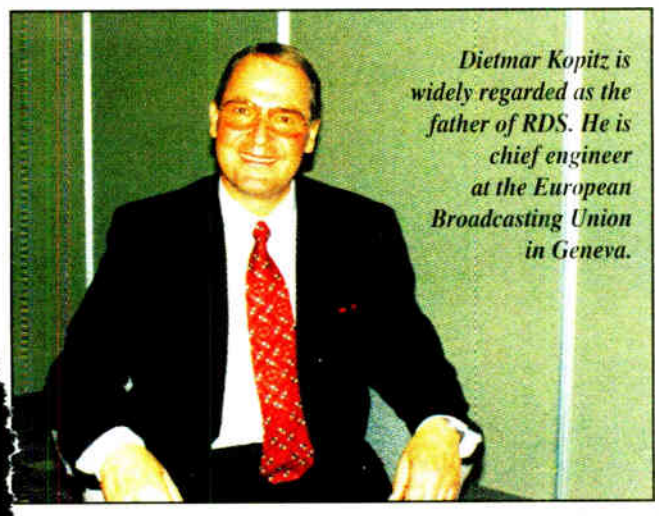
The FM and AM demos on chartered buses were conducted separately, traveling different routes in order to showcase the advantages of DAB over existing analog by direct A-B comparison in the moving bus.

The FM demo utilized the facilities of non-commercial KUNV(FM), a jazz station operating on 91.5 MHz at 1100 feet HAAT, 12 miles from the city, with 15 kW ERP (analog) and 700 watts of digital power multiplexed at the transmitter. KUNV transmits with a three-bay antenna

continued on page 8 ▶

A special RW award for engineering achievement goes to USA Digital Radio for its IBOC AM and FM DAB systems. Pictured are Glynn Walden (l), director of engineering, Group W Radio and Jeff Andrew, project manager.

RDS Innovator Predicts Technology's Success



Dietmar Kopitz is widely regarded as the father of RDS. He is chief engineer at the European Broadcasting Union in Geneva.

Editor's note: *You would never be able to pick Dietmar Kopitz out of a crowd on the street as being what some call "The Father of RDS." But that is indeed what he is—a visionary who helped develop, along with a host of skillful engineers, the RDS standard that we know here in the United States as the RBDS standard.*

An unassuming man with a telecommunications background, Kopitz is chief engineer at the European Broadcasting Union in Geneva. He has also worked at the EBU's Technical Center in Brussels, where he and others coordinated the development of new broadcasting technologies. While there, he became responsible for a group that looked after spectral management from the broadcaster's point of view, developed services with spectral demands such as those having to do with satellite, and digital broadcasting services for radio and television.

Kopitz sat down with RW's Alan Haber at NAB '95 for a wide-ranging discussion about RDS and a variety of related topics.

RW: *Let's talk about the history of how RDS got to this country, its success overseas, and what has happened in the two years since the RBDS standard was released.*

K: First of all, the history of the development of RDS is very long. We started in '74, and what we wanted to do was create a data service that would support what you now call Smart Radio. This is the main application. I think we wanted to give radio programs an identity. We wanted to make feasible that you can see what you hear—so (there are) the call letters display and... search tuning for program type and... radiotext to be broadcast. All sorts of program-related services.

When we started to develop this, we also looked at the possibility of creating a high-speed data system, and we have done all sorts of tests. The system had to be used in the mobile mode and we found out that at that time, we could not achieve a high-speed data system.

We had to be very cautious also with respect to not creating interference to the stereophonic channel. Particularly to program content like classical music. We had people who were actually able to detect the data stream when it was on the

continued on page 17 ▶

NEWSWATCH

Radio, TV Pitch in To Help Bomb Victims

OKLAHOMA CITY At press time, area radio and television stations were reported to be helping out with the disaster aftermath of the Oklahoma City federal building bombing.

The Oklahoma Association of Broadcasters headquarters felt the blast five miles from the disaster site.

NAB President/CEO Eddie Fritts said, in a release: "Again our industry proving that in a time of civil upheaval, there is no substitute for free universal (radio) service."

Complete story coverage on radio's response to the bombing will be included in the next RW.

RE Provides Codecs To SW Networks

WESTLAKE, Ohio SW Networks has selected RE America to provide audio codecs for its satellite and terrestrial links.

This comes in the wake of RE's recent agreement to provide Radio Data Service (RDS) codecs to 500-plus stations across the United States as part of the Electronic Industries Association's RDS promotion.

The company selected RE 660/661 encoders/decoders to transmit programming and information through a Wegener DR96Q qpsk satellite audio system and ISDN links. The RE codecs can create flexible data links ranging from 64 to 192 kilobits per second (kbps), according to the company.

According to Ron Schiller, SW Networks vice president of engineering and technical operations, RE was selected because of "shared interests in building the digital future."

The RE 660/661 codecs employ the ISO/MPEG Layer II compression algorithm. According to the company, the codecs are easy to operate and feature a simple setup.

RE codecs include as standard equipment a digital interface that can be configured in either an AES/EBU or SPDIF format, making it easy to keep signals in an all-digital domain. This interface also can be used for sample rate conversion and equalization.

Index

Arbitron Supports CouponRadio

by Thomas Pear

NEW YORK CouponRadio, Arbitron and the Interep Radio Store are joining forces to launch the first market study of CouponRadio's interactive listening technology in Miami during January and February of 1996.

Dave Alwadish, CouponRadio president and CEO

The equipment combines RDS (Radio Data System) ready radio receivers and a credit card size "smart card" to allow listeners to download broadcast advertisement information to the card from their radio receivers, CouponRadio President and CEO David Alwadish said.

Listeners could later take the card to a store with a kiosk machine—a type of interactive CD-locating machine already found at CD retailers—where product data along with a coupon would be printed out from the information saved on the card, he said.

"This is the first compelling application of RDS. It should help the technology progress faster because it offers clear benefits to the broadcaster and the listener," Arbitron Vice President Jay Guyther said. Guyther is the general manager of Arbitron's New Radio Ventures.

"We think this is a good opportunity for radio," Arbitron Vice President of Marketing/Communications Thom Mocarsky said. "We think radio can make money off this."

The study will involve Miami and Ft. Lauderdale stations WBGG-FM, WEDR(FM), WHYI-FM, WKIS(AM), WPOW (FM), WSHE(FM) and WTMI(FM). In conjunction with Arbitron, the FM stations will sponsor some sort of contest to distribute roughly 3,000 car receivers for the market test. An unidentified chain of Miami record stores will serve as the retailers for the study, Alwadish said.

Music stores are a natural tie-in to one of CouponRadio's features, Alwadish explained. If, for example, a listener driving along the edge of Biscayne Bay hears a catchy tune for the first time, he or she could merely press a button on his receiver to store the song title, artist and station ID. Later, when he comes to a stop he can insert his card—equipped with a microchip—into the car receiver to download the stored information.

The listener can then visit one of the participating record stores and once inside, insert the card into the store's kiosk to receive information about the CD and a purchasing coupon.

In conjunction with Arbitron, FM stations will sponsor a contest to distribute 3,000 car receivers.

Alwadish also said he is trying to involve fast food chains in the study, as those outlets are capable of printing coupons from their cash registers. "What is beautiful about Florida is that it is franchise heaven," he said.

The CouponRadio card also offers safety features because a motorist can store information in his or her receiver with a push of a button instead of trying to read it in real time on an RDS screen while driving.

Another advantage of the card to radio stations, Alwadish said, is that the card enables stations to invade the mostly newspaper-dominated coupon market and offer tangible accounting of how well the coupons are working.

"In today's marketplace, advertisers are looking for accountability," Interep Radio Store Marketing President Marc Guild said. "This is the ultimate accountability."

Also, an advertiser could see if the number one station in the market is the number one station for its products. Sometimes a number eight station can do a better job of targeting a product to a specific audience than the advertiser wants to reach, according to Guild.

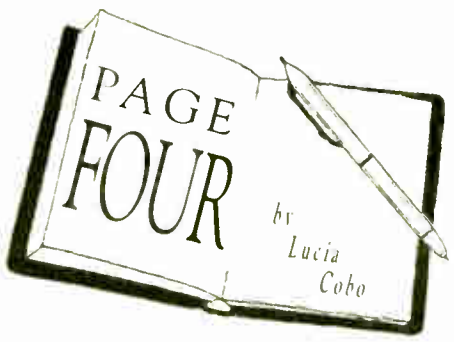
Eventually, as the technology goes into widespread use, Alwadish would like to see a chip that is fixed on the coupon cards placed on credit cards, allowing consumers to save product information on the same card with which it is purchased.

As a matter of fact, he noted, that is why the coupon card is the exact shape and size of a typical credit card.

One drawback, however, is that RBDS so far has only been developed for the FM band. But Alwadish believes that as RBDS grows in popularity it will eventually make its way into the AM band. He also believes CouponRadio could be incorporated into digital audio broadcasting (DAB), and therefore be a part of DAB.

Radio Reflects Ups and Downs of Life

WASHINGTON I hope I didn't surprise too many of you with my last *Page Four*. It seems to me that NAB time is always a great time to get worked up about things, and the high level of stress associated with that show for your humble **RW** employees merely facilitates climbing on that high horse and venting. I meant every word I wrote.



And if Chairman Hundt has trouble keeping up with radio, perhaps he should turn his attention to Oklahoma City. Unfortunately, radio shines more brightly during periods of terror and grief in the life of a community. Remember the San Francisco earthquake? The Los Angeles riots, and then the earthquake? The floods in the Midwest? Through it all, radio, and to some extent television, became the glue holding the communities together. At press time, many of the Oklahoma stations were running commercial-free programming geared toward the victims and families of the victims of the bombing.

The Oklahoma Association of Broadcasters reported to the NAB that a number of stations and state broadcasting associations have offered assistance to the victims of the bombing. Stations that wish to ask for donations should ask for them for the Governor's Victim Relief Fund, State Capitol Building, Oklahoma City, 73105. The NAB relayed this message in Radio Week from Carl Smith, executive director of the Okahoma Association of Broadcasters: "Your thoughts, prayers and concerns for our people are welcome and appreciated."

But if radio shines brightest during our darkest moments, it is because radio is always there, entertaining, informing and just accompanying us on our daily routines. Naturally, we turn to radio on a daily basis. Instinctively, we reach for it in times of trouble. The dichotomy says it all.

Often radio gets criticized for lacking imagination in today's programming, especially when compared to the programming of the '20s and '30s. In fact, if one were to believe everything that gets written in some of the medium's trade magazines, you'd think that indeed there are only six radio stations across the entire country. But I don't buy that.

As a society, after 200-and-then-some years, this country has become more homogeneous. So it makes sense that there be mass-appeal formats. But look at any market in the United States and you will find niche programming-be it talk, ethnic or very localized programs.

If the stations weren't good, the people would not listen. Everybody knows that.

I think my favorite moments are when radio entertainers remind us that you need to be just a little silly every now and then. WEJT(FM) in Decatur, Ill., recently pulled a stunt that reminded me of just that. A presumably homeless man roosted on a billboard along one of the city's streets on Feb. 22. The billboard (see photo) gave the plight of the homeless man, along with a phone number that connected to a cellular phone he was carrying.

WEJT's Don Glaze poses as a homeless man.

Callers were informed that the man's name was Don Glaze, and he and his family were on their way from Nashville to Omaha, Neb., when they ran out of money; well, except for just enough to rent the billboard and the cellular phone.

The local media got wind of the story and one TV camera crew even showed up to cover the story. At that point, WEJT 'fessed up: The stunt was a promotion to introduce Don Glaze, the new morning man, to the audience.

Later that week, Glaze and sidekick/newscaster Shannon Cantrell, tossed glazed donuts to cars cruising along the same street with their windows open. Talk about silly...

★ ★ ★

Anyway, on a much more serious note, I wanted to catch you up on some more NAB news. Seems our own Simone Mullins had a chance to chat with Elvis—well, actually, the Elvis impersonator I mentioned in my last column. He was a guest of FM 104 Select's Steve James and Harry Wong (the guys broadcasting from the BSW booth on the floor). Go Simone! That's one of the best impersonators I've seen floating around Vegas. (Or *was* he an impersonator?)

Swingin' with the King in Vegas

★ ★ ★

Congratulations to Michael Muthleb. RAB's Gary Fries announced that Muthleb is joining the RAB staff as vice president of marketing, to be based in the Detroit office. He will cover the Midwest, and is replacing vice president of marketing J.D. McKay who recently left to join the National Association of State Radio Networks.

Muthleb joins RAB from a 13 year stint in sales and sales management with Sports Illustrated. Prior to that, he spent several years at Detroit's WJR.

★ ★ ★

On a sad note, Elaine Jones of Gentner forwarded the obituary of Herb Jepko to me. He died March 31 in Salt Lake City. Herb developed and ran the popular overnight program "Nitecaps" in the 1970s. Elaine met him when she was doing an overnight news stint at KSL in 1974-75. According to Elaine, he had a "phenomenal memory for callers. Just by hearing the words, 'Hello, Herb?' he knew automatically who was calling and would jump right into a conversation as though he had been the caller's friend forever..." Our condolences to his family and friends.

READERS FORUM

If you have comments for Radio World, call us at 800-336-3045 or send a letter to Readers Forum (Radio World, Box 1214, Falls Church, VA 22041 or MCI Mailbox #302-7776). All letters received become the property of Radio World, to be used at our discretion and as space permits.

Natural leaders

Dear **RW**,

Years ago, when I was vice president for engineering at the Mutual Radio Network, I took the then upper management of Mutual to tour the beautiful studios of National Public Radio in Washington. Compared to the hole-in-the-ground of a basement that was the "world headquarters" of the "world's largest radio network" (Mutual, in case you've forgotten), NPR was like something out of "Star Trek." They came back from the tour scandalized over what had been done with "their tax dollars."

At that time, as it is today, NPR was a leader in broadcast technology and quality programming. No other network in the country had the commitment to technical quality NPR did and the facilities to carry it out.

It was among the leaders in the communities to improve service from the Bell System. It came right after Mutual in developing satellite distribution, and of course did it in a big way. Its nationwide training programs for engineers and producers was unmatched by any of the "commercial" networks or stations. I could write an entire article about the contributions public radio has made to the entire industry, in its quiet and polite manner. Public broadcasting has consistently spent its money providing quality programming at a high level of technical quality.

In my opinion, most commercial stations spent their efforts trying to line their pockets. There has to be at least one place in every industry to go to find the best, and no one else has shown even an interest—let alone an accomplishment. We all benefit from the existence of such an operation, whether we know it or not.

Public broadcasting is not perfect by any means, and there are many instances when I grumble at the radio. But I am listening. My biggest complaint is that there are still places in the country where I can't hear "All Things Considered," "Marketplace," or "What d'ya Know." In my opinion, the government of this country has done four things that work pretty well: civil rights, food for school kids, Social Security, and Public Broadcasting. Now they should quit screwing with them and work on something else. It ain't broke... don't fix it!

Terry Skelton, Audio Consultant
Doylestown, Pa.

See the light

Dear **RW**,

As a public radio producer, I was interested in the comments of David Anderson, Tony Wortmann and Fred Weinberg in your March 22 *Reader's Forum*. They don't like public broadcasting. Dave is worried that public broadcasting unfairly competes against his free market. Tony and Fred come right out and say it: public broadcasting is full of "liberal drivel," "democratic and socialistic principles."

Golly, guys, I finally see the light. I didn't fully understand the threat that public broadcasting was posing to free market values. I'm a changed person. You've made me a true believer.

I now believe in freedom and choice so much, I've become an advocate of a totally unregulated broadcasting marketplace, completely free of government intrusion. How dare the federal government think it can impose its Big Brother whims on the American broadcasting industry by regulating my freedom to do business, and supporting with my tax dollars competing broadcasting entities.

But hell, let's not stop with programming. Let's do away with all regulation. Right on, Newt! Let's open up broadcasting to everyone. And what keeps American taxpayers out of the broadcast arena of ideas more than the FCC's restrictive technological so-called standards, that tells God-fearing American broadcasters when and where they may operate a transmitter?

So Fred (President of KTRT 1270 in Tulsa, Okla.), I'm going to take my rightful place in the free market and start in your backyard. I'm building my own 1 million watt AM transmitter. I'm going to erect my own 5500 foot tower (I don't believe in government interference by the FAA or local zoning authorities, either) on the highest hill outside Tulsa, and I'm going to broadcast on 1270 morning, noon and night. I want to win your audience, Fred, because I'm sure it's just the kind of audience I want to serve, and it's my right as an American businessman to compete in the marketplace of my choice without undue government regulation. Sorry if I step on your signal, bud, but if you can't compete, well, I don't see why government intrusion in the marketplace should keep you in business artificially.

But, better yet! I've decided to design a brand new method of over-the-air broadcasting that will be more efficient than any method currently in use. It's miracle technology. I can blanket the entire United States with my signal and run the transmitter at the cost of running an electric clothes dryer.

I'm going to start by distributing free receivers with pictures of the Power Rangers all over them through Saturday morning children's programming. From there, I'll branch out and leave truckloads of receivers in rock and roll clubs in all major cities. Maybe I'll enter into a licensing agreement with the Hard Rock Cafe chain. If I play my cards right, my technology will become the dominant method of broadcast transmission.

Oh, but sorry, all you other guys, your signals can't be picked up on my receivers, so you'll either have to broadcast with my transmitters or get out of the business. Hey, that's the free market, right?

The fact is, all broadcasting is supported in some way by the government. What the conservative members of broadcasting don't like to admit is that they love the government support that protects their signals and their equipment (at taxpayer expense) and hate the standards they perceive are giving "competitors" unfair advantage.

Look, boys, whine all you want, but you won't convince anyone that "All Things Considered" is in direct competition with your local afternoon drive, or that if "Morning Edition" happens to lose its mind one morning and does a nine-minute piece on "Lesbian Poets of the Holocaust," that somehow this equates to forcing socialism down the throats of an unwilling public.

The argument is really about "I want your frequency." Universities and other community groups all over the country hold the license to what would become really valuable pieces of property if suddenly the signals went black. The conservatives, rapidly running out of frequencies everywhere else on the band, want them. And their pals in Congress are trying, through legislation, to hand them over. It's called piracy. Pure and simple.

So you don't like public broadcasting and the federal support it receives, which right now I believe is at an average of 13 percent per station? Tough. A lot of your fellow citizens do like this support, they do like public broadcasting, and as American citizens, have the same right to want that support to continue as you do in wanting the government to continue protecting your share of the pie.

Which is a pretty damn big piece, all told. I don't think you guys are hurting.

Kevin D. Powell, Producer
Public Radio, Stony Brook, N.Y.

Pleasureable experience

Dear **RW**,

What a pleasure to hear skywave AM radio as it must have sounded 70 years ago, with little fading and no interference. The experimental stereo digital/analog broadcast of KUSA on 1660 kHz from the NAB convention in Las Vegas was received clearly every night in the Bay area by several broadcasters, including myself, who read about it in **RW**. Reception became possible about one hour before local sunset. If this is any indication of how the expanded band will sound when fully functional, AM stereo has an excellent chance to compete with FM signals.

Ken Carpenter Sleeman
General Manager
Morton Communication
Petaluma, Calif.

A Little DAB'll Do Ya

The successful public demonstration of USA Digital Radio's AM and FM digital audio broadcasting transmission system at NAB '95 suggests it is farther along the developmental road than the other proponents (save Eureka-147). USA Digital Radio's in-band, on-channel scheme would least disrupt the current United States station allocation structure.

Judging from the demonstrations at the National Association of Broadcaster's convention, the system seems to deliver as promised and offers enormous potential for FM and AM stations. Imagine having the range of analog AM with the fidelity of FM.

With that said, it's premature to annoint the USA Digital system the winner. The systems are just emerging from the R&D stages and still need fine-tuning before real-world implementation is possible. We have yet to hear what the two AT&T systems sound like, or for that matter, Nasa/VOA's. The lab testing of all systems, under the careful leadership of the National Radio Systems Committee (NRSC) and the Electronic Industries Association, will not be completed until later this summer. The official field tests are to be conducted later in the year.

Once a recommendation is made, the Federal Communications Commission then has to decide how to implement technical parameters for a DAB system. So the industry is still a few years away from a wholesale DAB implementation—but not that many.

Now is not too early for radio broadcasters to continue and/or begin their digital education. As evidenced by the digital sessions at NAB, there is a lot of information to keep up with—especially the proliferation of competitive digital audio services (cable radio, DBS) and the promise of satellite DAB on the horizon. Station owners and engineers must stay up-to-date on the technological developments if they are to remain the primary audio service to the nation's thousands of communities.

—RW

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Surf's Up for Users of the 'Net'

Radio Stations Can Benefit from Both a Ratings and An Awareness-Building Standpoint with a Web Site

by Alan Haber

LAS VEGAS Surf's up, or at least it was up at NAB '95. Waves of interest in the Internet swept over broadcasters during the lively "Computer Technology for Broadcast Support" session.

There was no waxing of surfboards—just a comprehensive overview of the benefits that radio stations can realize from having a presence on the Internet, specifically, on the World Wide Web (WWW).

Tim Pozar, engineering manager of "Smooth Jazz" KKSF(FM) and classical KDFC-FM in San Francisco, joined Victor T. Jester, chief engineer of new rock WNNX(FM) in Atlanta, and Bill Ruck, engineering manager of KNBR(AM) and KFOG(FM) in San Francisco, in an **RW**-sponsored roundtable examination of the ever-strengthening marriage of radio and the net.

RW's roundtable on the 'Net' featured radio engineers Victor T. Jester(l), Tim Pozar (c) and Bill Ruck (r).

Commercial

Right up front, Jester said that being on line can provide income to stations, but cautioned that such income should be garnered in a tasteful way. "You can't play commercials all the time, so you can't have a strictly commercial site," he said.

Pozar agreed that stations should be careful about how commercial they are in cyberspace, pointing to the "old world philosophy" that positions the Internet as having been developed as a non-commercial network.

It is better for someone visiting a Web site to choose to connect to an advertisement than to be hit over the head with one.

A lot of people have a problem with the commercial nature of the Internet, but Pozar suggested that there are ways to get around this, such as saying that something on the Web is underwritten by an advertiser.

He also said that stations can conduct giveaways in conjunction with advertisers—a way to get people to read a page of advertising. The bottom line is that it is better for someone visiting a Web site to choose to connect to an advertisement than to be hit over the head with one.

But while stations may be able to profit from being on line, Pozar invoked another, perhaps even more important, benefit—goodwill. KKSF and KDFC-FM's Web site mainly functions as a goodwill ambassador, bringing station playlists and concert information, among other things, to listeners.

Positive feedback

The response from listeners excited about being able to be interactive with station personalities via e-mail was very strong. "This just thrills the dickens out of our listeners," said Pozar. And don't forget about the disc jockeys—they are excited, too. Most of the e-mail received from listeners is very positive.

Jester said that 99X's morning show is getting more and more involved with the 'Net,' replying to listeners and, interestingly, placing more faith into the comments received by e-mail than via the phone. And the station's new rock format may have something to do with it all.

"Our target audience is an age group for whom computers are second nature, so it was a natural for us," he said, adding that it might be a bit more difficult for other formats. But, he said, "There's no reason you cannot make it work with any format."

Ruck said his stations' primary concern in using the Internet is super-serving the listeners. The concern for the stations is that by going on line, the listeners feel that the stations are doing "all the right things, and in every way possible, are serving their needs."

The cost of putting up a Web site can vary, depending on variety of factors, such as the complexity of graphics. But Pozar said that if a station gets an additional diary or goodwill out of the enterprise, then it's worth the expense.

Personal replies

All of 99X's DJs have e-mail addresses, said Jester; if they get negative e-mail from listeners, "It's a real opportunity to sit down and personally reply, and turn that negative into a positive."

Ruck boiled it all down to an old radio adage: "A phone call is worth a hundred listeners, and a letter is worth a thousand listeners. E-mail is somewhere in between those two. So the easier you get feedback from people, the more they think about your station, and that's what it's all about."

There are seemingly innumerable opportunities to promote radio stations through cyberspace, including real-time broadcasting of on-air programming. But for all the excitement over radio stations' embracing of the medium, there isn't much danger of the 'Net' becoming a replacement for radio.

Radio stations may find that being on the Internet and having a WWW site for their listeners to access is a good promotional activity. Once a station goes on line with a Web site, said Jester, "You have to devote in-house, or in-house and contract, resources to maintain it. It's like any other service. You don't want ski reports in July, and you don't want your Internet page, when somebody brings it up—a potential client, for instance—to pop up with information that's no longer of any value."

In other words, keep the information available on line up to date and fresh, so listeners will come back and access a site again and again.

Usenet Alive With Digital Discussion

by T. Carter Ross

WASHINGTON Even before the first bus was fueled for mobile listening tests, KUSA(AM) was garnering ratings as the experimental USA Digital Radio station for tests conducted in Las Vegas during NAB '95.

In several radio-related Usenet newsgroups on the Internet, broadcasters, DXers and the members of the Group W team were reporting and QSLing the analog counterpart of the IBOC digital AM signal as far away as California, Idaho, Washington state and Minnesota. One person reported hearing KUSA in central Pennsylvania.

DXers raved about the clarity and reach of the 10 kW analog signal and 160-foot HAAT tower. They also pointed to the lack of interference in the expanded band and waxed nostalgic for clear channel stations.

Listeners reported hearing musical programming on KUSA ranging from classical to country to rock, as well as a lot of test noises. According to Group W engineers, the noises were USASI Pulsed Noise, which was used to stress the Orban Optimod analog processing system.

"USASI noise gives us a repeatable test signal for measuring Bit Error Rate in the digital transmission," said Glynn Walden of Group W in a posting to the rec.radio.broadcasting Usenet. "When you hear us playing music we are usually out in the van listening to the DAB transmission."

In the Broadcast Professionals forum on CompuServe, the mood was more skeptical.

While the Usenet discussion consisted mostly of DXers listening to the analog AM signal, several people who had taken the bus ride raised questions on CompuServe about the viability of an in-band, on-channel (IBOC) AM system.

Concerns that the bus route for the AM test was "an easy course" were raised. It included passing under only one overpass and it avoided the tall buildings of the strip, all of which might have caused fading. Also the point was raised that few stations have as simple an antenna system and pattern as KUSA.

Complaints about "digital hash" on the AM sidebands of the analog signal were noted in both CompuServe and Usenet, which raises a question about the ability of analog and digital signals to coexist without causing co-channel interference.

But despite these concerns, the general feeling in the forum was that although it may not be just yet, DAB will arrive in the near future.

RE America Stands Behind RDS Effort

by Alan Haber

LAS VEGAS While the fast moving feet of NAB 1995 attendees shuffled around him, RE America President Soren Pihlman stood in his booth and reflected on his company's participation in the Electronic Industries Association's (EIA) RDS promotional program (RE will be supplying encoders and educating broadcasters about RDS in such venues as SBE chapter meetings). He also spoke about RE's long-standing relationship with the technology.

RE is "very happy and very proud to be able to participate in (the EIA) program," Pihlman said. "I think it is going to make a difference in the general public recognition of RBDS in North America. And, with the support of the receiver manufacturers, with the advertising that the program is going to bring to the market, we believe it is going to make a big difference in RBDS."

Similar progress

Pihlman thinks RDS's progress in the market is similar to that of AM Stereo, although he said there are differences. With RDS, he said, "We have a standard. There's no disagreement on what the technology is. I think what we need is... the transmitters on the air. We need the radios in the shops."

Just as with any other system for consumers, Pihlman said, there has to be some benefits. "There has to be some features that they see, they like. If they like it, they'll buy it. And, right now, if you go to the places where you buy consumer products, they have some big trouble tuning into a signal where they can really demonstrate the powerful system that RBDS is" because there aren't enough stations on the air with the technology.

The 500 stations that EIA anticipates it can get on the air will kickstart the market one way or another.

A thousand stations on the air with RDS in a year as a result of EIA's program "is not out of line at all," Pihlman said. "The 500 stations that (EIA) anticipates it can get on the air with (the) program will kickstart the market one way or another, and the (other stations) will follow."

As far as more companies throwing their hats into the RDS ring, Pihlman said, "As a manufacturer, you are always looking at who else is offering a product. I think, if you look at the number of manufacturers offering products that sit on transmitters in the broadcast end, there are quite a few of them there. That's usually an indication that there is a market. At least, we all agree that there should be a market, but, again, what do you put out first—the transmitters or the receivers?"

Move the market

A manufacturer cannot move the market for RDS, Pihlman said—an effort such as EIA's is needed "to really draw attention to the technology, and with an effort from both the broadcast end as well as the consumer end, I think it will work."

The number of stations that will go on the air with RDS down the line is up in the air. Pihlman said he doesn't think all stations will embrace the technology, although, he added, "you never can tell... If having RDS makes a difference on whether people listen to your station or not, well, you may just see a complete transition into RBDS broadcasting."

Frank Lucia on Deck For FCC EAS Post

WASHINGTON Frank Lucia will likely succeed Helena Mitchell as EAS chief, said Compliance and Information Bureau (CIB) Chief Beverly Baker.

"He has been working on it (EAS) a long time and obviously he is very good at it," she told **RW** at this year's spring NAB show. "He knows all the details."

The EAS department is a division of CIB, and as acting EAS Chief Lucia reports directly to Baker, as did former EAS Chief Helena Mitchell.

After serving as EAS chief for a few years, Mitchell was promoted to assistant to Office of Engineering and Technology Chief Dick Smith.

Lucia's appointment will not be finalized until the FCC finishes restructuring EAS," Baker said.

"EAS is going into a new phase, exactly what kind of staff we need and how to integrate that staff is an issue we are looking at," she said, adding that the FCC does not want to name an EAS head "until we know what the department is like."

But, whatever the staffing arrangement turns out to be, Lucia will play a key role," Baker said, stressing Lucia's EAS experience.

"He has worked this beat for a long time and he really knows it," she said.

During an EAS presentation at NAB, Lucia was given a congratulatory round of applause as he was introduced as acting EAS chief by Mitchell.

But overall Lucia is low key about his prospect of being EAS chief, refusing to comment until all is finalized.

"I am acting chief right now, that is all I can tell you," he said.

USA Digital Radio

▶ continued from page 1

side-mounted on a self-supporting tower on Black Mountain, the community FM site for the Las Vegas market, and includes a 92 kHz analog SCA with Korean programming.

The analog signal used a standard Optimod audio processing chain, lightly processed. The DAB audio was essentially unprocessed and was conveyed to the transmitter site via QEI Cat-Link from the KUNV studio over T1 lines, and remained digital throughout the link to the output of the proprietary DAB exciter.

Inside the bus, the AM and FM systems each filled a separate short rack with the receiving and decoding equipment. The analog FM receiver was a stock consumer FM tuner while the DAB gear took up most of the remaining rack space with the proprietary receiver and MUSICAM decoder. Both the DAB and analog outputs were fed to a distribution amp that provided stereo headphone audio to every seat in the 18-passenger bus.

Consortium partners CBS's Tony Masiello, Group W's Glynn Walden and Project Manager Jeff Andrew before the first demo ride.

Each seat was equipped with Analog and DAB selector buttons so that the listener could readily compare the audible differences. A visual display of the transmitted 91.5 MHz signal was visible on two overhead spectrum analyzer extension screens so that everyone could easily see how brutal the mobile environment really was when presented to the front end of both receivers.

Before embarking on the FM mobile excursion, the POF (point of failure) mode behavior of the system was demonstrated. An RF attenuator was placed at both receiver front-end inputs. With 61 dB of attenuation, the DAB signal was perfect, with no form of degradation evident. The analog signal, on the other hand, was very noisy and basically unlistenable. Beyond that level, the FM DAB high frequency response began rolling off, but the signal was still useable.

At 63-64 dB, the high frequency response dropped dramatically and "chortling" noises in the audio were evident. Just beyond that point, a short buzz or "MUSICAM honk" was heard before the audio muted as the system reached POF.

Tony Masiello of CBS Radio "narrated" the FM press trip and answered questions along the way. The DAB signal could be called "narrow-band split channel spread spectrum" and resides in two chunks on the lower and upper protective sideband portions of the 460 kHz-wide FM DAB channel. It "carves out" the middle 220 kHz of the channel so that the analog FM is left undisturbed.

The two DAB signal components are each about 120 kHz wide on each side of the analog and are transmitted approximately 38 dB below the analog carrier.

Multipath mitigation on FM DAB occurs because of adaptive equalization and the fact that the coded digital information is spread out at the opposite ends of the 600 kHz-wide FM channel mask. If a selective multipath "hit" wipes out any part of either half of the DAB signal, all of the necessary data to decode the entire signal is available in the other half. Masiello explained that only a very long-duration intense multipath reflection would be capable of impairing data recovery across the entire channel to push the receiving process into failure.

Overall, the demonstration was almost spectacular, considering the limits in which the USA Digital IBOC FM DAB system is constrained to work.

The route chosen to demo the FM DAB system was specifically planned to include significant multipath holes, set up by the proliferation of tall hotel buildings along the strip.

Masiello alerted everyone to upcoming "difficult" areas where multipath was especially heavy. Because of the MUSICAM codec and interleaver requirements, the DAB signal was delayed from the analog by about three seconds—helpful during the evaluation comparisons, enabling you to hear the analog crashing in a bad area and quickly switch to DAB to hear how well it held together in the same area.

The analog signal seemed to be quite sensitive to even minor amounts of multipath while the DAB was very robust. The Sounderaftsman analog tuner used did not have a blend circuit, as do a number of car receivers. The spectral display confirmed the almost continuously recurring presence of multipath slicing down through the waveform. The "hits" could be seen erratically bouncing along the display.

When the DAB system did mute and recover, the annoying "MUSICAM honk" was heard. We also heard occasional "gouging ticks" about -20 dB under the DAB audio. They would occur when there were no DAB data errors, and Masiello speculated they were probably data anomalies on the T1 Cat-Link circuit that had been installed only days before the convention.

Masiello said that the 92 kHz SCA had experienced no service degradation with the addition of DAB.

There was no opportunity to judge whether the presence of the digital signal was actually degrading the analog receiver performance, particularly with regard to its apparent sensitivity to multipath. Such a showing could have been made by momentarily switching off the digital modulation, perhaps by remote control.

Different FM receiver designs handle multipath distortion better than others. Not intended as a slight at Sounderaftsman (since I am not familiar with all their products), USA Digital may have picked one of the poorer performers.

A local engineer remarked that KUNV was both the best and the worst station in the market to use for this demo because it was known as perhaps the worst signal on Black Mountain relative to coverage problems due to multipath. While the KUNV analog signal may suffer from more multipath than others—thus making the comparison with DAB more impressive—transmitting DAB on KUNV put the DAB system to perhaps an even more demanding demonstration of multipath mitigation.

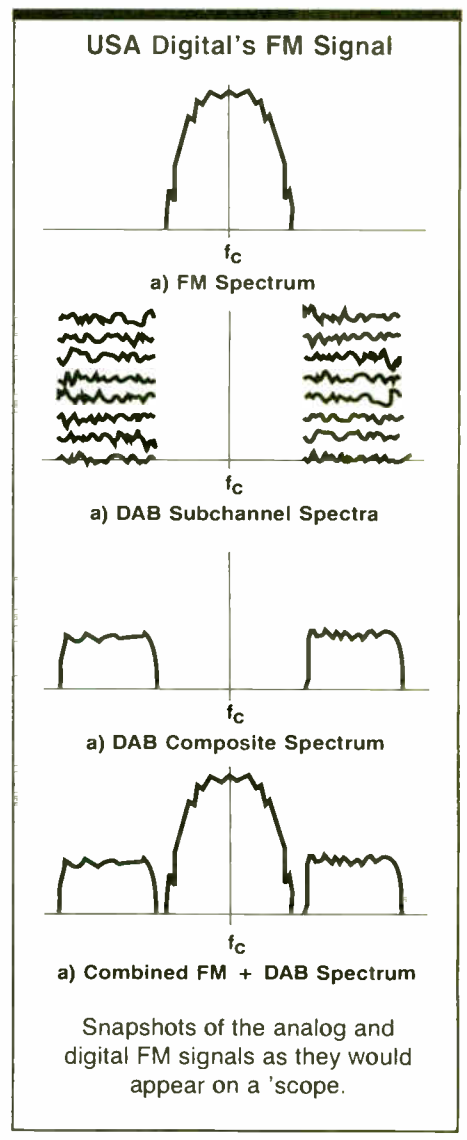
A more difficult multipath test for the FM DAB system will come this summer when it will be tested over the air at Shamrock's KSAN-FM in San Francisco.

After the bus returned to the convention center, Glynn Walden of Group W Radio switched the monitoring gear over to the AM DAB receiving system and served as the AM tour guide. The USA Digital AM DAB station was operating as KUSA on 1660 kHz at 10 kW analog. A slightly modified Harris DX-10 transmitter drove one tower of a silent six-tower array seven miles south of town.

Digital modulation was impressed on the carrier approximately 25 dB below the analog. Programming was provided by a studio setup in the Harris Allied booth in the NAB audio exhibit hall, conveyed to the transmitter via digital STL. The analog signal was processed by a standard AM Optimod, while the digital was essentially unprocessed.

USA Digital Radio IBOC AM DAB produces 15 kHz stereo response using MUSICAM audio coding at 96 kbps. With error correction and a 2.4 kbps ancillary data channel, the total data rate achieves 128 kbps in a 40 kHz channel and complies with the NRSC mask.

In the bus, a standard Delco car radio set to wideband delivered the analog audio, while the rest of the AM rack was filled with the developmental Xetron direct-conversion AM IBOC DAB receiver and MUSICAM decoder. The overhead spectral display showed the channel sideband magnitude response. However, the display changed very little throughout the trip except when the system failed briefly while going under a six-lane-wide parking garage.



Snapshots of the analog and digital FM signals as they would appear on a 'scope.

The most disappointing "flaw" in the AM comparison demo, was the fact that the audio quality of the analog was just awful. It sounded like a misadjusted Optimod with a very harsh and honky-sounding compressed high end. Some of this may have been a problem with the receiver, as an independent check on an expanded-band Walkman sounded a bit better.

The sound quality of the analog receiver

continued on page 14 ▶

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Unravel the Maze of Music Licensing

by Alan Haber

LAS VEGAS Keeping all the details associated with radio music licensing straight is a complex, but ultimately rewarding, process, when you consider the alternatives. Without knowing the latest information about how to prepare for an ASCAP or BMI audit, how to fully utilize the resources of the Radio Music Licensing Committee (RMLC), and what to consider when determining whether a blanket or program license is more appropriate for your station, it would be difficult to stay afloat.

Then, there are the issues of the new BMI rate court, and SESAC-related developments.

The NAB '95 workshop session, "The Hits Keep Coming—Radio Music Licensing, Your Money & Managing Both To Win," helped keep attendees straight on the important issues at hand.

How people feel

David Fuellhart, executive director of the RMLC since 1990, told the audience that "There isn't a lot funny about music licensing." Fuellhart said music licensing reminded him of "a funny man, Woody Allen, who once said he wasn't afraid of dying—he just didn't want to be there when it happened. I always thought that feeling describes how most radio people feel about music licensing."

The RMLC, Fuellhart said, helps radio broadcasters with advice and support relating to their dealings with music licensing organizations. The committee is funded by station owners, group operators, radio networks and rep firms "who believe that radio must be united in its dealings with the music licensing organizations," he added.

Most people, Fuellhart said, "are born into this world knowing that two things are certain. Radio people know that three things are certain—what we at the RMLC like to call 'The Greatest Hits of All Time'—death, taxes, and music license fees. These are facts of life for us."

During his presentation, Fuellhart asked a number of questions, related to music licensing, in the style of a very popular television game show; for example, if stations decide not to pay music license fees and ignore the warnings from the license organizations, how much money could they be sued for copyright infringement per title they broadcast once they lose their license? The answer: the law allows for $500 to $10,000 for each occurrence.

A billion dollars

Every member of the RMLC helps manage a billion dollars of radio industry money, Fuellhart said. "Over the life of the current ASCAP and BMI contracts," he said, "Radio will have anted up very close to one billion dollars in music fees to those organizations." A billion dollars of the radio industry's money, he added, can't be a part-time concern.

There are two types of music licenses, Fuellhart said: the blanket license, which allows stations to use all the music they want 24 hours a day, for which each station pays a percentage of its revenue minus some deductions; and the per program license, which allows stations to use music for limited periods during the day. In day parts, they choose (stations pay a base rate for incidental music, and a higher percentage for performance of music, but only for periods that are weighted in which the music is played during a year).

Current developments

It's important for stations to know about current developments that could impact their business, Fuellhart said, including the broadening interpretation of revenue clauses of their music licenses. Fuellhart told the audience to keep careful audit trails for special sales packages in order to show auditors that parts of sponsored revenue are used solely for the expense to create the package.

He also said it's a good idea to prepare proper invoicing for clients that delineates the portions that pay for broadcast facilities and those that are for packaged, non-broadcast costs. If this is not done, stations might have to pay license fees on revenues that are really credits against the packaged non-broadcast products or services.

The RMLC, Fuellhart said, is closely monitoring developments that could present financial challenges to radio in the future, such as the growing presence of the third music licensing organization, SESAC, which concentrates on Hispanic music, but is also taking a stab at country and other mainstream forms of music. The RMLC, he said, recommends that music stations get a SESAC license.

Best advice

Fuellhart said his best advice concerns dealing with music license or performance rights organizations in a dispute or disagreement. He said "to take everything they say and everything they write in letters and notices seriously. Capital letters. Seriously. They will do what they threaten, unless you respond to them. They may not react right away, but they never forget."

a message to am stations from frank foti

Dear Fellow Broadcaster,

My first job in radio was at WELW-AM in Willoughby, Ohio. I was the engineer, production director, morning disc jockey, sports announcer, and music director. Over my next 20 years in radio, I spent most of my time as an engineer at AM and FM stations and focused on improving the art of broadcast processing.

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- *Unity Remote Software.* Whether you have a single station or a national network, you will appreciate being able to adjust the Unity AM's processing from virtually anywhere by computer modem. Processing can be evaluated in "real-world" listening environments rather than in a noisy transmitter room.

- *NRSC compliance.* The Unity AM complies fully with NRSC pre-emphasis and low pass filtering requirements.

- *Stereo and monaural operation.* The Unity AM operates in either discrete left/right or matrixed L+R/L–R processing modes.

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Best regards,

Frank Foti

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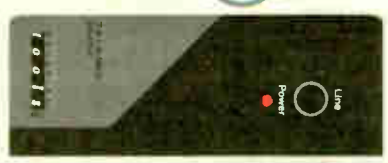

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All-Digital Future within Radio's Reach

by Thomas Pear

LAS VEGAS Digital technology dominated last month's events, exhibits and engineering sessions at the NAB show. Pulling it all together was a digital audio broadcasting (DAB) session titled "The All-Digital Radio Station."

First on the agenda for discussion was USA Digital Radio's demo bus trip—a momentous event for the in-band-on-channel (IBOC) DAB developer and for those listening to digital airwaves for the first time.

But what was a demonstration to NAB attendees was actually a scientific study to USA Digital, noted Glynn Walden, director of engineering for Group W, which is part of the USA Digital consortium.

"A lot of people did not realize that we were out making measurements," he said.

At the session Walden discussed preceding DAB experimentation and how USA Digital has since compensated for discovered DAB weaknesses and improved on the system.

During Cincinnati mobile testing last September, for example, USA Digital found that AM DAB is vulnerable to differing frequency responses on the upper and lower sidebands when approaching bridges and power lines, Walden said.

Generally, when one sideband is reduced in level, the other sideband is simultaneously increased, creating what USA digital has a dubbed "a tilted channel." It is not uncommon to see variations of 30 dB end to end across the DAB spectrum, Walden noted.

For mobile reception, USA Digital developed a new receiver that is capable of dealing with unexpected tilt coming across the channel when approaching obstructions like bridges and power lines.

Specifically, the system will compensate for channel tilt and continue to recover DAB as the receiver traverses under city infrastructure, Walden noted.

Also, USA Digital found that the AM coverage area of the 15 kHz AM stereo signal delivered digital quality to the 1.2 mV/m contour, confirming similar measurements made in the fall study, Walden said.

USA Digital was scheduled to conduct further tests to confirm the coverage area a couple weeks after the show.

At the 1 mV/m contour, USA Digital observed nighttime self-fading conditions on KUSA, the Las Vegas station on which the DAB demonstration was broadcast.

In these tests, Walden said, the fades appeared to be flat fades where audio was recovered as long as the signal was in excess of 1.2 mV/m. No audio was recovered when the signal fell below 1.2 mV/m.

Although there were no noted phase or channel response anomalies on KUSA, according to Walden, USA Digital expects to see these anomalies under different conditions and has already taken precautions.

"The receivers are designed to deal with the anomalies," he stressed. One of USA Digital's features in its FM system is graceful degradation—a condition where the signal fades out instead of abruptly muting—commonly referred to as the "cliff effect."

"It is a whole lot more pleasing than the cliff effect," he said noting that feature will be included into the USA Digital AM receivers via the National Semiconductor chip using the Corporate Computer Systems' MUSICAM in the next several months.

But despite the success of USA Digital, IBOC still has its opponents. During the DAB session, Eureka proponent Dr. Paul Ratliff, who noted that Europe and Canada are adopting L-Band DAB, argued that the International Telecommunications Union has agreed to adopt a world-wide DAB standard and that the Conference of Postal and Telecommunications Administrations (CEPT) is scheduled to hold L-band DAB frequency allotments in July at Weisbaden, Germany.

Ratliff said that a market study which started with just a few stations a couple of years ago will have 27 stations by the spring of 1998.

Ratliff then questioned the logic of a world-wide DAB system that would require consumers to purchase different receivers as they left the United States to travel abroad.

He argued that "out-of-band" DAB provides the capacity to make multimedia a reality through its ability to carry accessory data.

Proponents, however, said that the USA Digital Radio IBOC system will be able to accommodate data at a rate of 64 to 128 kilobits per second.

Ratliff said the IBOC digital signals could adversely affect the analog signals. "We live in a fairly mature FM market," he said. "Putting digits on top may damage analog broadcasts."

He then noted that L-band DAB is ahead of the game implementation-wise. Broadcasters can already order wideband DAB production supplies.

Describing a comparison between IBOC

continued on page 14 ▶

Vegas' Digital Airwaves

▶ continued from page 8

may be moot anyway. The AM DAB audio was really something to behold. Listening to 15 kHz stereo out of an AM radio almost brought shivers to the spine. Even had the AM analog sounded better than it did, the difference would have still been massive.

Walden explained how USA Digital Radio discovered a new phenomenon while evaluating system failure when riding through an underpass. It turns out that an underpass forms a loop antenna which selectively attenuates or "tilts" the channel sideband response differently, depending on which side of the road you are traveling. This means that phase response across the channel and sideband symmetry will be more important with IBOC AM DAB.

However, Walden explained that adaptive equalization at both the transmitter and receiver ends within the error correction coding will minimize reception problems relating to sideband response anomalies. The consensus among USA Digital engineers I interviewed was that if a transmission system has been optimized for C-QUAM AM stereo and works well, it should be acceptable for AM DAB. They did concede, however, that old plate-modulated transmitters and some of the marginally designed directional antenna arrays may not accommodate AM DAB.

The failure point of this system occurs at 1.2 mV/m of received signal strength. Beyond that contour, the receiver simply hard-mutes. There is no soft-fail mode like in the AM DAB systems. So at a SNR of 26 dB, AM DAB performs well. This will potentially mean a significant increase in realized coverage area for some stations, depending on the nature of the interference level.

As with the FM DAB signal, there was significant transmission and recovery delay, up to almost four seconds. This again allowed a beforehand "aural glimpse" of analog versus digital degradation. I recall the DAB failing only once as we went under the parking garage. The analog almost completely dropped to noise at that point. Perhaps the only other disappointment during this demo was the fact that only one brief encounter with a difficult reception area was on the route.

Walden emphasized that development of the IBOC AM DAB system is about a year behind the FM. There are still several important unanswered questions regarding this system. Virtually no evaluation of how skywave fading and interference affects its performance has been done. KUSA on 1660 kHz has received many impressive reception reports from around the country, but there are no other interfering signals yet occupying the channel.

The effective night limit for this station in the Las Vegas metro is only 1.2 mV/m for digital, and even lower for analog. Will the coded bitstreams of data be smart enough to ignore other interfering digital signals riding in on skywave? Only the future will tell.

Walden did point out that USA Digital designed the system for optimized ground-wave service. No effort will be made to deal with distant skywave reception problems, although close-in skywave fading will be addressed.

Because there are no other competing AM systems to be tested and evaluated by the National Radio Systems Committee, the team from USA Digital Radio should have time to answer these concerns.

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Tom McGinley is chief engineer of Washington's WPGC-AM-FM as well as ***RW****'s technical advisor.*

All-Digital Future

▶ continued from page 13

and L-band DAB as "no sensible contest," he called on the FCC to allocate L-Band DAB spectrum.

Probably the most objective IBOC and L-Band DAB discussion came from a DAB testing panel comprised of National Radio Systems Committee (NRSC) and Electronic Industries Association (EIA) members. They referred to on-going laboratory testing and upcoming field tests that will include IBOC systems and out-of-band systems. The NRSC is only concerned with the in-band systems.

"We are basically studying to determine whether an in-band-on-channel system will be substantially better than what we have today," NRSC Chairman Charles Morgan said.

Receiver manufacturers will not create DAB receivers if the market will not embrace the system, said Morgan, who is also the senior vice president and director of engineering for Susquehanna Broadcasting.

The lab tests at the NASA Lewis Research Center will wrap up by June and the raw data will be distributed to the NRSC and the EIA's Digital Radio Subcommittee in late summer with a two-and-a-half-day discussion of test data Aug 24-26-at-a yet-undetermined location in Monterey, Calif., Morgan said.

The NRSC will start a San Francisco field study sometime in late July or early August, which should be completed by the end of the summer.

Tests analysis and report production, however, will most likely take until the end of this year to finish, at which time NRSC will decide whether or not to recommend an IBOC DAB standard based on results from both tests, Morgan said.

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RDS Innovator Predicts Success

▶ continued from page 1

air. We had to reduce the injection level of the data, and to make the bandwidth of the data channel very narrow.

I think what we have done is establish a data channel that is very rugged and that works under bitstream multipath conditions extremely well. And this is, I think, the fundamental advantage of the radio data system.

We were ready with the system around 1982, and the standard came out in '84. It was in '84 that I came for the first time to the United States, to talk about (the) radio data system. It was at the Society of Automotive Engineers—actually (the) Ford Motor Company—that had detected that we at the EBU were developing something like this. They invited me to their conference in Detroit, and I spoke about this. The Ford car radio development people... decided instantly that they should develop radios for RDS. And they have done that, from 1984 onwards.

RW: *In Europe?*

K: No, in Detroit. The product that they had developed, they could then use in Europe. Because, as a manufacturer, it is the old chicken and egg situation. You cannot come on the market with a receiver if nobody broadcasts the system. And, in the United States, there was no standard.

Dietmar Kopitz

The standard that we had established for Europe could not be applied without any modification in the United States, because there are country codes included in the standard. I think it was necessary that NAB look after the possibility of adapting this system for the American environment.

This also was recognized at the end of the eighties. I think it was 1986 when we met with Michael Rau (formerly with the NAB Science and Technology department) and we explained to him all the technologies that were now under development in Europe. He was very positive to all this, and channeled all the development into the National Radio Systems Committee.

They created a subgroup that started the possibility of adapting the standard. I have never attended any meetings, but I worked with the standardization committee by correspondence. I made a lot of comments, how the system could be adapted. And at the final stage, I had the chance to meet with some members of the subgroup at the Public Radio Conference in New Orleans.

My intention was to present the state of development of RDS in Europe, but I met with one of the engineers who wrote the adaptation for the RBDS specification—Terry Beale from Delco. This really was an historic meeting. We met in New Orleans. Terry Beale explained to me, from an insider's view, what the problems were in using RBDS in the United States. He explained that program, type, format, was different, and he had this idea of program, type, name, to be broadcast (as) sort of soft program type, because you have to limit the number of choices to a reasonably low number—if it is too big, then the end user cannot understand the concept.

In reality broadcasters cannot easily conform to these pre-defined codes, so it is very nice to roughly define the category and then further identify with program, type, name, what the format of the program actually is.

RW: *What year was that?*

K: I think that was in 1991. At that stage Terry and I started to define a number of new groups that were, in the end, included into the RBDS standard.

RW: *Which groups, for example?*

K: The program, type, name, group, which is the 10A group. We also invented together the 15A group for people who do not use alternative frequencies. In Europe, we had assumed that in most cases we would have a network. Here in America, in most cases you would not have a network. So we created a group where we then would not waste capacity of the data channel with information that is not necessary. And I think this was a very, very good collaboration between the two of us.

So we solved all these technical problems, and... that put us in a position— when the American standard was publicized—to produce an article that explained the differences between RBDS and RDS, and we started to realize that the differences are very small.

We have established a data channel that is very rugged and works under bitstream multipath conditions extremely well.

If we wanted to express how much commonality we actually have, I would say it is something between 90 and 95 percent. That means that European RDS radios would work well in the American environment—at least with the five basic functions: PI, PS, TP, TA, and AF; which were the ones that were first implemented in Europe.

When it comes to implementing program, type, code, the manufacturer has to be made aware that there is an American table and a European table. They then have to use a software switch between the tables. But, country codes are to be included into the data stream that is broadcast, and a decision can then be made by software in the receiver (about) which table applies.

I think we are very happy from a European point of view about the outcome of the standardization committee that worked at the NRSC. I think that the RBDS is an umbrella standard that has under it the RDS system, as it was defined in Europe. And it is a very good situation for the manufacturers, because many of them look at (the) world market nowadays. Also, with RDS, we had initially specified it only as a European Broadcasting Union (standard), and thus only for the European environment. But our broadcast standard (has) been picked up in other areas of the world, because they do not have similar standardization activities.

We were also asked to issue country codes for the rest of the world, which we have done. Any country in the world, in theory, could implement RDS as published

continued on page 18 ▶

Kopitz Predicts RDS Success

▶ continued from page 17

by the European standardization body CENELEC. Some countries have done so: South Africa, Hong Kong, (and) South Korea. Australia is now considering it; Singapore is very close to using it; Malaysia, and India also.

We are very happy from the European point of view about the implementation stage of RDS in the United States, because this considerably enlarges the market for the components and for the products.

In the car radio business, there are a large number of manufacturers—they have very good names but in reality these companies are not always so big. And if you look at the products from the hi-fi sector, they are often designed to cover a world market. It helps them a lot, and it makes the products less expensive (if there were to be a world standard). I think the ultimate expectation from us in Europe is that very soon we shall reach the stage where all FM radio receivers would have RDS.

RW: *All over the world?*

K: That would be ideal. I think it is possible, because it has a lot to do with the development of the components. Because there are many manufacturers that look into integrating into one IC all the functions of a radio. So it will be a complete FM receiver, and the RDS decoder is then part of the chip. So, somebody who wants to build an FM receiver buys one chip and sometimes even the AM receiver is integrated into the same chip. I know of one company (that) is trying to do this. You can buy only one chip. And the RDS is part of it.

So what is then the cost of implementing RDS? You need an additional microprocessor, but it too could possibly be on the chip. At the end you will need a special display. So the most expensive part of RDS is actually that display, because a conventional receiver uses only four digits on the display, to show the number of the frequency that is characterizing the channel. In RDS you would need eight characters, and they must be alphanumeric. So these chips, they contain also the drivers for these displays, and they are all produced in large quantities nowadays.

If I were a station manager, I would run after the EIA and try to get its support—because you can now get RDS for nothing.

I think that at this stage in Europe, there must be some 20 million RDS receivers in the hands of the users, and let's say, the prices are very low. Generally speaking, we can say that it is not true anymore that you have to pay more money for an RDS radio, in comparison to a radio that does not have RDS.

If you look at the car radio manufacturers, the biggest ones all have a large number of car radio products. If you take an example of a very well established company, it has at least 20-30 different receiver models on the market. And usually, for the European market, only one of those 30 different models does not have RDS. And that one is mainly for those markets (that) have not yet well implemented RDS.

RW: *And where are these markets in Europe?*

K: Mainly in Eastern Europe because it is lagging in the technology. And that is also the situation now in the United States, from the manufacturers' point of view. If there are 5,000 FM stations and only 250 up to now have implemented RDS, I think it is not a situation yet where you can start to market RDS radios.

I believe very much that this promotional campaign that has been started now by the EIA will have a lot of success. I think it is necessary that somebody at a centralized point take care of the promotion of this technology. This is true for any new technology. There is so much new technology around nowadays, end users can be very confused.

I think it is very important that the NAB encourages the broadcasters to use this technology, because I think it is established technology. It is not correct to say that this is not the latest technology, and to give the impression it is a bit old fashioned and that there can be other technologies like high-speed data systems, that could at the end replace the RDS.

First of all, any high-speed data system will have to be complementary to RDS. This is already necessary, because of the international standards that are established. RDS is not only a standard of CENELEC or of the National Radio Systems Committee—it is also a recommendation of the ITU (International Telecommunications Union) and of what was formerly called CCIR (International Radio Standards Committee).

Any additional system will have to comply with the already accepted things, and so it has to be compatible. We know, for example, that the DARC system, as it was developed by NHK, actually is compatible with RDS—fully compatible.

If we look at RDS, we must not overlook that the main purpose of the RDS is to make the radio smart. It is not to provide the broadcaster primarily with an additional source of income.

Now, if the broadcaster wants to give his radio channel a more modern look, I think RDS is the ideal solution. The encoder costs only 2,000 dollars, and if you put this in relation to the annual budget of the broadcast station, or if you put it in relation to the technical equipment that the broadcast station utilizes, it is absolutely nothing.

I think that this promotional campaign by the EIA is very supporting to the broadcasters who would like to upgrade their stations to RDS. If I were a station manager, I would run after the EIA and try to get its support—because you can now get RBDS for nothing. The only return that you would have to give is some advertising time to support the promotional campaign, but even that is not a giveaway, because it will just support the new technology that you are using. So the only aim of EIA is that more receiver manufacturers come on the market with receivers, and that is actually what you as a broadcaster would also wish.

RW: *What you say makes a lot of sense, yet, in two and a quarter years, there are about 240 stations, give or take.*

K: That is constantly growing.

RW: *Constantly growing, right. But, why do you think there are not more stations on at this point? A lot of broadcasters will tell you that if they cannot make money off it, they are not doing it. So, why do you think some broadcasters have a problem jumping into this with both feet?*

K: About making money... RDS would in a way permit to make some money, not really very big money. I think the idea of making money came out of the NAB. When NAB picked up about (the) Radio Data System, they thought that it would be a data channel that (would) enable the FM broadcaster to make money. And this is true in a certain way.

There are some services that have become very popular, like radio paging, also differential GPS. We are starting a Traffic Message Channel (TMC), and... I think there are possibilities, but the possibilities are very limited.

I think that RDS is a forerunner for future multimedia services. I think all our future will be digital, anyhow. In 10 years, we will have digital radio, and there will be a data channel that supports the high data capacity, and where we can implement, without any problem, all the ideas that we have now encountered in conjunction with RDS.

I think the FM broadcaster enjoys very good popularity because of the audio quality of the stereo that is possible and the mobile reception that is quite acceptable at this stage. I think it is a must for all broadcasters to go for RDS, and I think most broadcasters would probably have done so and not been so reluctant if the NAB would be a bit more positive about this.

I think it is NAB's effect of so reluctantly promoting this technology (that) has contributed a lot that the thing didn't take off.

I believe very much in the new campaign of the EIA, and I think what the EIA wants to achieve to equip 500 additional stations in the main markets covering 85 percent of the population of the United States is very realistic. This is going to happen within one year.

And I think in the RDS Forum, and in the RBDS Marketing Development Group, we have talked to all the manufacturers that are concerned. I think they have understood what it is all about, and I think they are going to act.

Now while it is true within a year there will be some 800 RBDS stations on the air in the United States, we will probably not yet have achieved a large range of receivers on the market. I think the receivers are in Europe, and it is possible to make them. Now, in order to reorient the marketing of these receivers to the United States, the industry must be given some time. But they are going to work on it. I assure you. I think in two years the whole thing will look completely different.

Take Advantage of Computer Technology

by Alan Haber

LAS VEGAS The days of simply knowing how to connect wires are over, said Bill Ruck, engineering manager for KNBR(AM) and KFOG-FM in San Francisco, in kicking off a timely, information-packed NAB 1995 workshop session titled "Computer Technology for Broadcast Support: BBSs, LANs, WANs, and The Internet."

"Just about everything we do today has the word digital in it," Ruck said—all forms of media are merging together, one way or another. A cursory look at the electronic landscape will reveal that to even the novice broadcaster-as-computer-user.

William F. Bakker, president of International Tapetronics Corporation, began his presentation with a discussion of how stations can use networks. Speaking primarily about Local Area Networks (LANs), Bakker defined a network as a place to share information between two or more devices. In addition to LANs, he spoke about Wide Area Networks (WANs), Campus Area Networks (CANs) that connect a group of buildings, and Metropolitan Area Networks (MANs).

The ways in which networks transfer information, Bakker said, need to be transparent to users and network facilitators. He spoke about four of the topologies to be concerned with: server to client (the most common), peer to peer (for use between servers to get, for example, a level of redundancy), dedicated processor to workstation, and pipeline (used in an automation environment and which is very direct).

Bakker said that the key protocols being used today within network applications represent 90 percent of the installed base of those now being used. They include ARC Net that runs at two megabits per second and is the most reliable, particularly in an electromagnetic noisy environment; Ethernet, which runs at 10 megabits per second and is the protocol of choice for virtually every standard information exchange LAN; Token Ring, which runs at 16 megabits per second and exudes high performance for both reliability and throughput; and Fiber Direct Distributed Interface (FDDI) that runs at 100 megabits per second and is a high-speed network with token-based reliability. Bakker also spoke about a series of high-speed networks, including Asynchronous Transfer Mode (ATM).

Radio stations are becoming resident on the Internet's World Wide Web at a fairly consistent rate.

Key info

Tim Pozar, engineering manager for KKSF-FM and KDFC-FM in San Francisco, keyed attendees into the latest information that can help their stations join others already promoting themselves on the Web.

Pozar talked about the various ways of connecting to the Internet: with shell accounts, for which a station would run communications software on a personal computer on-demand dial-up, and full-time Internet connection.

"Full-time connection is kind of the best of all worlds," Pozar said. "It means that you can serve up information out to the Net. You don't have to worry that your connection isn't up for somebody who may randomly call in and try to grab data off your server."

As far as resources available on the Internet that radio stations can take advantage of, Pozar said there are more coming on-line all the time. Some of the resources that are now available include those offering things like weather and government information, and dictionaries and encyclopedias.

Interactivity

Possibly a 360-degree turn from the Internet, interactive voice response (IVR) systems were examined by Victor T. Jester, chief engineer of WNNX-FM in Atlanta.

IVRs, Jester said, allow stations to turn added value to clients they have on the air. These days, he noted, the systems are interactive and do a lot more than ever before.

There are several considerations, Jester said, to consider; for example, stations will need to service the unit. Stations will also need to ask: Is there power in the room in which the system is installed? Is there cooling on weekends? Can phone lines be connected to it? Jester said a closet or an office might be an acceptable place to install an IVR system; he said to look at equipment rooms and central locations for computers.

Stations should consider the noise level of their IVR system; it might not be able to sit in somebody's office. Space should be set aside for system documentation and for backups, which are just as important as for any other computer, he said. "Otherwise," he noted, "you're going to wind up paying for it down the road at some point, maybe more than once."

Power is another consideration, Jester said, who suggested stations put their IVR system on an uninterruptible power supply (UPS). "The longevity of components in the systems will be greatly increased," he said, "if they're sitting on a UPS, and they don't suffer from sags, brownouts and transients, and that sort of thing, where the hard drives are constantly coming on and offline."

IVRs are another revenue stream for a station. "In radio," he said, "as competitive as it is nowadays, you really need... to look at technology and see what's available out there.

Compliance Primer for Stations

by Dennis J. Martin

LAS VEGAS Deregulation has, in many ways, simplified the business of broadcasting. But the FCC expects compliance with its Rules and any special terms specified in the station's license. "Insuring That Your Station Will Pass Inspection: Ask The FCC" was a session at the NAB Convention in Las Vegas designed to explore how compliance can be guaranteed.

Moderated by David Wilson of the NAB's Science and Technology Office, the panel included six FCC engineers: Richard Breen, an EMU (Engineering Measurements Unit) engineer in the Atlanta Region; William Borgman, who is responsible for the Chicago Region's EMU program; James Higgins, who mans the EMU vehicle for the Boston Region; Clark Poole, who operates the EMU van in the Central Region; James Walker, an investigation specialist in the Baltimore office; and William Zears, a senior investigations and EMU engineer for the Livermore, Ca., FCC office.

Video instruction

A highlight of the session was a video tape produced jointly by the FCC's Denver Field Office and SBE Chapter 48, which is also in Denver. The 20-minute video is designed to prepare station personnel for FCC inspections and was introduced by Leo Cirbo, engineer-in-charge of the FCC's Denver Office.

"On the average of once every seven years, an inspector from one of the 35 Field Operations Bureaus, known as the FOB of the Federal Communications Commission, will pay a visit to any given broadcast station," the video began."In early 1994, SBE Chapter 48 followed FCC inspectors. What follows is unrehearsed and real."

Compliance is "glue"

A prologue explained that the FCC's regulatory plan is comprised of four key components: allocation, assignment, rule making, and compliance. Compliance was described as the "glue that holds the other parts together." Station inspections can be the result of a complaint filed with a Field Office or the FCC in Washington D.C. Inspections can also be assigned because of "strategic goals and projects," or due to random selection.

"An inspection could consist of a check of a single item, or a limited number of items," the video continued. Represented as a typical studio inspection, the presentation was really an overview since time constraints limited it to key aspects only. To assist stations in preparing for inspections, the FCC issued a Broadcast Service Checklist, Bulletin FOB-18, dated April 1993, which is available from many sources including the FCC and the SBE.

When the inspection portion of the video began, the FCC Inspector identified himself, and asked to see the General Manager or Chief Operator. He explained that he would inspect the studio, ask that an EBS test be performed, examine the Public Inspection File, then report any problems he discovered; the transmitter would be inspected at a later time. The Inspector estimated that one to two hours would be required.

A 20-minute video, designed to prepare you for an FCC inspection, is available.

He first visited master control, met the operator on duty, and reviewed operator and station licenses. Noting that ownership had recently changed, he asked for photocopies of the station license, assignment letter, and renewal application. During the requested EBS test, he timed the transmission of the tones to ensure that the period was within 20 to 25 seconds. He asked for the call letters and frequency of the EBS monitoring assignment, inquired about the location of the EBS receiver and generator, and requested that the operator demonstrate how the EBS assignment could be monitored.

The Inspector then turned his attention to the transmitter—he verified the operating power level, then asked that it be lowered by remote control. The operator on duty was also quizzed about how often meter readings were taken, and the station's operating hours.

Possible violations

The Inspector complimented the operator on duty, departed master control, and asked the Chief Operator what the station considered its broadcast week. During his inspection of station logs he learned that two EBS test receptions had been missed; one allegedly because the monitoring station failed to send a test, and the other was caused by operator error. He asked if the logs were inspected on a daily or weekly basis and by whom. Because the station logs did not include a statement describing why the tests were missed, a Notice of Violation would be issued.

He asked when the carrier frequency was last checked, and when the transmitter had been tested for spurious and harmonic emissions. He questioned how tower lights were monitored, and whether the operator could determine if, say, a single side light had failed. The inspector was satisfied to learn that tower lighting was monitored via a current sample, and that any lamp failure would reduce the metering indication. An instruction manual at the station was said to describe how lamp failures would affect the readings.

The Inspector continued to question the chief operator about the technical operation of the station. Often, the response was "that's in the operator's manual," which suggested to the Inspector that the operators had immediate access to the information they needed.

The Public Inspection File was the last item reviewed. He examined license renewal and transfer of ownership documents, and inquired about the most current ownership report, which appeared to be missing.

The inspection concluded in the General Manager's office where he disclosed his findings. The Inspector explained that the station could be fined for the two missing EBS tests.

The station subsequently received a Notice of Violation for failing to log the EBS tests and for the missing ownership report. Later, the ownership report was located, and a copy was forwarded to the Field Office along with revised instructions that dealt with missed EBS tests.

The video was updated with a statement that noted the Field Operations Bureau was renamed as the Compliance and Information Bureau in the latter part of 1994.

On November 10, 1994, the FCC adopted a rule that changed the name of the Emergency Broadcast System (EBS) to the Emergency Alert System (EAS). Other pending proposals may affect transmitter duty operators and tower-owner requirements.

The final portion of the video covered an inspection of an AM directional transmitter site. The Inspector arranged to meet the chief engineer at the site where he compared transmitter operating parameters to licensed values. Outside, he checked the non-directional base current, fences, tower painting, and general conditions. Because safety is a primary concern of the FCC, a violation will be issued for any "hot" towers that are not protected by an effective locked-fence arrangement. The tower light controller's photocell was covered to confirm that the lights were functional. Then the station switched to directional operation, and the inspection continued in the field.

The location of the towers was confirmed by use of a GPS receiver. Monitor points were checked using both the FCC's and the station's field strength meters. And, after returning to the transmitter site, the Inspector reconfirmed operating parameters, and verified operation of the remote control system.

More questions

The remaining time of the session was devoted to a question and answer period. Questions were varied, and largely covered AM, FM, and TV technical issues, but included telephone and computer topics.

Responding to a question, the FCC panel discussed how they verify NRSC compliance of AM stations using a spectrum analyzer off-air, near the station. Although not routinely scheduled, the FCC does sample stations in specific areas as assigned.

Besides complaints and projects, inspections are sometimes initiated by special programs, such as a zip code survey. In one case, all broadcast stations within a certain zip code were inspected.

If a station is operating unattended, an Inspector will verify that there is indeed control of the station. He will confirm what happens when there is a malfunction, and whether the alarms are adequate to notify someone locally for prompt action. He will also ask what happens during an EBS test or alert, and how it is relayed.

The FCC panel, in addition, affirmed that they still check FM peak modulation using an oscilloscope.

"Compliance is an ongoing daily must," the video said. "The relationship between the station and the FCC need not be adversarial. The SBE and the FCC have worked together to produce (the) video to take some of the mystery and apprehension out of the inspection process.

For information about the video, contact the SBE or your local FCC Field Office.

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Dennis J. Martin is chief engineer for KBIG-FM in Los Angeles.

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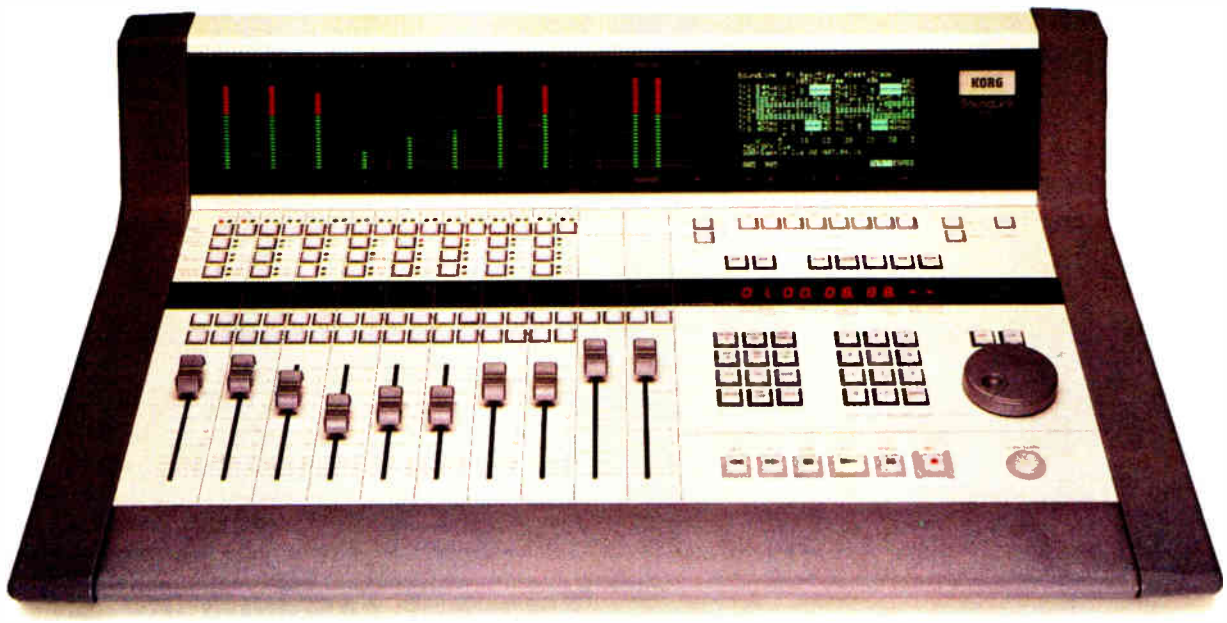

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PRODUCT EVALUATION

Quality, Accuracy Obvious in KRK 6000S

by Bruce Bartlett
with Jenny Bartlett

ELKHART, Ind. Every time I attend an audio trade show where KRK monitors are used in various vendor displays, I am impressed by the speakers' smoothness. Recently, I obtained a pair of the KRK 6000S to review and was equally pleased with their performance in my studio.

When I pulled one of these small units from its packaging, I was impressed by how much it weighed for its size: 18 pounds. Part of that weight is magnetic shielding, which comes in handy when sitting them near your workstation view screen. (KRK model 6000 is the same speaker but without shielding.)

The $925-per-pair KRK 6000S is a compact, two-way vented system using a six-inch polyglass woofer and a one-inch Kevlar inverted dome tweeter. A horizontal slot vents the cabinet for bass extension. Crossover is listed at 2.4 kHz. The company rates the response as 62 Hz to 20 kHz ±3 dB. Sensitivity is 89 dB/W/m. Power handling is 75 watts continuous, while maximum SPL is 106 dB. Distortion is claimed to be "very low." Nominal impedance is 8 ohms.

The dense, rock-like cabinet measures only 13 inches by nine inches by 10 inches (HWD). Finished in dark grey, the cabinet is made of medite, a mixture of wood particles and resin. The cabinet is very inert; it does not ring when you knock on it. Cabinet edges are rounded to reduce diffraction and smooth the response, according to KRK.

On the back, a pair of five-way binding posts accept thick wires or a banana plug. Although they are easy to access, the posts stick out from the back, making them vulnerable to damage. (A connector cup, though, reduces the internal volume and is a potential source of leaks). No switches or grille are included.

Listening tests

Because I use a pair of Alesis Monitor Ones for much of my studio mixing, I compared the KRK 6000S to them. The Alesis costs only half of the KRK list, but is becoming a popular mix monitor. And as such, a comparison can educate a potential user as to whether the KRK's extra expense actually nets sonic improvements.

In the test, the Alesis had deeper bass (60 Hz and lower). I could hear a deep bass drum roll with the Alesis but not with the 6000S. However, the 6000S had no audible doubling (second harmonic distortion), so it did not produce "fake" bass. The bass was tight like a very good audiophile speaker. If you mix with the 6000S, however, you may want to add a subwoofer to hear the deep bass (40 Hz and lower) or check the deep lows with good headphones.

On-axis, the Alesis made cymbals sound crisper, but this characteristic was actually an overbrightness. The KRKs were more accurate with a natural, airy sound. (To compensate for the Alesis' overbrightness, I listen to the Alesis 30 degrees off-axis.) The KRK's had a very slight hardness on strings not as sweet and lush as a few other speakers I have heard.

KRK 6000S

On vocals, the KRK was more realistic than the Alesis. The KRK had a seamless, organic quality—all the frequency ranges seemed to be of one piece. With the Alesis, I sensed a separate woofer and tweeter. However, the KRK had a hint of chestiness or tubbiness on vocals not heard with the Alesis. It was just a slight bit of a midbass rise, not a serious problem.

Both speakers sounded tight on transients. This surprised me, because the KRK cabinet seemed especially "dead." In any case, the KRK put out very tight bass and clean attacks. Kick drum and electric bass were well-defined, with no overhang. Snare hits packed a punch and dynamic range was impressive.

The sense of detail the KRK conveyed was remarkable. I heard guitar strings rattling on their frets, or the individual hits in a tympani roll. Stereo imaging was quite sharp.

I mixed an entire album with the KRKs, and the mix was among the best I have ever done. Because the speaker does not exaggerate the highs, I cranked in more high-frequency EQ than usual. The result was a bright, punchy mix that sounded great no matter what I played it on.

I measured the time response (Energy Time Curve) of the KRK 6000S. The direct-sound spike was sharp, and delayed signals from the woofer appeared 15 dB down from the direct sound. This is good performance, and shows that the KRK 6000S has sharp transient response.

Using a Techron TEF-20 analyzer, I checked the anechoic frequency response at 1 meter (300 Hz up) and nearfield (below 300 Hz). The response was impressively smooth: ±3 dB from 62 Hz to 20 kHz, exactly as claimed.

The change in response at 30 degrees off-axis was the smallest I've ever seen: about –4 dB above 11 kHz. This shows that the dispersion is excellent. If a producer sits next to you during mixdown, both of you will hear the same tonal balance.

Product Capsule: KRK 6000S Nearfield Monitors

Thumbs Up	Thumbs Down
✓ smooth, accurate response	✓ lacks deep bass (normal for small speakers)
✓ low distortion	✓ exposed connectors are vulnerable
✓ tight transients	
✓ no off-axis coloration	
✓ compact and rugged	

For more information, contact KRK at 714-841-1600; or circle **Reader Service 145.**

Conclusion

Although the deep bass is lacking (not unusual for most small speakers) and it is

continued on page 26 ▶

FIRST IMPRESSION

TDK Breaks Two-Hour DAT Barrier

by Frank Beacham

NEW YORK The instant reaction of most audio professionals to an ultra-thin, extended-play audio cassette is caution. Avoid it completely, we tell ourselves. This could be trouble. It is an attitude rooted deeply in the collective audio experience.

Now the folks at TDK, the Japanese magnetic tape manufacturing giant, want us to re-think the long-play tape. The problems of the analog past don't apply, the computer says, to the digital future.

Incredible DAT lengths

TDK's new DA-R180 is the first DAT tape cassette from a major manufacturer to offer 180 minutes of recording time in the standard mode and a whopping 360 minutes in the half-speed mode. This extra recording capability comes, according to TDK, with no reduction in performance or reliability.

"When most people look at a DAT cassette they think in terms of analog cassettes," said Doug Booth, TDK's national sales manager for pro products. "They think of the old- 120 and 180-minute analog cassettes in the $39 Walkman or el cheapo boom box that would be eaten... that would be grabbed by a capstan.

"That experience doesn't really apply to DAT machines as we know them today because they all have very high-quality transports," Booth continued. "DAT machines treat tapes very delicately by nature."

Although Booth admits the old analog mindset is "a cross that a super-thin tape has to bear," he said the new 180 tape is a no-compromise cassette that can stand up to the rigors of editing and daily use in a radio station environment.

The big difference between the new 180 cassette and the rest of the TDK DAT line, Booth said, is the use of a thinner base film. DAT tapes of up to 120-minute length have a base film about 13 microns thick while the 180 length uses a film that is about 11 microns thick.

No stretching, no breaking

"When we say the base film is thinner, that's being very simplistic," Booth said. "We use an extremely high-quality base film that's very pricey. It doesn't stretch or break easily. By having this very high-quality base film we can avoid cutting back on the coating, which allows us to maintain high performance."

Many tape manufacturers, Booth said, use a lesser-quality base film that forces them to increase thickness to maintain reliability. However, this added thickness forces the manufacturer to put a thinner magnetic coating on the film, thus compromising performance, he said.

At half-speed, TDK DAT can hold 360 minutes of audio.

All TDK tapes, including the 180, are manufactured with a proprietary technology called an Electron Beam Cured (EBC) binder system. The EBC binder uses a high-energy electron beam to create an extremely strong three-dimensional web surrounding each pure-metal particle. This process is designed to ensure that the particles remain firmly in place, even under the rigorous high-speed search and access functions that typify studio and broadcast use.

TDK said the EBC process gives its tapes superior resistance to such environmental conditions as heat, cold and humidity.

RW evaluated samples of the DA-R180 at both regular and half-speed modes and found the cassette's performance equal to any normal-length DAT tape from a major manufacturer. When using the tape in a Sony D-7 portable DAT recorder, I noticed that, for the first time, I could exceed the battery life of the recorder by recording in the half-speed (6-hour) mode.

Time display

In most DAT recorders, the 180 cassettes should be completely interchangeable with normal-length tapes. However, TDK notes that some DAT decks may give an inaccurate display of the remaining tape time due to the reduced thickness of the tape. This inaccuracy, the company said, does not indicate any malfunction with the display or the tape cassette. It is simply related to the way a particular machine measures tape time.

The TDK DA-R180 represents an important new recording tool for the DAT arsenal. A recording time of up to six hours opens new possibilities for recording conferences, symposiums and long events where the recordist wants to avoid missing any of the content due to tape changes. Now if they could get longer battery life for portable DAT recorders.

□□□

TDK Electronics Corp. is located at 12 Harbor Park Drive, Port Washington, NY 11050. Phone is 800-752-9835. The TDK DA-R180 is priced at retail between $10 and $12, depending on the distributor.

PRODUCT EVALUATION

Symetrix Enhances The 528E

by Ty Ford

BALTIMORE Remembering that I had written a review on the original Symetrix 528, I checked my archives and found... nothing. This was a challenge. I finally stopped digging when I hit the March 15, 1987 issue of **RW**. The first thing I noticed was that after eight years the list price had increased only $50 to $699.

Before I get into the evolutions, you should know that the Symetrix 528E is a single-channel mic/line multiprocessor. There is a mic pre, a de-esser, an expander, a compressor, a three-band parametric equalizer and a phase rotator circuit. The back panel of the 528E features separate balanced XLR inputs for mic and line, a phantom power switch, a balanced XLR output connector and an unbalanced 1/4-inch TS jack.

Product Capsule: **Symetric 528E Voice Processor**

Thumbs Up	Thumbs Down
✓ quality, all-in-one multi processor	✓ okay mic preamp

For more information, contact Symetrix at 206-787-3222, or circle **Reader Service 140.**

An internal switch allows the output to run at mic or line level. The barrier strips of the old 528 have been replaced by a series of normaled quarter-inch jacks. With the 528E, you can use quarter-inch TS unbalanced patch cables to add, omit or rearrange the order of processing. Access to the expander/compressor side chain is via an unbalanced quarter-inch jack.

Mic/line Input

As with the original 528, the heart of the 528E preamp circuit is an Analog Devices SSM 2015 chip used in a balanced transformerless configuration. According to Symetrix, it will be upgrading to the SSM 2017 (the same chip used in its 601 digital processor) later this year. While both chips are used a lot for mic preamps, they are no match for a high-quality mic preamp such as the API, but there is a big difference in the cost.

If you are using high-quality condenser mics and mic preamps already and feel the need for a bit of processing, you can use the 528Es line input to bypass the 528E mic preamp.

The mic/line input is switchable from the front panel. Because there are two balanced XLR connectors on the back panel, one for mic and one for line, you can use the front panel switch as an input selector. I

continued on page 32 ▶

Denon's MD Cart™ Recorders and Players are the modern choice for *any* application that requires repeated recording and playback of audio, from broadcast to post-production. Why? Compared to NAB tape carts, the MiniDisc is free from wow, flutter, jamming, stretching, wrinkling, drop-outs and shedding.

MiniDisc's advantages (including *full* inter-machine, inter-brand compatibility) are quickly making it *the* universal standard. Compared to other digital formats, Denon's MD Cart technology offers the lowest cost per Megabyte of storage, shirtpocket transportability, and non-contact, optical media reliability.

Obviously, once you've chosen MiniDisc, your next decision is which MD to buy. Features like serial and parallel interfaces, digital and analog signal inputs and outputs, external sychronization, and *MD Remote*™ software (see side bar), make Denon MD Cart the obvious choice.

DN-980R MD Cart™ Recorder (shown) and the DN-980R DN-905R machines

Denon's MD Remote™ Software, running under Windows™, offers a graphical interface for fast, easy control of all functions and modes on any Denon MD Cart machine, including automatic dubbing of tracks or discs between machines, complete with titles and cue point information.

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PRODUCT EVALUATION

New AT 'Phone Made For Long Mix Sessions

by John Gatski

WASHINGTON When you think of professional headphones, the first names that come to mind are AKG, Sennheiser and Sony. However, Audio Technica has been moderately successful in garnering a share of the business with its line of headphones, including the ATH-910 and the ATH P series of inexpensive open phones. Many of the purchases have been made on the music side of the business.

ATH-M40

The latest products to join the line are the ATH-M40 and ATH-D40. After **RW**'s shootout (July 13, 1994), in which the ATH-910 was a strong contender, I had high hopes for the ATH-M40 series. As our shootout article noted, the 910 was very comfortable to wear, had decent isolation and pretty good sound—a little flat sounding with a touch of midbassiness. The folks at AT said the M40 series built on the strong points with more accurate drivers.

Two versions

I was sent both versions of the ATH-M40s. The ATH-M40 is the "flat" response version while the ATH-D40 is the "enhanced" bass version designed for bass-hungry folks: bass players and drummers, etc. For broadcast production work, however, the ATH-D40 has an overexaggerated bass hump that made it inappropriate. I quickly put it back in the box and tried the ATH-M40.

Priced at $175 retail, the ATH-M40 is a closed headphone with plastic earcups (that have small holes in them—perhaps bass ports?), thick foam ear cushions and a wide plastic head frame. The phone cups adjust by pulling out or pushing into the headframe. Each cup can be rotated 180 degrees, permitting single-ear monitoring. The 11-foot cord is uncoiled with a quarter-inch connector. Weight is a light 8.8 ounces.

Audio Technica rates the frequency response rating from 5 Hz to 28 kHz (no tolerance given), 100 dB sensitivity and 1,600 mW at 1 kHz maximum input power.

In my home studio, I plugged the headphone into a Mackie console, put on a CD and let it "break in" for a few hours before I did any listening. Although such break-in is controversial and is often said to be unnecessary, headphone and speaker manufacturers often recommend a break-in for optimal sound.

Very natural

After the break-in, I listened to the headphone on voice, a variety of CDs, recordings from cassette, audio recording from S-VHS and some live guitar. The first impression is that the headphone is very natural with no emphasis in the upper-midrange or treble. The midbass had a very slight puffiness to it, but still the overall sound was fairly accurate.

In comparing the ATH-40 to the very popular Sony MDR-V6 (7506 on the pro side), the Sony sound is much crisper and brighter, giving it a more punchy sound — but not necessarily 100-percent accurate. On bright material, the MDR-V6 sometimes sounds too bright.

Comfort-wise, the ATH-M40, like the ATH-910, really excels. I spent a long time wearing the phone, and found it very light and easy to wear with the thick foam ear cushions. On my ears (and I also wear glasses), the Sony is not as comfortable over a long period as the AT.

In terms of isolation, the AT did a very good job of isolating background music I was playing, as did the Sony. Only when I had no audio routed to the headphones could I still hear people in the room talking normally.

My only complaint, a minor one, with the ATH-M40 is that the phone does not come with a mini-jack adaptor. Other than that nitpick, the AT M40 is an accurate, very comfortable headphone that can be bought at a reasonable price. Although the retail price seems high, I have found that AT products are often discounted heavily through their outlets, and this product should be no exception.

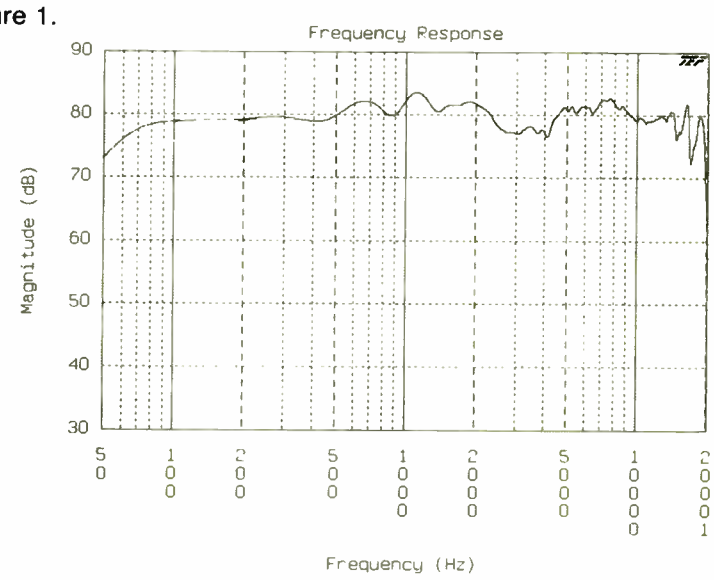
For more information, contact Audio Technica at 216-686-2600; or circle ***Reader Service 160.***

KRK 6000S Monitors

▶ continued from page 23

a bit more expensive than broadcasters typically pay for a pair of monitors, the KRK 6000S is a definite winner. It easily meets all its specs and is a self-effacing, neutral monitor. If you are used to exaggerated bass or overemphasized midrange/treble from your current speakers, the KRK may not be impressive on first listening. But give it time and you'll come to appreciate its virtues: tight bass, sharp transients, fine detail and imaging, good dynamics and smooth, natural sound.

Figure 1.

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0 dB is 0.00002 Pascal

Job Description:



Start Time:                2.5000 ms
End Time:                  5.8333 ms
Time Resolution:           3.3333 ms
Distance Resolution:          3.8 feet
Frequency Resolution:       300.0 Hz
FFT Size:                   16384 samples
Window:                 Rectangular
```

Bruce Bartlett is a microphone engineer and technical writer for Crown International, and the author of "Practical Recording Techinques" published by Howard Sams. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.

SIGNAL-TO-NOISE

Sony Sees Business Audio Niche for MD

by Frank Beacham

NEW YORK It is no secret. From day one, I have been cool to using consumer MiniDisc audio technology for professional music applications. I know there are some who strongly disagree with me on this, but those screechy "dueling algorithm" demos a couple of years back left a lasting impression on my sensitive ears.

Portable Sony MD

And, to be honest, I still despise the fact that I have to pay a federally mandated tax to the music industry on digital recording media even though I use the media for professional purposes.

That said, I am really impressed with a new product Sony has designed for the MiniDisc. Dubbed the MZ-B3 portable MD business recorder, the new unit could be a significant tool for radio news gathering. Like all MiniDisc recorders, it offers the standard 74 minutes of stereo recording time. What is unique about the B3 is a mono mode which doubles the recording time to 148 uninterrupted minutes.

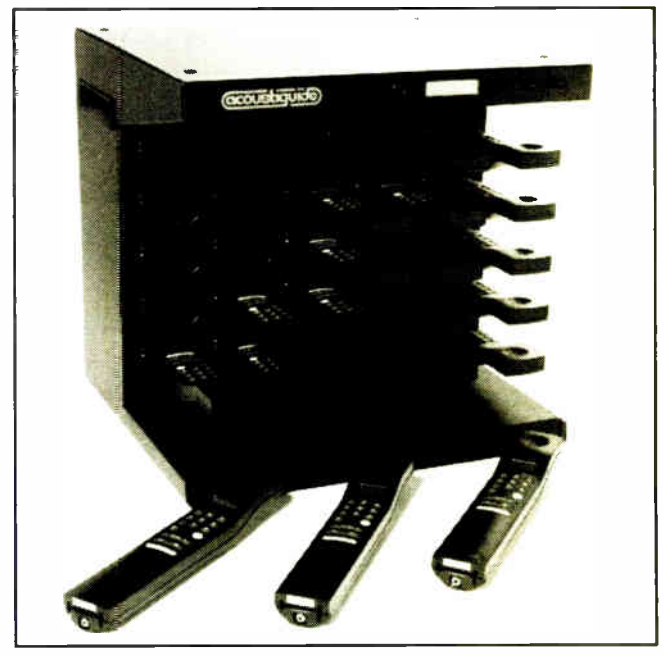
No larger than a standard cassette recorder, the B3 has random access, high speed playback, instant erase and a voice-operated recording (VOR) function to conserve space on the disc and eliminate soundless pauses during playback. It runs on AA batteries and will be available in August for a list price of $899.95.

A reporter using the B3 could simply press a button to mark audio segments that might be of interest and then instantly locate those sections for dubbing or transcription. Sony says there will even be an optional foot switch for the recorder.

Because a Sony MiniDisc recorder is already available as a drive for personal computers, it is not hard to imagine B3 discs being loaded into a PC for a quick audio edit of news or other spoken word segments. I think Sony is on to something here and should pursue giving MD a second life as a voice recorder with a wide range of search and edit functions. This may be where MD will really shine as a pro application.

★ ★ ★

From Acoustiguide, the people who make pre-recorded tour tapes for museum exhibitions, comes Inform, a new random access audio playback device with a lot of interesting possibilities. Inform resembles a cordless telephone receiver with keypad, but is actually a programmable sound playback system that uses a RAM chip for memory.



From Acoustiguide: the Inform

Designed for museums and historic sites, Inform allows visitors to encounter a gallery or object of interest and obtain information by simply entering an identifying number on the keypad of the handset.

This means visitors to a museum can wander as they please and not be restricted to a linear tour such as is required when using a conventional cassette-based tourguide system. When the visitor wants information about a particular art object, he or she enters an ID number into the Inform for instant audio information.

Because Inform can be programmed with up to four hours of audio at any one time, users have access to unprecedented amounts of informational material.

However, it can be used in short, palatable segments, and easily layered so that a visitor can choose to hear more by simply keying in another number. Weighing only 13 ounces, Inform allows users to pause, rewind and fast forward the audio information.

Audio programming for Inform is stored on "flash" memory card, that can be downloaded in less than a minute into a rack holding up to 25 units. The system uses a proprietary compression scheme and has a 4 kHz audio response.

First installed in Paris at the Louvre in November 1993, Inform is currently being used in the newly-renovated Medieval and Renaissance galleries of the Philadelphia Museum of Art, and on a trial basis at the National Gallery of Art in Washington and at the Rijksmuseum in Amsterdam.

★ ★ ★

New Stuff Alert! Sony is updating its venerable TCD-D7 portable DAT recorder. The new TCD-D8 adds a 44.1 kHz recording mode to the D7's 48 and 32 kHz modes. Also added are gold plated connectors and a new power switch.

Otherwise the D8 looks virtually identical to the D7. The D8, available in November, will finally come with an AC power adapter and a price increase of $100 over the D7 with a list of $799.

Last year Apogee announced a DAT tape with a 50-year archival life. Now, HHB announces a recorded CD with a 100-year life. The new CD, that works in all CD-R format recorders, uses a new organic dye recording layer that is supposed to be far less susceptible to the effects of UV light and therefore more stable. In addition, the discs are double coated for further protection against scratches and fingerprints, and the effects of extreme temperature, humidity and light. Price: $11.99 each.

□□□

Frank Beacham is a writer, director and producer. His address is 163 Amsterdam Ave., No. 361, New York, NY 10023. E-Mail: beacham@radiomail.net.

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PRODUCER'S FILE

The Producer's Own NAB 'Neat Stuff' Product Picks

by Ty Ford

LAS VEGAS Keeping an eye on the audio production domain at the NAB spring show gets tougher every year. One person just can't see it all. In fact, **RW** has a secret squad of people who scan the displays and honor the most innovative products with the highly coveted *Cool Stuff* award. This year, due to the overwhelming amount of pro audio gear, I reconnoitered on my own. Read on for my short list of some (but certainly not all) of the more innovative audio production stuff.

Actually it's a two-part list. In the first part are things that stopped me dead. Following that are a few things I sort of expected, but was still surprised to see.

Mager Systems had the most amazing custom studio furniture on display I've ever seen. Words can't really describe how impactful this console was. In fact, this isn't just furniture; the faders and meters are custom fit into custom-cut sections of acrylic solid-surface material called Fountainhead, made by Nevemar.

The oak equipment pods were excellently crafted and finished. KOOL-FM will be the one of the first lucky recipients of this great looking design.

Tunebuilder

Another product I was impressed with was TuneBuilder ($750, plus $1 per theme) by AirWorks Medi. It is a music librarian, editing, assembling program for the AV Macs, Windows and Amiga platforms. For DOS operation, you need a 386DX or better, MS-DOS, DR-DOS, PC-DOS or Novell-DOS. Airworks recommends MS-DOS 6.2. You also need a mouse, trackball or other pointing device, a video card with a minimum of 16-bit color 640x480 VGA display, one of a dozen sound cards and (of course) a CD-ROM drive.

In addition to its extensive "search" capabilities, this program automatically cuts theme-length cuts into any length you want. The people at AirWorks analyze every tune in a library and create a data file for each tune. If you don't like the edit, hit the button again and another one comes out. If adjacent parts don't work because of volume differences, you can "draw" level changes so that they match. And, because you can save the file, if the client comes back six months from now and wants THAT edit, you can get it back in seconds. So you get built-in music search and music audition, automatic editing, CD audio and CD audio file transfer, dynamic adjustment and automatic project reassembly, all in one software package.

Present documentation includes files for Arpeggio, BMG, Fresh, Killer Tracks, NJJ, Signature Music and Valentino. The neat thing about this technology is that there is room in the data stream of the production music CDs for this information. So as more libraries work with the company, much of the data can be imbedded in the music CD itself.

Speaking of software, S/Link 2.0 ($249) from The Synclavier Company is a handy tool if you're headed for the multimedia domain with your Mac. S/Link supports a long list of digital audio file formats. How Long? Here goes: .WAV, SoundEdit, IFF/8SVX, .snd/.au, VOC, MOD, sound resource files for the Mac (types 1 & 2), AIFF/AIFF-C, SND, Sound Designer I & II, CD-ROM, CD-Audio, QuickTime and OMF-1.

S/Link will translate files from the following formats: Mac, MS Windows, Amiga, NeXT, Sun, SoundBlaster, MS-DOS, Silicon Graphics, Atari, Digidesign and DAWN.

S/Link requires a Mac system 7.0 with FPU (or emulator), Sound Manager 3.0 or later, Quicktime run on a 68020 or higher Mac or Power Mac. In addition to file format conversion, S/Link also does on the fly sample rate conversion and 16-bit/8-bit conversion. The file viewer allows to to see and select an entire file, or just portions of it, for conversion. Expect a DOS version as well.

Where's my checkbook?

Digidesign's ProTools III with TDM, shown at AES, was on display along with an increasing number of third-party, plug-in EQ, dynamics and effect software. Version 3.1 now allows up to 48 tracks of record/playback and 64 channels of I/O.

Perfect for morning shows, TV, theatrical productions (and even small-to-medium-market radio stations), 360 Systems has evolved its Digicart technology into the Instant Replay ($2,995/4 hours, $3295/6 hours, $3,495/8 hours). The is a self-contained desktop unit that holds up to 1000 cuts, 500 of which can be mapped to ten "pages." Each "page" holds 50 cuts. DNET, a file transfer system, allows cuts to be transferred to and from a Digicart system.

Roland's DM-800 eight-track workstation ($7,295) also gets the nod from me. This light-weight (14lb) workstation operates in much the same way as the DM-80. Now you can take your work home with you, or go to the client with a mic and mic preamp and record on location (with AC power). The DM-800 comes with two 500MB internal hard drives. In an upcoming issue I will do a full-length review of the DM-800.

continued on page 31 ▶

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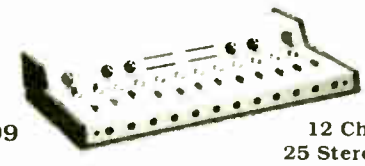

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Jocks love AXS: A fast 99 page, 28 button Jock F/X panel that can be time linked and remote wired is standard.

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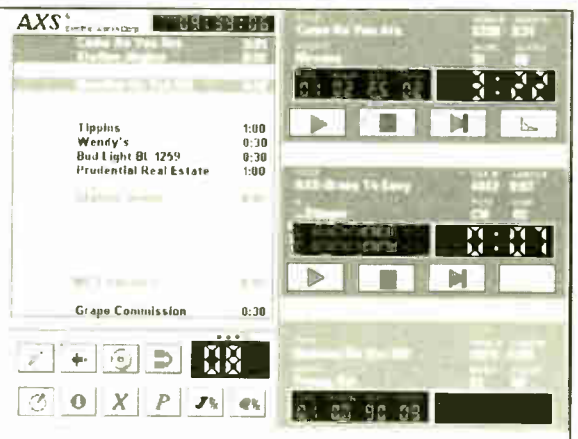

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Realities of Satellite Audio Uplinking

by Rich Rarey

WASHINGTON In the first installment of *Public Domain*, I mentioned a transmission technique where high fidelity audio could be transmitted in both directions by coupling a CCS CDQ 1000 codec to a portable satellite phone. "Not so!" according to NPR engineer Dave Argentieri.

Argentieri pointed out that in the application I described, the digital stream was a simplex transmission, and the high quality audio path was in one direction only. He used that codec and an MTI-TCS Lite satellite phone in Serbia and later a MagnaPhone in Cairo, and he found the "return" audio signal from Washington was so noisy and bandlimited that it was unusable, and a separate dial-up call had to be made for backfeed and coordination purposes.

Further complicating the transmission was the requirement that the remote site had to place the call, else the digital signal could not be sent. Combining the costs of the sat phone and a dial-up phone made the entire proposition pricey. At the time of these remotes, the satellite service provider had only a few high speed data channels available, which made "calling home" even more time consuming. A lot of busy signals were endured trying to get a land line connection from the U.S. Earth station to NPR.

To help understand these limitations, I spoke to Guy White, operations manager for technical support at COMSAT, the U. S. signatory to the multinational InMarSat consortium. I asked him to clarify how high speed data (HSD) signals are handled by COMSAT.

PUBLIC DOMAIN

Satellite limitations

His "short answer" was that the return digital audio from NPR had to use the G.722 protocol. It was converted from a digital stream at the Coast Earth Station into an analog FM signal with a 3.5 kHz bandwidth. This meant for the system to work properly, a suitable modem's data output (a channel service unit in COMSAT terminology) had to have a cable that split the transmit data plus transmit clock from the receive data plus receive clock. The transmit data is plugged into a codec that uses G.722 protocol, and the receive data would be plugged into a codec that used whatever protocol the remote site was using. This high speed data service COMSAT provides is called "Standard A." The service in its voice-grade quality has been available from COMSAT since prehistoric times (well, actually 1976).

The "long answer" Guy White revealed, is worthy of a chapter in a broadcast history class, and it all began with oil. Oil companies were traditionally big users of mobile communications: between oil rigs, sea vessels and their headquarters. Extensive oil exploration, driven by high crude oil prices, spurred the companies to search for a way to quickly transmit seismic data from the field (usually the ocean) to their laboratories. Data sent from the field could be quantified in the labs while the company still had its research vessels at a particular site.

In 1982, COMSAT instituted a Quadrature Phase Shift Keying (QPSK) Carrier to its Standard A service that could transmit this data at 56,000 bits per second. This HSD service was well used by the oil companies until the price of crude dropped, and exploration efforts were reduced. White said that during that period, the COMSAT data business became dormant.

Migration to news

Former COMSAT company Mobile Telesystems and a French Company, T.D. Comm., eventually collaborated to

continued on page 32 ▶

'Neat Stuff' from NAB

▶ continued from page 29

AKAI showed its new DR8 Hard Disk recorder from Akai ($4,995) with a 1GB drive. According to AKAI, this is not a re-invented DR4D, but a whole new design.

Tascam's DA-P1 portable, 2-head DAT machine with mic preamps and phantom power for $1,800 should ship this July. The portable will help fill a void in between the lower cost-consumer portables posing as pro units and multi-thousand-dollar true pro machines. It has balanced XLR plus unbalanced RCA jacks for input and unbalanced RCA jacks and SPDIF RCA jack for output. Sample rates of 32, 44.1 and 48 kHz are supported. The unit also has a built-in limiter and 1/4-inch headphone jack with volume control. Fostex' new portable, time code DAT recorder, PD-4 ($6,795) should ship in May.

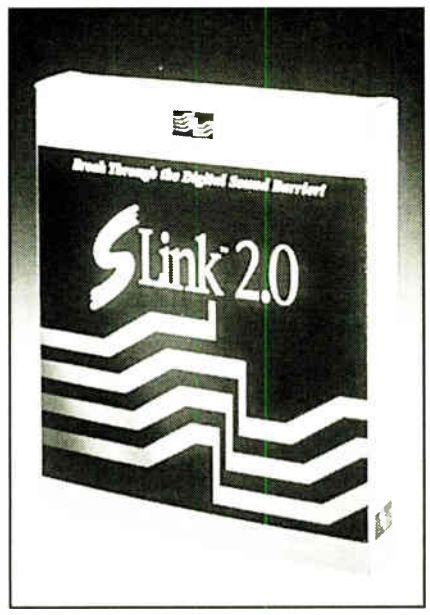
Another intersting product was Otari's UFC-24 Universal Multi-track Digital Audio Format Converter, ($1,995.00). It will convert up to 24 channels of digital audio from any one to all of the following digital formats: PD, SDIF-2, ADAT, TDIF-1, AES/EBU. The units are expected to ship in June.

A tiny microphone

AKG introduced its new amazingly small omni, dual-diaphragm, mini lav: the CK77 and C577. The opposing diaphragm design reduces incidental physically-induced noise. Capsule and cord can be unscrewed and replaced in the field. AKG also showed the new D-230 dynamic omni mic for ENG ($179) that sports a longer shaft to accommodate mic flags and still leave enough room for a good grip.

At Audio-Technica, the AT-MX341a four-channel automatic "smart" mixer ($799) stood out as competition for the Shure FP-410. Shure Brothers showed their SCM810 ($1,650): an eight-channel version of the FP410 IntelliMixer (missing a few of the FP410's features).

The Eventide DSP4000B Ultra-Harmonizer ($3,995) with broadcast and production effects designed by Jay Rose will be shipping in July or August. Special sound effects like rain and thunder, seashore, wind and jet fly-bys are grouped into 11 categories such as Commerce, Communications, Machines, Fantasy Voices, Backgrounds and Science Fiction Voices. The DSP-4000B has both analog and digital I/Os, 18-bit A/D and D/A converters and a 24-bit digital I/O. 32, 44.056 kHz, 44.1 kHz and 48 kHz sample rates are supported. An internal sampler board is optional.



Synclavier SLink 2.0

My ear was also caught by the QuadraSynth Plus Piano ($1,695) at the Alesis booth. It contains nice on-board sounds, 24MB, 64-voice polyphony and an ADAT Multi-channel optical digital output that lets you port audio directly to the ADAT recorder. There are four easily accessible hardware controller knobs on the face of the unit for real-time manipulation of MIDI controllers. You can load new sounds in via the MIDI port. The system will import Sample Cell, Sound Designer, Sound DesignerII or AIFF files.

This year's ADAT advances with System 4.01 include use of the 180 (61-minute) tapes, a feature that lets you go into record even if the record knockout tab has been removed and improved lockup (typically in less than three seconds).

Ty Ford is interested in knowing about any production toys that he missed at NAB. His E-mail address is TFord1010@aol.com.

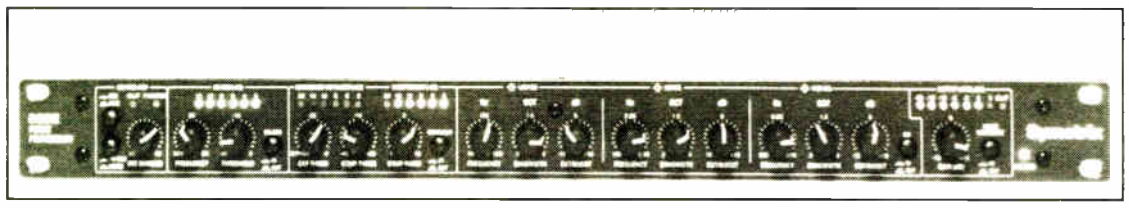
Symetrix 528E Gets Enhancements

▶ continued from page 24

checked for line level leakage into the mic pre-circuit and found none, so you are safe in leaving two different sources connected to the input. The front panel of the input section also has a 15 dB mic pad, a mic preamp gain knob, clip LED and phantom power LED. The phantom power switch is on the back panel.

Next is the de-esser circuit. De-essers are frequency-dependent limiters that are usually used to limit the sibilant "SSS" sounds in human speech. If viewed on a graph, sibilant sounds would show as a spike of high-frequency energy well above the main envelope of normal speech.

Because sibilance can occur across a fairly broad spectrum, the de-esser also has a frequency control that should be adjusted to the offending part of the spectrum. The trick is to set the adjustment to control the sibilance without dulling the rest of the sound. A six-LED display registers the amount of gain reduction applied by the de-esser circuit. While no de-esser I have heard is perfect, the 528E's is less brutal than most and slightly less destructive than I recall the older 528 circuit being.



The latest version of Symetrix's 528

Expander/compressor

Although the expansion ratio is not adjustable, the expansion threshold is, and there is a six-light LED display that indicates the amount of downward expansion. Because of the interactivity of the mic gain, compressor and expander, you may have to tweak around a bit to get the expander to operate smoothly.

In one situation, the expander threshold setting became too jumpy. I either had no expansion or 4 dB to 6 dB of expansion, regardless of how carefully I adjusted the expansion threshold control. That is a function of the amount of control applied as the expansion threshold knob is first moved from the extreme CCW position. Changing the input gain and compressor settings required the threshold setting to be set higher and out of the "jumpy" range.

The original 528 offered up to 20:1 compression ratios, whereas the 528E maxes out at 10:1. That is still more than enough to increase the density of the processed audio to the point of true ugliness. Setting up the 528E for use as a mic processor is easy. Basically, all you have to do is set a good mic gain level (somewhere between 10 o'clock and 2 o'clock), set a compression ratio (2:1 is a good place to start) and adjust the expander threshold clockwise until the ambient noise disappears. Then, while speaking into the mic at a normal level, adjust the compression threshold until the LEDs show 4 dB to 6 dB of gain reduction. If you still hear too much room noise after you quit talking, turn the expander threshold control more to the right.

Now try speaking short words like "test." If you hear a noisy trail that follows your last sounds, turn the expander threshold control more to the right and/or back the mic gain control off a bit.

With the older 528, using higher compression ratios and over 8 dB of gain reduction resulted in dull and "squashed" audio. The 528E has a new "look-ahead" detector that anticipates the transients and density of the incoming signal. The compressor attack time is floating and adjusts depending on what's about to hit it.

Parametric EQ

The three-band parametric equalizer section of the 528E has three overlapping bands: 16-500 Hz, 160-6300 Hz and 680-22 kHz. If you actually used the -30 dB offered by the older 528, be prepared to do without it. The 528E boost and cut is ±15 dB.

The final stage of the 528E is a master output control and eight LED display with Clip light and switchable voice symmetry circuit. The voice symmetry circuit uses a second-order all pass filter to render the audio that passes through it more symmetrical. The idea here is that the positive and negative peaks of speech are not naturally of the same value. Because of this, maximum gain adjustments are limited to the value of the greater peak. The voice symmetry circuit, over time, rotates the phase of the signal to create an envelope in which the positive and negative peaks are of more equal values.

While I understand the concept of normalizing the peaks to allow for maximum transfer, I still have philosophical problems with the concept of distorting... oops, I mean modifying the phase of the original waveform.

I will say, however, that the 528E's symmetry circuit doesn't sound as bad through the headphones as others I have used. In fact, I was hard pressed to tell the difference between In and Out. With the symmetry circuit in, the level seemed to drop very slightly, maybe 1 to 2 dB. Because it was impossible to tell whether this was the result of the reduction of the larger peak or an amp stage not working exactly at unity gain, any conclusions as to the benefits of the circuit I have remain theoretical.

In conclusion

The 528E manual is extremely well written. If you're just starting to get into audio processing, it contains a wealth of good basic information expressed in an easy-to-understand way. The refinements of the 528E probably won't push 528 owners into selling off their older units, but it will give them good reasons to consider a 528E when they need another channel of processing.

□□□

Ty Ford is the author of "Advanced Audio Production Techniques," which can be ordered by calling 800-366-2665. He can be contacted at Tford1010@aol.com.

Satellite Audio Uplink

▶ continued from page 31

encourage the use of COMSAT HSD services for broadcast and other uses, Mobile Telesystems was committed to reducing the size of the satellite terminals (in this technology a "terminal" refers to all the equipment needed to uplink and downlink satellite signals), and it acquired the expertise of Scientific Atlanta to begin this project.

When audio codecs became readily available this marriage of technologies was natural for international broadcasters, and for those broadcasters that wanted to get higher quality audio from remote places across the globe. Radio France was one of the first users of Standard A high speed data service for broadcast.

But what about the busy signals when trying to call? White said there are three "public-use" high speed data channels in the Atlantic East region, three in the Atlantic West region, and two channels apiece in the other two global regions. Apparently it is possible for a sat phone to "see" two suitable satellites from almost anywhere on Earth, but as White explained, in the East Atlantic and Indian Ocean region the channel use is congested because of the amount of "news-users" in those areas.

That is, where news happens, organizations take their satellite terminals, and everyone seems to want to file simultaneously. Interestingly, the path to the satellite may be available, but the resources at the selected Earth Terminal may be in use, causing a busy signal. According to Guy, the total L-Band bandwidth for all Standard A services is 7 MHz; that is, a portable terminal transmits at around 1.6 GHz (L Band), the satellite transmits the signal to the earth station on 4 GHz (C Band). The satellite receives 6 GHz (C Band) from the earth station and relays the signal to the portable terminal at around 1.5 GHz (L Band). The L Band, White said, is very precious spectrum, and COMSAT has changed the frequency plans to help relieve the traffic congestion.

The Standard A HSD portable terminals use a transmission scheme that allows the user to select between an analog kHz carrier (for voice grade conversation) and the kHz QPSK carrier (for the digital signal). A new COMSAT service, called Standard B, will be completely digital and not require this switching. These frequencies, opened up by international agreement, should make voice grade communications come down in cost, as the spectrum can be more efficiently used.

Broadcasters can get Standard B high speed data service, and will be able to use duplex transmission techniques; you can use your choice of protocol in both directions. Looking further ahead, White said that COMSAT is investing in ISDN technologies and examining ways to provide 128 kilobits per second (kbps) transmission paths.

Dis 'N' Dat

If it's got a colon in it, it must be a public broadcasting title. NPR's Linda Wertheimer has published her first book "Listening to America: Twenty-Five Years In the Life Of A Nation As Heard On National Public Radio" (Houghton Mifflin). It'll be in your bookstore on May 29. It's out just in time for NPR's 25th anniversary and is a year-by-year "listen" to the major news stories and cultural life of these United States.

Until next month, I remain, Your obedient engineer.

ADX *Ensemble*

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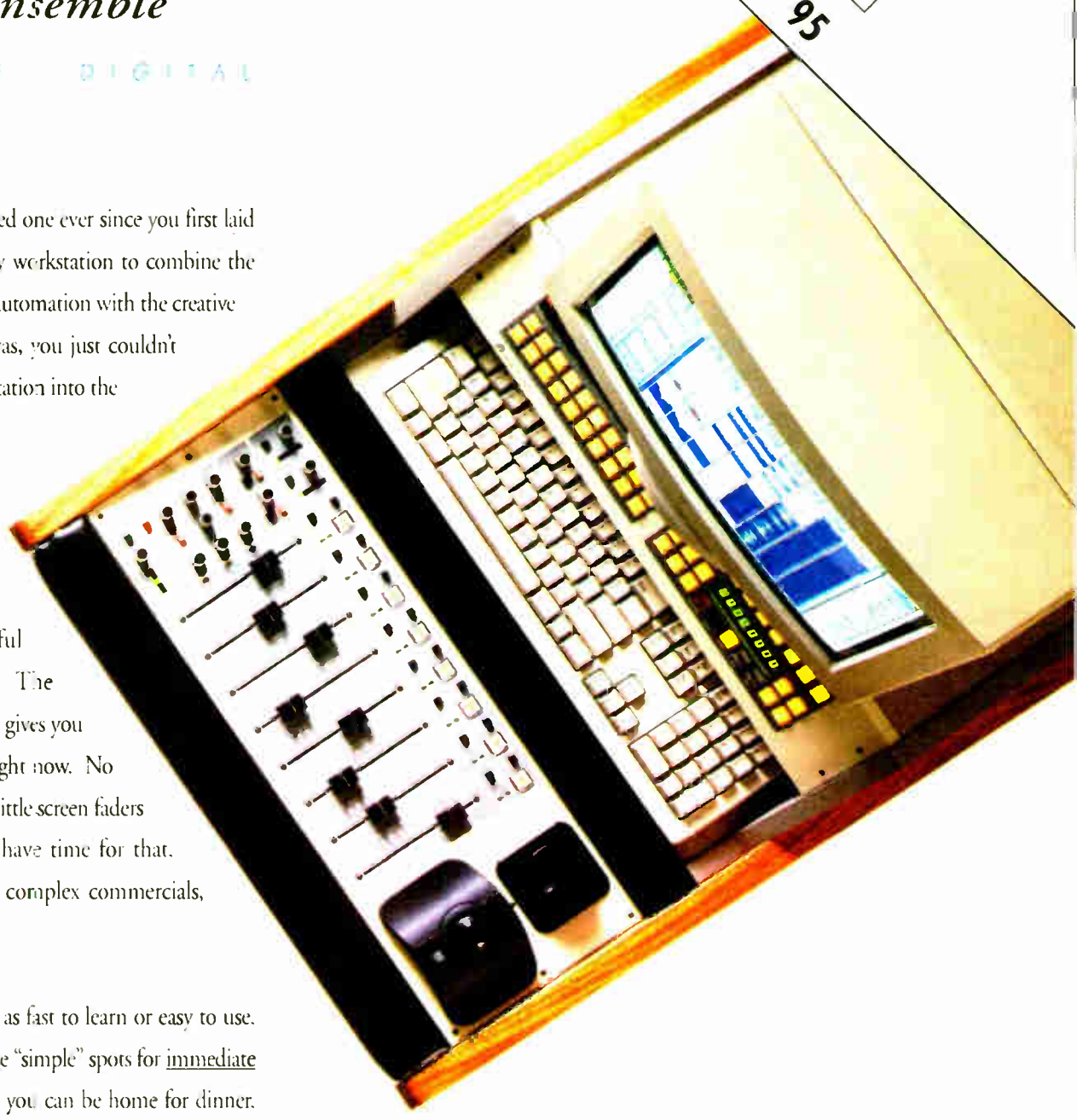

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NAB COVERAGE

Radio Production Tips from NAB 1995

LAS VEGAS For the first time, the NAB offered three radio copywriting and production seminars at this year's spring convention held last month.

In his opening address, keynote speaker Ty Ford traced the history of radio advertising and demonstrated how radio stations have lost touch with their direct clients and their audience. He went on to say that in order to survive, radio must reinvent itself to restore those connections.

"It's extremely important that owners, general managers and station managers rethink the connection between commercials, clients and station revenue," Ford said. "Management needs to shift away from the idea that radio is about selling spots or time. Instead, stations need to focus on the idea that what they are really selling is access to their listeners."

Ford's seminar, titled "Raise Ratings & Rates With Better Radio Copy," illustrated that in paying more attention to the content and production of commercials, stations could simultaneously decrease tune-out, improve ratings and increase revenue

"The key here is that there are five elements of any spot; concept, copy, performance, production and technical," Ford said. "Underperformance in any of these areas leads directly to tune out. Once you understand the anatomy of a spot, and what the problems are, you can begin to fix them."

According to Ford, servicing the client properly doesn't mean bending over backwards to accommodate them, but integrating them into the creative preproduction process.

"Early integration of the client into the creative process is a time-saver for the production director," he said. "Instead of "blue-skying" three or four different approaches to completion, early integration allows different approaches to be considered before deploying a full commitment."

Ford also gave advice on hiring production talent, and finished by challenging radio to re-invent itself. "We have to start now" he warned. "When DBS (direct broadcast satellite) becomes a reality, it will be too late."

On Monday, April 10, a panel of production experts conducted a number of presentations. Jeffrey Hedquist, president of Hedquist Productions, presented "The Ultimate Radio Production Tool—Your Brain."

At the core of Hedquist's approach is his "Whole Brain Radio" concept. "This is the perfect wedding of emotional/entertaining and logical elements of a spot." Hedquist suggested that production people "tune in" more to life around them to pick up real-life experiences that can be used in commercials.

"Do your own little focus groups," he said. You'll be surprised at what's on people's minds and what they say. Effective advertising comes from experience and intuition, not hard science." Hedquist also advised those in attendance to use the "five-seconds test." If you don't catch the listener within the first five seconds of the spot," Hedquist said, "you've probably lost them. Radio commercials should be written as stories, with all the elements of a good play. Remember the radio palate; voices, music, sound effects and silence."

When writing, Hedquist suggested using a tape recorder. "You can usually speak the words much faster than you can type them, and when typing, you have a tendency to think too much about what's coming out."

If that doesn't work, try "continuous writing." Just put your pen on the paper and continue writing for five minutes, regardless of what comes out, according to Hedquist.

Hedquist also suggested using the "What/So What?" method to find the essential copy points. "What you're looking for is the most powerful truth. Once you find out 'What' the product or service is, keep asking 'So What?' until you arrive at the true benefit to the customer."

In an effort to move clients away from hackneyed or overly abrasive approaches, Hedquist uses the "Peer Selling" approach. "Whatever your client is selling healthcare, automobiles or what ever, you need to play them examples of good commercials advertising the same sort of business or service. Once they hear the good ones, you can pull them away from the bad approaches."

Following Hedquist's presentation, a radio production workshop moderated by Topline Design Ltd's Dennis Daniel offered ideas and suggestions of six top radio production specialists.

continued on next page ▶

WBZO Production Director Suzanne Ventra spoke about the importance of having a comprehensive production form and offered an example in the session handout. "A properly filled out form saves an enormous amount of time," she said. "It is the nucleus around which the entire production process is built. A good production form reduces make-goods, makes sure spots run correctly and reduces tension between the sales and production departments."

WKLQ Production Director John Pelligrini followed with good advice for hard straight=sell spots. "These spots are considered the "bastards of the business" by most advertising experts. They are also considered the most effective form of radio advertising. What people don't realize is that hard sell spots aren't all "Crazy Eddie" spots. Rush Limbaugh, Howard Stern and even Paul Harvey are examples of hard sell."

Pelligrini said that hard sell is not about shouting, but about a direct approach. "What's important is that you concentrate on one thought per spot," he said. "Clients who insist on loading spots with prices and numbers are making a big mistake. The listener simply doesn't have time to absorb that kind of information. Describing the location with words like 'On Division, just one block north of 36th Street' is fine but addresses and phone numbers are usually a waste of time."

WMXB Production Director Holly Buchanan commenting on the comedy/straight approach to spots had three rules for their success. "If you start out with a scenario, always come back to it at the end. That last scene should contain the punch line, followed by the advertiser's name and address or slug line."

Buchanan also stressed the importance of maintaining the message. "Make sure the scenario reinforces the main message. In fact, the first thing you should do is identify the main message. If you have a great commercial, but no one can remember what the commercial was promoting, you haven't done your job."

Buchanan also suggested to not go with the obvious. "Just because the business is an auto repair shop doesn't mean you have to use a scenario involving a car crash."

ALLIES FM Production Director Rich VanSlyke addressed the use of comedy commercials. "Comedy covers a wide area, but the essence of comedy is the indirect or implied insult, he explained.

There are a lot of clever commercials that use sound-alike words or current events for their starting point, according to VanSlyke. "Like the Denny's spot that parodies Jacques Cousteau in search of the rare Alucani (all you can eat) fish. There are singing silliness spots, cartoon voice spots, funny sound effects and even reworded nursery rhymes."

"The general rule in comedy," VanSlyke said, "is to set up in one direction and flip the results. Your best tools are character voices, movie soundtracks, quirky music, cartoons, sfx and books on comedy writing."

An insightful presentation on station promos by WHTZ's Dave Foxx demonstrated that careful attention to program clocks and promo programming had resulted in a fifteen minute increase in TSL. Fox also revealed that WHTZ rates each commercial by a combination of production value and target interest to determine the playing order in spot breaks.

According to Foxx, "If a commercial features a great jingle, like Mountain Dew, it generally gets a score of five for production value. If a spot features a cold voice, straight sell, it gets a one. Then we evaluate the spot on the level of interest to our target audience. A concert spot for Greenday or Nine Inch Nails would get a five and a hardware store commercial would get a one, or even a zero, not because it's a bad spot, but simply because it's not as interesting for our target."

Foxx noted that stations need to go further than demographics to arrive at their target audience. "You have to start to think like 'Female, 24, college-educated in liberal arts, annual income of $25K, single but seriously involved with someone, lives in the suburbs, but works in Manhattan.' Just thinking 'Female 25 to 34' doesn't work. The result, Foxx said, is a sharper focus for all promotions and a real sense of purpose and direction."

Foxx also noted that his promos fall into two categories, "positional" and "attitudinal." "The positional statement for WHTZ is 'Today's Best Music.'" Fox said. "News stations typically spend all of their time on positional statements, whereas music stations spend more on attitudinal promos," he explained. "This is the real ear candy. It's where the listeners have the most fun. And it's where we talk directly to our target listener."

Foxx addressed the importance of matching the style of a station's production to its image and keeping the message simple and unpolluted. He also suggested that, by using the right music and production elements, a bigger story can be told with fewer words.

Steve Morrison of Topline Design completed the first part of the session by discussing how a production department can survive when presented with multi-station responsibilities.

NAB COVERAGE

Industry Responds with Affordable DAWs

by Cris Crump

LAS VEGAS Many of the "card- and software-based" products have definitely proved appealing to first-time digital audio workstation (DAW) buyers as well as facilities looking to complement their existing digital editing systems. Potential buyers were on the NAB 95 floor en mass looking for the new "hot box."

One of the biggest buzzes in Las Vegas was the rollout of the new SAW Plus software from **Innovative Quality Software**. SAW, which stands for Software Audio Workshop, had been available as an eight-track mono/four-track stereo hard disk editor for around $600. SAW Plus offers an additional eight tracks for 16-track mono/eight-track stereo for a suggested retail of $999. Both systems require a PC 486DX-50 with at least 16MB RAM (although the eight-track SAW can function on a 386-40 PC with 8MB RAM), Windows 3.1 or higher, a minimum 250MB hard drive and a 16-bit digital sound card like Digital Audio Lab's CardD or Turtle Beach's Multi-Sound card.

In addition to complete "drag & drop non-linear editing" with 16 live virtual tracks of playback, the SAW Plus offers in-line digital effects, multiple card outputs and a complete, feature-loaded 16-track software mixer.

In the MultiMedia Hall, **Micro Technology Unlimited** (MTU) was displaying its MicroSound Digital Desktop Editor. Although the system uses a "proprietary" processing box, this Windows-based editing program offers significant editing power at a substantially lower price. A fully outfitted MicroSound system is available for well under $10K and offers a very simple one-screen user editing interface and one-button record and playback. The MicroSound system can be purchased as just a peripheral and software to be plugged into your existing 386 or 486. However, MTU recommends considering a complete MicroSound system as it engineers and builds its systems not to "crash."

The EditView

The **Synclavier Company**, formed from a user group of the legendary (and now-defunct) New England Digital Synclavier, has began to develop various software packages to operate on Apple System 7.0 or higher. EditView 4.0 is a very simple and intuitive software editing package that has been designed to operate on several hardware configurations including: Pro Tools III, Fostex Foundation, Sonic Solutions' Sonic system, Spectral Synthesis and others. The idea is to allow the user to be able to work just about anywhere there is hardware.

Synclavier's SLink 2.0, a file conversion utility, serves to make proprietary system language a thing of the past. Both software packages require a floating point processor unit and a 68020 or higher Mac or PowerMac computer.

Spectral's AudioEngine hard disk recording and editing system is a favorite among video post production houses and many radio outlets as well. Starting at just under $30,000, however, this product may be a bit out of reach for many broadcasters. Responding to the need for a more economical editing system, Spectral has developed the Audio Prisma, a complete eight-track workstation integrated into a single peripheral card and bundled with a powerful software package. For right around $4000, you get the card, networking software and both Prismatica and Prisma Music—two very powerful and feature-laden pieces of editing software. The purchaser simply supplies its own 386/25 MHz or faster PC, SCSI hard drives and digital I/O box.

Staples of business

Many audio professionals swear by their **Digidesign** systems. Both the Session 8 and ProTools III have become a staple part of the DAW lexicon. Offering 16 to 48 tracks of record and playback and operating on the Apple Macintosh platform, the core Pro Tools system starts at around $7000. The system operates using two peripheral cards and Pro Tools 3.0 software interface.

Digidesign's "TDM Plug Ins" enable the user to utilize various software-based DSPs that are available for an additional cost. Session 8, while offering only eight-channel direct-to-disk digital recording, has conformed the power of Digidesign's product line to operate on both the IBM and Mac platforms with a basic start-up cost of only $2000. As is typical with most card-based DAWs, an audio I/O interface is required and Digidesign offers the 888 for $3000 and the 882 for $1000. Networking, OMF support, third-party software upgrades and backup storage are also options that are readily available.

There is great promise in slogan the "PowerMac Hard Disk Recording No Additional Audio Hardware Required! $399." **OSC**, a small software design group that formerly provided products for Digidesign, has made serious waves in the

continued on page 39 ▶

The New Math for ISDN

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- Only Layer III permits mono 15kHz operation on a single ISDN "B" channel or one Switched 56 line.
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Zephyr™ ends your dilemma because it now provides both the superior quality of Layer III and compatibility with installed Layer II-only equipment. With the push of a button, you select which coding scheme to use.

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NAB COVERAGE

Studio Mics, Speakers in Las Vegas

by Tom Osenkowsky

LAS VEGAS Scarcely a studio exists that doesn't have at least one microphone in use. NAB '95 saw microphones and studio monitors abound.

New to the **Harris Allied** product line are two Oktava-brand studio condenser microphones. The MK 012 uses interchangeable, screw-on capsules to provide a choice of cardioid, hypercardioid and omni-directional patterns. Low-noise, transformerless preamplifier circuitry ensures good performance in close and distant miking situations. A wide, flat frequency response (specified from 20 Hz to 20 kHz) ensures sounds are captured with a high degree of accuracy.

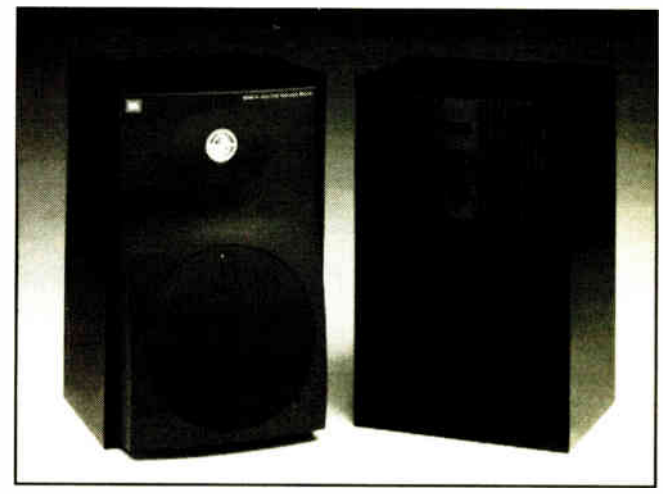
The MK 219 delivers the warmth, brilliance and character of a large diaphragm, gold-sputtered membrane condenser microphone. Manufactured in Russia, Oktava mics will be distributed exclusively by Harris Allied in the Western hemisphere.

Audio-Technica unveiled its ATM series of condenser microphones, designed to be powered by either an internal 1.5 volt battery or external phantom power. The ATM01a is an omnidirectional model while the ATM33a is designed for unidirectional applications. Also new are the ATM75 cardioid condenser and PRO-8HE hypercardioid dynamic headworn microphones as well as the AT873R remote-powered condenser vocal mic. Audio-Technica features the ATH-M40 and ATH-D40 precision headphones which are new for 1995. The company manufacturers a complete line of studio and broadcast condenser and dynamic microphones and headphones.

AKG recently introduced the C5600 and C3000 large-diaphragm condenser microphones for studio and voiceover applications. AKG also features the omnidirectional D-230 made for field use in radio/TV on-site reporting. Small in size but big in performance is the CK-77 dual-diaphragm lapel microphone, ideal for situations where small size is of utmost importance.

JBL introduced its model 6208 bi-amplified studio monitor speaker. The 6208 offers built-in protection, two discrete 50 watt amplifiers and multiradial baffles. The 6208 is intended for control room nearfield monitoring.

Sennheiser highlighted its IS850 digital infrared headphone system. Comprised of a high-quality digital infrared transmitter and HDI850 headphone, this system meets the demands of studio monitoring and production where freedom of movement is essential. New for NAB '95 is the EM2004-UHF true diversity receiver, comprised of 16 preprogrammed channels and featuring built-in HiDyn Plus noise reduction. Also new for the show was the BF1053 medium-cost VHF lavaliere system consisting of a true diversity receiver, bodypack transmitter and MKE2 microphone.



JBL 6208

beyerdynamic introduced the XS range of microphones suited for news and ENG/EFP applications. A number of specific models in the series were on display. Also new is the MCE-83 electret studio microphone with inherent wide frequency response. New headsets are dubbed the DT-200 series, available with/without boom headsets and choice of microphone capsules. One the wireless front, the company introduced the U-600-UHF synthesized true diversity receiver with 64-channel capability. A matching bodypack incorporates an LCD display for easy channel identification.

Neumann showed its popular TLM-193 studio condenser and its new KM 184 condenser that has seen usage on the road as well as in the studio.

Shure introduced the SCM-810 automatic microphone mixer featuring noise-free operation, automatic gain adjustment and adjustable EQ per channel. Also new is the M367 mixer, now featuring six channels that are user selectable between mic or line level, dual balanced outputs, phantom power and 100 db dynamic range. New to the Shure extensive microphone line is the SM-93 miniature lavaliere with omnidirectional pattern and condenser element.

Crown International featured its CM-311HS condenser headset microphone specifically designed for broadcast use. Intended for installation on Sony MDR series headsets, the CM-311HS rejects background noise and performs very well in traffic 'copters, sporting events and car races. Crown also displayed the CM-10 professional quality lavaliere electret condenser microphone. Miniature in size and economically priced, the CM-10 is supplied with a tie clip and features wide frequency response.

Vega unveiled the T-678 ProPlus synthesized UHF bodypack transmitter. The T-678 compliments the ProPlus UHF wireless microphone product line. Nady also debuted two new wireless microphone transmitters, the ENG-11 (VHF single-channel) and the ENG-12 (UHF synthesized 160-channel) both for use with XLR connector or lavaliere microphones. Electro-Voice displayed their well-known RE microphone line and highlighted the RE2000 studio condenser model.

Neotek Corp. unveiled two four-channel microphone preamplifiers: the MPX 4A, and the MPX-4D. The MPX-4D is

continued on next page ▶

Affordable DAWs at NAB

▶ continued from page 36

professional audio community with its $400 Deck II v. 2.2 card. Designed to operate on the PowerMac, Deck II 2.2 delivers up to 12 tracks of playback of 16-bit digital audio with no additional audio hardware required.

At NAB 1995, OSC unveiled the new Deck II version 2.5 due for the second quarter of this year. It offers real-time in-line DSP effects, third-party compatibility with Adobe Premiere plug-ins and the ability to achieve up to 24 tracks of simultaneous playback on a PowerMac 8100 series. OSC (which incidentally stands for "our stinking corporation") also has an impressive assortment of software peripherals in its product line.

Since its introduction in 1992, **SADiE** has gained in popularity among radio broadcasters. The IBM-based system, which uses a familiar Windows graphical user interface (GUI), comes available as a complete turnkey system for about $10,000 and in subsystem configurations for $7000 and $6000. The SADiE system is built around two peripheral cards—one for digital audio processing and the other for analog conversion and time code. All the editing functions for the system are emulated in easy-to-understand icons on the screen and several different backup, networking and control interface options are also available.

As networking of audio goes, one would be hard-pressed to find a company that could rival the expertise of **Sonic Solutions**. Already used by many of the broadcast networks, Sonic Solutions has developed Sonic Radio Station (operating on the Macintosh platform). The heart of Sonic Radio is the SSP-3 DSP card which, in the basic 8-track configuration, starts at about $3,795. The "modular" nature of Sonic's hardware allows for a simple upgrade process. Sonic Solutions has a number of different system configurations and networking options that can be customized for practically any facility need utilizing MediaNet—Sonic's revolutionary high-performance networking system.

Ready for Windows

As MicroSoft Corporation prepares to roll out its new multitasking environment Window 95 (Chicago), so too are DAW manufacturers preparing to create effective and powerful products based on the new and improved operating system. Among the first entrants into the Windows 95 arena is **Merging Technologies** with their PyraMix Digital Media Workstation. Pyramix is scheduled for release this summer for about $6000. The 32-bit floating point DSP card called "Kefren" has optical digital-audio connectors for connection to modular units such as the Alesis ADAT.

The PyraMix software includes both graphical and list-based editing, a sophisticated mixer, very flexible patchbay and Open Media Framework support for ease interchanging file information.

When you get down to making a decision on which system to buy, it's best to take your time and figure out which product will meet the needs of your facility. There are, of course, new systems being introduced to the marketplace nearly everyday.

□□□

Chris Crump is creative services director for Paxson Communications in Maitland, Fla. and a contributor to ***RW***

Microphones At NAB '95

▶ continued from previous page

digitally controlled and includes a microprocessor controlled gain system, front panel digital gain readouts and PA422 serial control inputs for remote control over standard serial lines. Also new this year are the EQ4X-M1 microphone and four-band parametric equalizer.

Developing Technologies previewed the **Sanken** COS 11 omnidirectional miniature electret lavaliere microphone, and the Sanken CSS-5 shotgun stereo microphone.

Micron Audio Products introduced the TX-505 wireless microphone system, SDR portable diversity receivers, and the SQN-IIIa location stereo audio mixers.

The line of Micron wireless microphone systems, SQN portable audio mixers, and Tram lavaliere microphones were also on exhibit this year.

Electro-Voice highlighted its RE2000 studio condenser microphone this year, and displayed its established line of microphones including the RE50, RE50 N/D, 635 N/D, RE20, RE27, RE38, RE45, RE15, RE16, ELX1-A, S-60A, and S-80A.

Comtek previewed the BST-25 frequency-synthesized base station transmitter, offering front panel tuning; and the PR-50 wireless cuing system.

Three existing wireless microphones were shown by Comtek: the MRC-82 C Camera Companion; the studio/professional grade M-182 wireless handheld microphone; and the MR-182 wireless microphone receiver. The RC-72 portable wireless cuing system was also on display.

Wohler Technologies debuted a serial digital embedded audio extractor to AES/EBU to analog DA option for its line of rackmount powered speakers; the Broadcast line of 1U and 2U powered rackmount monitor speakers; and the AES/EBU digital level meters for both powered monitor speakers and up to 10 standalone units in a one-rack space.

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NAB '95 COVERAGE

Automation Enhances Creative Aspect

by Alan Haber

LAS VEGAS It used to be that using the word "automation" struck a rather ghastly cord in broadcasters, suggesting something akin to waking up in an episode of "The Twilight Zone" and being replaced by... machines!

These days, the word automation has a whole different meaning. Today's automation products, more than anything else, free on-air talent from the mechanical tasks associated with doing a show so they can concentrate on the creative aspects of their trade.

Radio automation enjoyed a high level of visibility at NAB '95. The only downside of having so many exciting products under one extended roof was having to walk so much to see them; perhaps NAB '96 (and the upcoming World Media Expo) could 'automate' the process!

Versatile

Automation products are, in a word, versatile. They're affordable, too. Whether your station is considering full automation or live assist, or simply cart machine replacement, there are products to suit your needs, and your budget.

Floor traffic for digital-based systems was "extremely heavy," according to Jim Hauptstueck, worldwide sales, digital product specialist for **Harris Allied**. "Efficiency," he said, "is kind of the name of the game. How can I capitalize on my capital expenditures, not only to get the most out of my money, the most out of my investment, but also, more importantly, the most out of my staff?"

Off and running

AEV showed its new Aurad System 2 Virtual Radio broadcast automation system, capable of both full automation and live assist. The Windows-based product can be controlled by either a touchscreen (which seemed to be very popular on the NAB '95 show floor), mouse or keyboard, although Luca Bergonzini, marketing manager, said that, normally, station personnel prefer to work with a mouse because most of them have smaller monitors and it is difficult to work with a touchscreen on a smaller monitor.

The complete Aurad System 2 package includes a personal computer able to interface with a variety of audio sources, such as multiple CD, DAT, cassette recorders and satellite receivers; monitor; and keyboard—a turnkey system.

The Digi-Link hard disk digital audio workstations, for satellite, CD, tape, and hard disk automation, were on display at **Arrakis Systems** (and at **Broadcast Supply Worldwide**). Support for the Sony 360 and Pioneer 300 CD jukeboxes is provided. Touchscreen support is new this year; mouse and keyboard support are also offered. Removable hard drives for the Digi-Link systems were also new at NAB '95.

For satellite automation, the Digi-Link systems have auto-size sets, log sat closures and offer external satellite control for starting stop sets, station IDs, four jock-specific liners, timed record and clock sync. In live assist mode, the Digi-Link systems can pre-program as many as 30 live-assist stop sets per hour, with up to 300 events. Stop sets can be triggered manually, by time or from a start closure on the audio console.

According to Raymond A. Miklius, director of digital products for **Broadcast Electronics** (BE), there are different degrees of automation. "What we like to say is automation means taking over tasks that can be done more efficiently by machines and freeing up people to be more creative," he said.

All together

BE was showing several automation products, including the AudioVAULT digital studio systems, which bring together computer software, processors and connections on a circuit board for live assist or automation of local- and satellite-delivered formats. AudioVAULT OnLINE, meanwhile, is BE's system of networking for radio stations, allowing simultaneous record/playback access by more than one broadcast studio to a single digital audio storage system.

AudioVAULT Music-On-Hard-Drive Format Libraries by Broadcast Programming were also on display; they can be pre-loaded onto the AudioVAULT digital audio system. Also in BE's booth were the Format Sentry FS-12C Radio Programming Automation Controller, a

continued on page 43 ▶

Amplification Products Play Key Role in Station's Sound

by Chris Crump

LAS VEGAS As a production person, I am somewhat embarrassed to admit that I had never really given much thought to the importance of amplification in the studio. As long as I had sound coming out of the speakers I was okay.

Little consideration was ever given to the problems that could be caused by an amp that significantly "colored" the sound. Should those of us in radio be concerned with the quality of components in relation to the quality of sound they produce? By all means. Are we? In most cases, no.

A number of amplifier manufacturers have been developing products that, while delivering quality sonic performance through advanced circuitry, operate within the confines of the dreaded capital budgets of potential buyers. NAB '95 allowed many amp and preamp manufacturers to showcase these latest products.

Exciting news

One of the most exciting recent developments in the amplification on display at NAB '95 was Hafler's new Trans-Nova line. The line is based on James Strickland's Trans-Nova topology employing a simple yet elegant three-stage amplification process. The Trans-Nova series amps utilize direct-coupled lateral MOSFET output devices for reliable and powerful output.

Hafler's most popular P3000 lists for $799 and pushes 150 W/channel at 8 ohms. The P1500 is rated at 75 W/channel at 8 ohms for a list of $549. Both units are convection-cooled (no fans), double-rack spaced and are equipped with a unique electronic fuse. The Trans-Nova amps also feature new LED indicators for real-time visual monitoring of each channel's signal, clip, short and thermal status.

Word from Hafler reps is that engineers are currently developing a Trans-Nova unit that would fit within a single rack space.

The British manufacturer Bryston has been developing and producing home and professional audiophile components for more than 20 years. The quality of its products is reflected in their cost but they generally use only high-quality components: Gold-plated five-way binding posts and RCA connectors, 1 percent metal film resistors and hand-matched transistors help keep noise to a minimum and ensure durability.

High quality gear

The Bryston 2B-LP amplifier is rated at 50 W/channel at 8 ohms, convection-cooled, has dual power supplies, has a list price of around $795 and conveniently fits in a single-rack space. The high-powered 7B Pro outputs 250 W/channel at 8 ohms for $2195. But with a 20-year warranty, even on second-hand units, Bryston's amps provide solid performance and durability.

Bryston's two channel BMP-2 microphone preamp lists for $2500 and provides very high input headroom at +10 db. Features include 48 volt switchable phantom power, mic impedance matching switch, mic polarity switch and channel muting. Each channel has a 12-position gain control that increments in 4 db steps. The BP-20 balanced control preamplifier has five unbalanced RCA inputs, a balanced and unbalanced pair of outputs, a tape/effects loop and discrete circuitry construction in a single-rack space. For $1495, the BP-20 has virtually no input-to-input crosstalk, a very low noise floor and an externally mounted power transformer to eliminate noise and interference.

Crown amps and preamps have long been a mainstay in the majority of radio stations across the United States. Crown's D series, in production for more than 25 years, has introduced the latest version of "broadcasting's most popular amplifier" the D-75A and it's new "younger brother" the D-45. The D-75A is a familiar single-space, convection cooled rack unit with new signal presence and IOC LED indicators rated at 40 W/channel at 8 ohms, while the D-45 offers all of the same features at 25 W/channel at 8 ohms. The units are list priced $625 and $395 respectively.

Manufacturers have developed products that deliver quality sonic performance.

Crown's PSL-2 preamp is a very cost effective and versatile unit with seven separate inputs, tone controls, signal and overload indicators and flexible tape copying capabilities for $995.

Latest additions

Ramsa's latest addition to its line of amplification products is the WP-1000 series. The WP-1200 and the WP-1400 output 120 W/channel and 240 W/channel at 8 ohms respectively and are listed for $650 and $800. Both units feature Ramsa's class H circuitry and are fan-cooled utilizing a servo-control system to vary the speed of the ultra-quiet fans with low operating temperature. The WP-1400 does, however, occupy three rack spaces as opposed to the WP-1200 double space configuration.

Adding to its incredibly huge product line, Yamaha introduced several new and powerful amplifiers designed to meet the needs of almost every application. The P3500, P2500 and the P1500 all offer three different types of input connectors, Protection, Clipping and Signal LEDs, low noise and harmonic distortion. All units are double-rack spaced, fan-cooled and have standard "crowbar" protection. The P3500, P2500 and P1500 carry a list price of $899, $799 and $599 respectively.

A favorite among audio purists at NAB '95 was the new Aphex 107 Dual Channel Tube Microphone Preamp. Offering two discrete preamp channels, the 107 combines solid state circuitry with the warmth of tube technology in a unique tube circuit that Aphex calls, "Tubessence." Priced at $595, the 107 has switchable 48 volt phantom power, continuously variable (as opposed to stepped) gain controls and very low noise and crosstalk. The unit even features talent-activated muting using a remote foot switch, a handy feature for studio recording applications.

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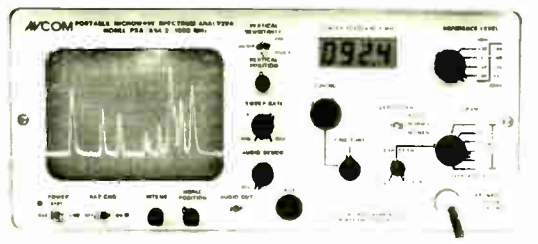

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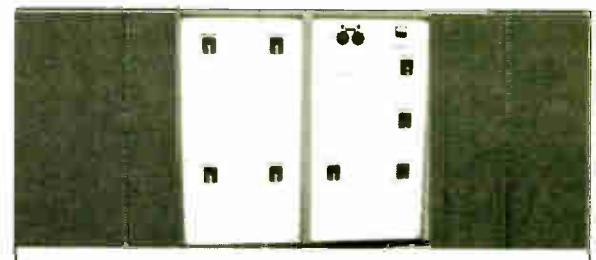

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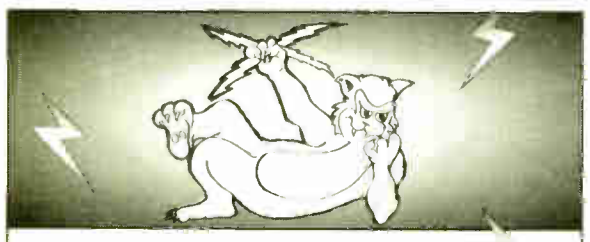

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READER SERVICE NO. 209

Enhance with Automation

▶ continued from page 41

PC-controlled program automation switcher, and the CORE hardware/software system that presents the live radio announcer or operator with an automated radio environment.

Rid of limitations

Miklius agreed that the word automation has negative connotations, "because some of the (older) automation devices were so rudimentary." He said music on hard disk "is the next phase in automation. It takes away some limitations you have with CD jukeboxes. For example, you have to watch out when you schedule music so you don't play a back-to-back cut (by the) same artist. What you're seeing is that, with the random access, instant access of hard disk, you get rid of those limitations."

Miklius mentioned the rapidly falling prices of hard disks versus the cost of CD jukeboxes.

"I think the competitive market is changing," he said. "It's 'How do we make these advanced programming tools make automated radio sound live?'" The hottest trend in automation, he said, is "providing the tools to make it sound live."

Systems that cater to both total automation and live assist may be a station's best choice when going the automation route. "You absolutely have to have a mixed mode operating environment," said Miklius. The next competitive arena, he added, will be the integration of traffic, billing and music scheduling. In the end, the company is looking to tie all elements of automation together "on a wire, eliminating paper, and freeing up time for creative people to do creative things."

Kevin Alcock, product manager for Computer Concepts, feels similar. "Our concept of automation is more automating the menial tasks of the radio station, so the talent has more audio and more flexibility at their disposal, and they can concentrate on doing their on-air programming." The word automation has connotations of "lack of flexibility and a routine run program, whereas, in actual fact, it's the complete opposite," said Alcock.

Management and control

Pristine Systems was showing its Pristine Music Management and Commercial Control System (MMCS). The digital MMCS, which is network-compatible (LANtastic or Novell), marries scheduling and playback in a single system. Able to operate in either a live-assist or totally automated situation and interface with existing automation equipment, the MMCS provides on-site redundancy through multiple workstations. Up to 48 multidisc CD and DAT machines can be controlled, as can satellite networks. Software is updated every quarter. Pristine's new Music Plus Multi-Pass Play List Scheduler allows stations to generate music logs up to a week or two in advance.

Computer Concept's Digital Commercial System is able to work with live, automated and satellite formats. Multiple workstations can be networked, which is especially useful in LMA and duopoly situations. Spots can be cued from a station's log; "start" and "stop" dates keep obsolete spots from airing.

For satellite formats, cues are picked up through an audio switching interface. Commercials are pulled from hard disk and put in a queue. Complete walkaway ability is offered, as is automatic backfill of unfilled commercial breaks. Local time announcements are also part of the package. Users have the option of backing up their hard disks by a number of different options, including automated mirroring and total mirrored CPUs.

Development Digital Universe, the first digital automation management

continued on page 45 ▶

Radio World **Cool Stuff Award** NAB 1995

The **Harris Allied** DRC1000 digital radio console, manufactured by Zaxcom Audio, includes features chosen especially for radio broadcasters. The DRC1000 features 11 stereo digital input channels and seven stereo digital output busses, as well as seven stereo analog output busses. An assortment of options enables the DRC1000 to accommodate specific operating requirements. These options include analog inputs, reverb, time compression, redundant power supply and a 10-fader control extender. Also available is a direct serial interface to Radio Systems' DDS.

Standing with the DRC1000 is Jim Woods. For more information, circle **Reader Service 93**.

Products & Services Showcase

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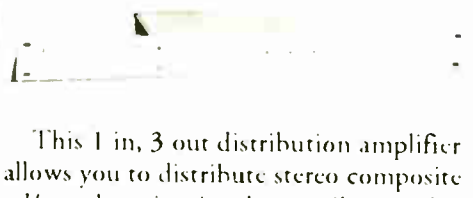

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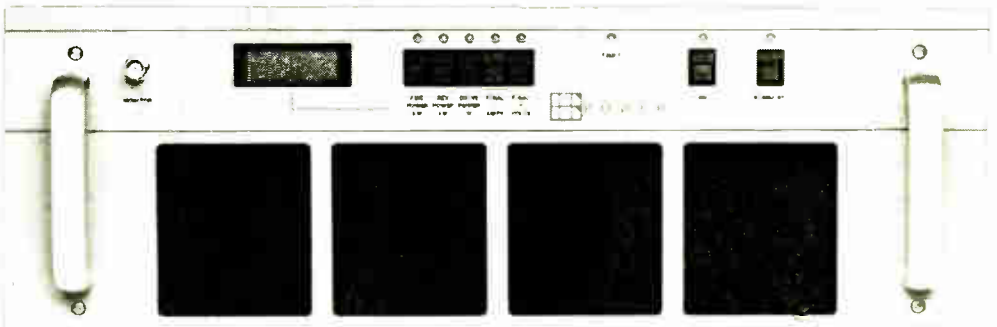

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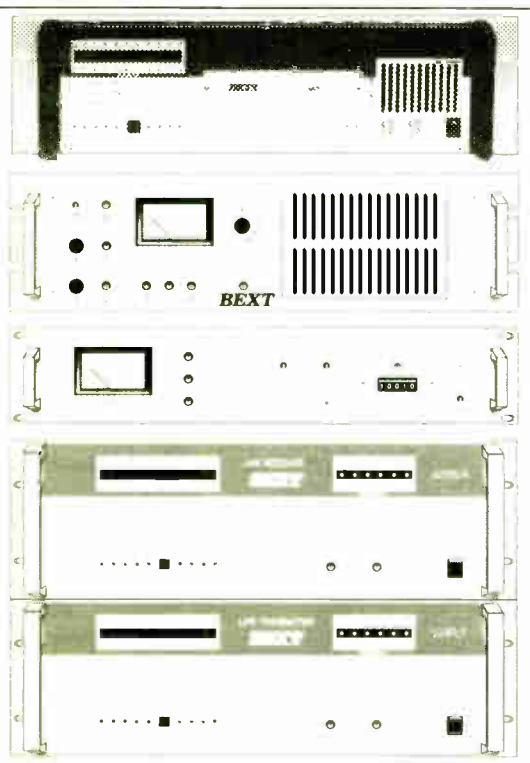

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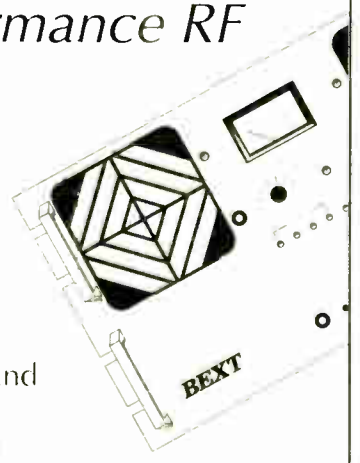

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Better with Automation

▶ continued from page 43

system from **Custom Business Systems (CBSI)** was unveiled at NAB '95. Still in development, Digital Universe is capable of running four stations off one centralized hard drive inside a central server (Joe McDonald, division manager for CBSI's digital audio division, said the system has run eight stations). A standard AES/EBU interface is included.

Stations can get all necessary hardware and software from CBSI. Digital Universe uses Microsoft Windows NT as its operating system; Microsoft Windows for Workgroups is used on all workstations (Windows 95 will be supported).

Henry Engineering had on display the TeleStor, which automates the recording and storage of news stories, weather updates and other material that is sent to a station via phone lines. The device automatically records the feed from a regular dial-up telephone line and stores it in digital memory for instant on-air playback. It operates unattended and can store up to five and a half minutes of audio. It is played back either manually or via a broadcast automation system.

Rainbow of systems

Automation was indeed one of the big stories at NAB '95. **The Management**, the automation division of Electric Works, was demonstrating its modular AXS full-service digital automation system that can function as a simple cart machine replacement, as well as tackle live and satellite duties. Using a standard 486 PC, AXS includes in its AXS-3 Satellite Super System a 540 meg hard disk for more than four hours of stereo audio, as well as a stereo four-channel audio switcher (a LAN card is included). The AXS-3 also includes sat micro fill, must fill, unlimited real-time scheduling, cut rotators, macros programming and as many as 36 voiced-matched jocks.

Harris Allied was showing the UNIX-based DDS Digital Delivery System by **Radio Systems**. Running on a PCI bus with Pentium power, Hauptstueck said the DDS is "about 150 times faster" than other systems. Harris was also showing The Phantom, from **Register Data Systems**, which Hauptstueck said was "probably the best standalone satellite system that's available in the market" (see below).

Also on display at Harris Allied: **ENCO**'s DAD486x Digital Audio Delivery System, which features open architecture, standard Novell networking, and instant access to audio and uses a 486 personal computer. Hauptstueck said the system could run four independent radio stations off the single PC.

Master control

International Tapetronics showed its DigiCenter, for program or satellite automation. Featuring an open architecture design, the DigiCenter allows stations to mix hard disk drive events, networks, CDS and other external sources. Both automation and live dayparts can be scheduled; the switch from live assist to automation can be accomplished with push-button ease.

The DigiCenter also allows the programming of traffic events for satellite automation feeds from a station's traffic computer over the DigiCenter network. Multiple network feeds can be managed, and traffic and music schedules can be merged and edited with DigiCenter's Programming Directors Music and Traffic Editor (PD Mate).

Automated Time Announcements and Backtime modules were shown by **Prophet Systems** for the company's Wizard for Windows product. Wizard for Windows is Windows- and Novell-based, provides Dolby AC-2 audio access and tends to live or automated operation. Four or more radio stations can be run; 25 workstations are supported.

Radio Computing Services' booth featured the company's integrated Master Control digital system for live assist, full automation and satellite applications. Features include open architecture and a number of control options, including contact closure, input sensing, relay control and direct console control by way of start/stop buttons. The system is fully redundant and easily expandable. User-selectable audio sample rates of 32, 44.1 and 48 kHz are offered, as are ISO/MPEG Layer I and Layer II (MUSICAM).

Radiomation software, which was on display at NAB '95, operates in a Microsoft Windows environment and runs on standard personal computers. Perhaps unique among the automation products at the show, the system does not operate with a hard disk. According to the company, Radiomation works with Pioneer's CD jukebox. Live-assist

continued on page 46 ▶

Today's automation products free on-air talent from the mechanical tasks associated with doing a show.

Enhance with Automation

▶ continued from page 45

situations benefit from automated picking of commercials for playout, and interfaces to music scheduling systems—the company's or others.

Register Data Systems (RDS) showed The Phantom 486 PC-based hard disk digital audio automation system. Hard disk configurations from 345 minutes to 20 hours and up are available. On-air playback DSP is included. The MS-DOS-based Phantom does automatic time compression and expansion of stop sets, and is well-suited for both walkaway and satellite operation. Relay closures to control external equipment are an option for users; another option is hard disk backup (hard disks are removable).

Backing up a hard disk is "real good for piece of mind," said RDS's Wayne Bundrick. "Customers are concerned about having all their eggs in one basket, so we provide a completely redundant hard disk system...If the system should fail you, just take the primary hard disk out and put the backup hard disk in (and) stay on the air."

Jock-friendly **Scott Studios'** digital audio system is used at more than 200 radio stations. Cart replacement, full walkaway, satellite operation, network switching and time shifting are all possible. Regional Manager Brenda Burt said the company's main forte is the system's touchscreen controller, which is "very jock-friendly, designed for jocks who are not necessarily computer literate."

In fact, said Burt, the only thing jocks need to have in order to operate the touchscreen is a finger. Scott's hot keys provide live disc jockeys with drops, sounders, rim shots and comedy bits at a moment's notice. The system merges a station's music and traffic logs together. The basic Scott system comes with the station's music library pre-loaded on a 9GB hard drive.

Automation means taking over tasks that can be done more efficiently by machines.

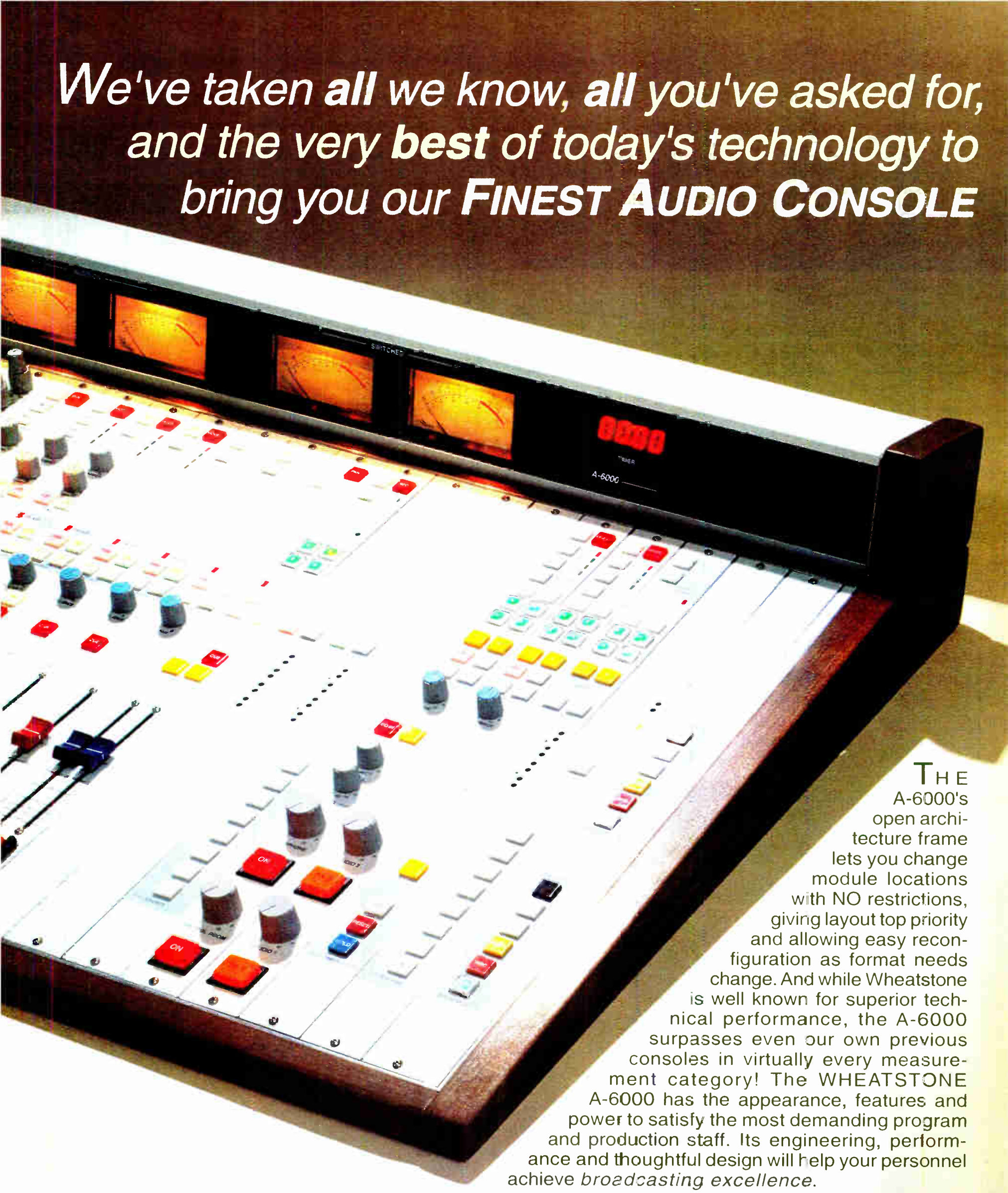
Smarts Broadcast Systems showed its Generation 2000 networkable system for live assist and walkaway. The modular system can be configured to a station's needs and can be used by multiple stations in a single facility. The company's Smartcaster system is for use by single stations. Full stereo or mono, it can be used for satellite or CD automation (with an optional CD server system).

Tiesseci's TS 35 Digital Radio Studio was on display in the company's booth. Hard disk-based, the TS 35 works with live broadcast or full automation. The system can drive more than 25 PCs. Touchscreen, keyboard and trackball use are possible. Stations that purchase the rack-mountable product get all the hardware necessary to run the system, which can drive four different outputs. Backup can be provided on a local PC or DAT.

Automation today

Regardless of the automation system a station chooses, the multitude of possibilities lays the groundwork for a more creative on-air product. Automation may sound like an undesirable entity to radio veterans, "but to the younger radio people," said Radio Computing Services' Managing Director Paul McKnight, "I think it's a buzzword. It think it's a word that just means we're up into the nineties—we're keeping up."

*We've taken **all** we know, **all** you've asked for, and the very **best** of today's technology to bring you our* **FINEST AUDIO CONSOLE**



THE A-6000's open architecture frame lets you change module locations with NO restrictions, giving layout top priority and allowing easy reconfiguration as format needs change. And while Wheatstone is well known for superior technical performance, the A-6000 surpasses even our own previous consoles in virtually every measurement category! The WHEATSTONE A-6000 has the appearance, features and power to satisfy the most demanding program and production staff. Its engineering, performance and thoughtful design will help your personnel achieve *broadcasting excellence*.

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Gentner's new TeleHybrid connects to an existing phone and delivers full duplex audio to a console or conference system without echo or feedback. It doesn't matter whether the phone is a single-line, multiline, analog or digital. The only requirement is that it have a detachable handset with a modular connector. To place a call on an audio system, the user sets the telephone's handset on the TeleHybrid. Setting the handset back in the cradle disconnects the call.

Pictured with the TeleHybrid is Brooks Gibbs. For more information, circle **Reader Service 51**.

Innovations Unveiled in Test and Monitoring Gear

by Tom Osenkowsky

LAS VEGAS Monitoring the performance of broadcast equipment and ensuring it is operating within specifications is a primary function for today's engineer. The gear necessary to perform the required tests is ever evolving with the rapid pace of technology. NAB '95 saw no shortage of new and upgraded RF and audio test and monitoring apparatus.

Tektronix unveiled its model 764 digital audio monitor. Demonstrated for the first time in public at NAB '95, the 764 combines the features of a phase and level meter with complete facility for monitoring digital audio data. A unique feature of the 764 is calculation of audio levels by interpolation. Using a built-in CRT and VGA port, the 764 is a portable instrument targeted for broadcast, production and technical personnel.

Also on display at Tektronix was the TG2000 signal generation platform, a multiformat, Windows-based test signal analog/digital precision generator. The TG2000 is modular in design, making it easily expandable to meet the needs of today and tomorrow.

Belar introduced the FMSA-1 FM digital stereo monitor. Using DSP-based hardware, the FMSA-1 accurately demodulates FM audio without phase distortion or susceptibility to temperature variations. The FMSA-1 has its own RS-232 port and interfaces with Belar's Wizard software for highly flexible monitoring of the FM stereo baseband signal.

Also new at Belar are the RBDS-1 RBDS monitor and the DSD-1 digital stereo demodulator, both scheduled for June 1995 shipping. For summer of '95 offering, Belar schedules shipping of its TVM-250 SAP/PRO television monitor and the Sentry 16 Audio and status alarm system. Belar's well-known AM and FM Wizard modulation monitors as well as its AM and FM RF amplifiers, frequency monitors and fixed frequency FM receiver were also on display.

Handheld

Loral Microwave introduced its handheld 8718 survey meter for RFR measurements. Using microprocessor-based design and built-in digital display, the 8178 can display data in any unit such as mW/cm2, percent of international standard, V/m, A/m plus a host of others. The 8178 uses RMS average detection, avoiding inaccuracies that may appear using other detection methods. The 8178 can be programmed to a flat response or shaped to International Standards at the press of a keypad.

The 8178 accepts E & H probes in a 3 kHz to 40 GHz range using fiber-optic or cable inputs. Loral also displayed its 8520, an economical analog RFR measurement meter.

Inovonics displayed its 530 FM modulation monitor. Complete with eight station presets, the 530 is an all-in-one FM monitor with digital bar graph display for carrier and baseband modulation levels. The 530 can be used to measure crosstalk, separation and noise levels as well as received multipath levels. Inovonics also displayed the model 510 RDS/RBDS decoder/reader, which features a front panel LCD readout and rear panel RS-232 port for PC computer interface.

New to the Inovonics line is the model 540 AM modulation monitor, complemented by its 550 "Sentinel" monitor receiver that combines AM/C-QUAM, FM/FMX, and RBDS/SCA monitoring.

Hallikainen & Friends highlighted the DRC200 digital remote control system. Using a 386DX-40-based motherboard, the DRC200 is flexible, user-configurable and able to handle multiple sites, status and

continued on page 51 ▶

The Dynamax MX Series

"E" Models From 8 to 18 Channels
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- Active balanced line inputs, transformer isolated mic inputs
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- Opto-isolated remote module on/off
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- **New** **Optional 5-band mic EQ module with pan**
- **New** **Telephone interface module**
- Two inputs per module, mic/line or line/line – line input may be mono or stereo, consumer or professional form
- Four assignable outputs – two stereo plus two mono
- Available in 8, 10, 12, 14, 16, or 18 channel models
- Independent level controls for each "A" and "B" input
- Separate audio and logic power supplies
- Sturdy, all-steel construction
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Circle (59) On Reader Service Card

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The StereoMaxx: Spatial Image Enlargement.

When everyone in town is processed to the hilt, what can you do to win the sound battle? The answer is StereoMaxx. It makes your station sounds bigger, not just louder, by enhancing and enlarging your station's stereo image, making it wider and deeper beyond the boundaries of the speakers. No matter what type of radio your listeners tune, StereoMaxx will make your station sparkle with energy and excitement. While your competition will sound flat, dull and lifeless by comparison. And when you use it with our Composite Processor and the FM ModMinder, you get to be the most identifiable station in your market. Guaranteed.

The Composite Processor: 6 dB More Loudness. U.S. Patent 4,441,199.

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Don't Pay Big Money For Big Name Processors.

Big name processors come in two basic versions: The economy model that does very little and the expensive models that do too much. Either way, your station may be stuck with the same sound as your competition. Big money for big name processors does not necessarily mean market winning sound.

The FM ModMinder: Absolute Max Modulation.

Digital technology and the FCC approved measurement method utilized in the FM ModMinder enable your station to operate at absolute maximum legal modulation. If your competition is not FM ModMinder equipped, your station will have them beat. Guaranteed. Easy dial-up access software included so you can perform a host of test functions by remote control from your office based PC (or from anywhere else in the world), giving you peace of mind every day.

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We give you a free CP-803 Composite Processor when you buy the StereoMaxx and the FM ModMinder together (you save $1,495). Or, if you don't need all three, your MSI dealer will surely give you a great deal on any one or two of them. And if you're running duopoly, here's an opportunity to get the MSI processors you need on a great deal for all your stations. Act now, because this is a limited time offer.

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Test and Monitoring Gear

▶ continued from page 48

analog inputs with Boolean-type programming for display and alarms.

Portable measuring

Neutrik debuted the A2/A2-D portable audio measurement system for analog and digital analysis. The A2 features a large LCD screen, four-graph storage capability, PC and printer interface, built-in DSP-based audio/noise generator and all-metal, EMI-proof construction. The A2 can measure noise, wow and flutter, THD, crosstalk and phase. Neutrik also features the A1 audio test system, Amber 3501 and 5500 audio analyzers as well as manufacturing a full line of audio connectors.

Potomac Instruments displayed its product line, consisting of the AA-51A audio analyzer, AG-51 audio generator, 1900 series digital antenna monitor, FIM series AM, FM and TV field intensity meters, 1500 and RC-16+ series remote controls, SD-31 AM synthesized signal generator, QA-100 quantaural audio program analyzer, and SMR-11 C-QUAM AM stereo receiver.

The AA-51A upgrade is available to owners of the renowned AA-51 analyzer as a factory retrofit/recalibration package.

Modulation Sciences offered the PRD-3000 professional PC-based RBDS decoder/monitor in its line of FM monitoring and generating devices. MSI also makes the RDS-X RDS/RBDS data receiver based on the technology employed in its RDS-1 PC-based encoder. Most readers are acquainted with other MSI products such as the Sidekick SCA generator, CP-803 composite clipper and the Modminder FM modulation monitor.

Well-known

QEI displayed its well-known 691/01 FM/SCA modulation monitor in addition to its solid-state FM transmitters. **Delta Electronics** demonstrated the SM-1, better known as the AM Splatter Monitor, for measuring sideband emissions. Delta manufactures the OIB-1 and OIB-3 AM in-line impedance bridge, CPB-1 permanent impedance bridge and the TCA series of toroidal RF ammeters used in AM transmission systems. The ASM-1 C-QUAM AM Stereo modulation monitor is complementary to the ASE-1 stereo exciter. Delta also produces the AAM-1 analog directional antenna monitor.

Broadcaster's General Store offers **Sine Systems'** Thermal Sentry transmitter temperature alarm system as well as Sine's RFC-1B/RP-8/SP-8 inexpensive dial-up remote control. Sine's AFS-1 is an audio fail-safe warning device, complete with built-in 8 amp capacity output relay.

Holaday Industries displayed its line of RFR/EMF measuring and recording equipment. The HI-3000 series is suited for broadband field-strength indications. When equipped with suitable probes, both E & H fields are measured to ensure compliance with FCC, EPA and local/state radio frequency regulations. Holaday also manufacturers EMF and microwave measuring devices in both digital and analog readout formats.

Audio Precision demonstrated the new System Two PC-based dual architecture audio/digital test system. The System Two can verify every parameter specified in AES-3, the government document for professional serial digital audio transmission. The System Two operates in the Windows environment using APWIN software.

The **Gorman-Redlich** model CEB EBS encoder/decoder was on display along with its CD portable radio EBS monitor for off-site remote operation. Gorman-Redlich also manufacturers the digital model CMR AM directional antenna monitor and model CRW weather receiver.

Last but most unique of the monitoring systems unveiled at NAB '95 was **NSN Network Services** InSAT Internet terminal system. Offering direct Internet access from any shared or private hub, InSAT can meet the needs of broadcasters wishing to avail themselves of the opportunities on the Information Superhighway.

Radio World **Cool Stuff Award** NAB 1995

Autogram introduced its CYA-3 (that's Cover Your Audio), a prioritized audio switcher. The CYA-3 acts as an emergency audio and console/automation switcher. It features three stereo inputs, two stereo and two mono outputs, and one stereo headphone jack. Measuring 3 inches x 10.5 inches x 6.5 inches, the CYA-3 weighs less than four pounds. It works on 117 or 234 V, 50-60 Hz, and also serves as a power source for other equipment. It can be controlled remotely, and features gold-plated relay contacts and miniature plug-in connectors. Gil Garcia (l), John Hutson, Jim Laird, and Ernie Ankele flank the CYA-3. For more information, circle **Reader Service 37**.

Radio World
Cool Stuff Award
NAB 1995

Wheatstone's D-500 console can accept both analog and digital input signals, process them in the digital domain and then provide output signals in both digital and analog formats. The D-500 can accommodate existing analog equipment, as well as digital equipment as it is acquired. Both channel and machine status can be reported to an external PC, allowing the console to integrate with a larger system.

The D-500, pictured here with Gary Snow, also can accept simultaneous signals from several different data rates and mix them without dropout, noise bursts or sonic malfunctions. For more information, circle **Reader Service 95**.

New Phone Gear Makes Radio from Afar Easy

by Ed Bukont

LAS VEGAS Integration and function, rather than mere repackaging, define the new crop of products for moving audio and related data via telephone lines.

Whether as a standalone product, or part of a larger system, ISDN made a big splash this year. This overview focuses on the radio and audio products, but it is worth noting that ISDN products where shown for the economical transfer of video, text and data as well in related industries.

POTS was there

Of course, the venerable Plain Old Telephone System (POTS) was also represented. A particularly neat and very cost-effective item for solving studio telephone problems comes from **Gentner Communications** of Salt Lake City. Appealing to both the broadcast studio and the teleconferencing market, the Gentner digital TeleHybrid series, including the TH100 and TH120, offers a literally one-button, nothing-to-adjust, no-more-to-purchase product for connecting audio equipment to phone lines.

Advancing on the company's earlier success with interfacing through the handset cord rather than the actual phone line as other hybrids must do, the TeleHybrid can be used with almost any business telephone system and its features, including conferencing (if your system has it).

While some stations certainly will continue to need more complex approaches involving key systems, control units, interface units and hybrids, not everyone can afford, or needs, that approach. With the TH series, you connect the unit in series with the handset of your phone, connect audio in/out via the XLR type plugs, place the handset on the sensor pad, and that's it. There are some adjustments upon initial installation. Chief engineers, program directors, general managers and chief financial officers have long wanted a box this small, simple and moderately priced (under $1,000). Check it out.

Gentner also displayed new PC-based call management and control software, console control modules and system networking for its TS612 product line. In a complete installation, the call manager PC can replace the present control console used to operate the TS612 mainframe and hybrids.

Audion Laboratories of Seattle introduced VoxPro/FX, a PowerBook version of its on-air studio telephone recorder. This provides a laptop version of the company's workstation and is optimized for field news gathering. Audion has also added Automatic Gain Control, audio metering and test functions, Start-On-sound and other enhancements to the VoxPro system.

Dallas-based **Scott Studios** introduced a basic telephone recorder software package for its line of workstations.

On display was a POTS product from **CCS Audio Products** using MUSICAM HQ, a proprietary version of ISO/MPEG Layer II: the FieldFone, the world's first digital audio codec for POTS. This unit allows bi-directional 7.5k audio via a regular telephone line. Incorporating all the usual CCS quality and the mixing, cueing and other features necessary for remote production, a pair of these units ($4,300) can give you ISDN-like audio anywhere in the world where you can use a 28.8k modem, virtually any telephone line. One of the big three networks has already placed a large order for this visionary product.

continued on next page ▶

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Telos Systems of Cleveland displayed its one-by-six hybrid and call director. Using the standard Telos Switch Console and Telos One hybrid, the unit includes a six-line call director, Program-On-Hold, conferencing, call screening and other features in a one-rack unit high package. With the One-By-Six, Telos now has a hybrid product for every need.

Codec buddy

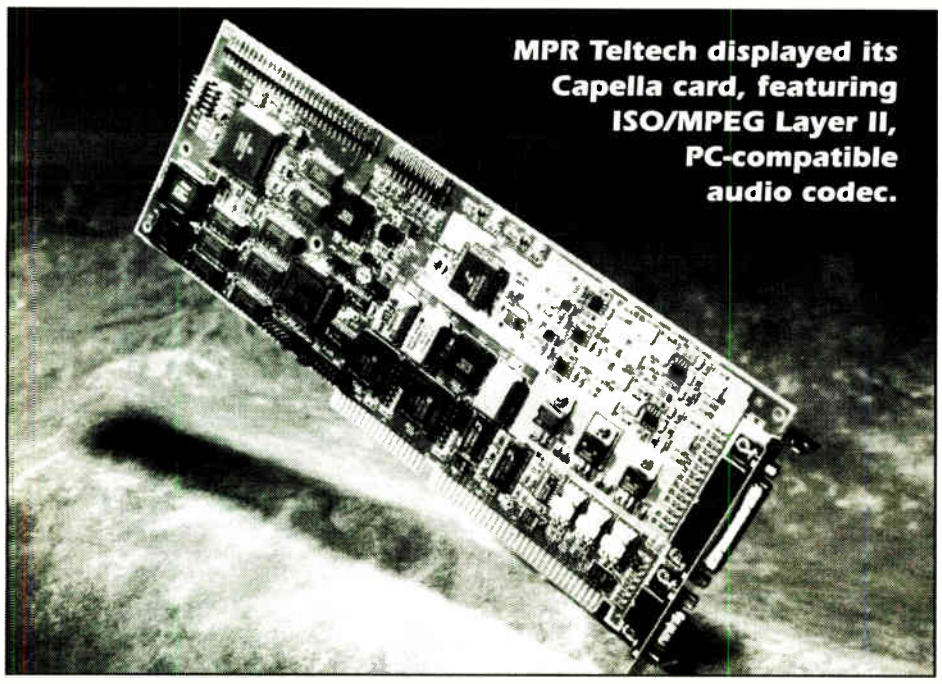
Before covering the many ISDN offerings, there are several specialty products that might find use in your facility whether using POTS or ISDN. **Comrex Corp.** of Acton, Mass., introduced the Codec Buddy, a complete four-input mixer, analog or ISDN IFB mixing and headphone DA system for $1,900. While designed to support the "codec" market, the unit's features make it useful in any remote application.

With some technical planning ahead, you could take the Codec Buddy and your 64k ISDN gear anywhere in the world using the Global Phone 3000 from **Glocom** of Bethesda, Md. Displayed at the COMSAT booth, the Global Phone is a totable satellite phone that provides digital connectivity via the INMARSAT-B satellite system. Prices depend upon application and start at $13,000.

If you're frustrated with the cost and cumbersome nature of "automatically" recording actualities, weather, sports, etc., **Henry Engineering** of Sierra Madre, Calif., introduced its Telestor products. Doing just what the name says, the Telestor will answer a ringing line and record the incoming audio for later retrieval. Featuring one to five minutes of storage ($595-795), the unit can replace your coupler, tone decoder, cart machine and their requisite space, for less money than the cost of individual components.

J-K AUDIO of Sandwich, Ill., displayed several telephone interface products including its new Remote Mix C+. The $595 Remote Mix includes mic, line, IFB and dialing functions in a small, battery-powered package for use with POTS or Cellular RJ-11 adaptors. Need more paging outputs on your office phone system, a simple talk path to the loading dock or perhaps you want to monitor what's happening in the lobby? Use **Radio Design Labs'** new ST-TC1 telephone coupler. In cooperation with external devices, this handy Stick-On allows you to use a spare CO port of your telephone system as a dry talk path with some logic for controlling external devices.

Another inexpensive problem solver is Broadcast Tools' $300 Talking Duck (love that name!) audio circuit identifier. Incorporating a five-second 1 kHz tone burst and recordable 15-second message, the Duck alternates each continuously to its 600-ohm balanced output. Use this on your broadcast loop, ISDN send, satellite feed or anywhere you need to let affiliates, the network provider and the telephone company know who you are and that the circuit is in use. The Talking Duck uses either battery or external 9-48 VDC power.



MPR Teltech displayed its Capella card, featuring ISO/MPEG Layer II, PC-compatible audio codec.

AEV of Bologna, Italy, introduced the UMR 6200 portable telephone reporter unit. Featuring six mic/line inputs with EQ and phantom supply, two output busses, telephone hybrid, tone oscillator, recording and IFB/ monitoring systems, this is a versatile 25-pound portable studio with internal battery or AC supply.

From the United Kingdom, **Systembase Limited** introduced the RG70 two-to-four wire converter that allows for interfacing 2 x 3.5 kHz IFB, telephone or intercom systems over ISDN lines via a single B-channel and the DATA port.

Antex Electronics of Gardena, Calif., introduced several new digital audio adaptors designed for the OEM market. The adaptors provide one to four channels of audio with either Dolby AC-2, ISO/MPEG Layer II, apt-X or other encoding schemes at various data rates from 16 to 32 bits. Also introduced by Antex was a MicroSoft Windows-based multiformat editor for use with Dolby AC-2 or ISO/MPEG Layer I/II and other compression algorithms.

Genie in a bottle

By far ISDN products were the largest crop of new offerings for telephony. Despite managerial snafus (rather than technical), which interrupted ISDN service to the convention center, this was the year when the potential uses for ISDN have finally become more than a genie in a bottle. Until now, most products and uses have focused on ISDN-BRI, the Basic Rate Interface that provides 2 x 64k data channels plus a 16k data channel.

Integration and function define the new crop of products for moving audio and related data via telephone lines.

RE America, Telos, APT and others introduced new products for use on multiple BRI-circuits or the next level, ISDN-PRI, Primary Rate Interface. The PRI service level brings multiple ISDN (11 to 24) circuits to your location over a single T1 type circuit. When used with the appropriate terminal adaptor (T-A) and call management system, multiple ISDN lines and ISDN-PRI allow rapid connectivity and control over multiple audio feeds and destinations at standard or greater bandwidth than possible with a single BRI-service channel.

Using multiple ISDN lines requires an inverse-multiplexer to assign portions of the data to each ISDN line. The inverse mux (IMUX) is typically an integral part of either the terminal adapter or the codec. **Telos Systems** announced upgrades to its popular Zephyr ISDN transceiver that will add ISO/MPEG Layer II and an internal NT-1. The Zephyr already supports G.722 and Layer III in mono and stereo formats. Telos plans to

continued on page 55 ▶

Products & Services Showcase

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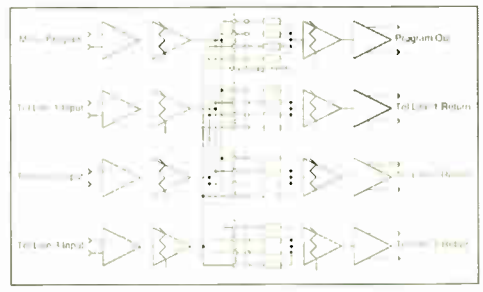

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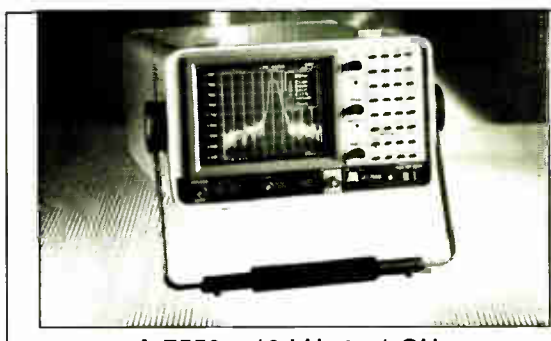

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Radio Remotes Made Easy

▶ continued from page 53

begin shipping these upgrades later this year. To the author's knowledge, this will be the first fully-integrated stereo ISDN product with bidirectional codecs, T-A and NT-1 all built in.

Comrex Corp. introduced the DXR.1 (rack mount) and DXP.1 (portable) upgrade product of its popular G.722 coding series of codecs. The X.1 upgrade provides 15 kHz mono audio via both B-channels of a single ISDN or Switched 56 line. The units must be used with a T-A that provides bonding and an IMUX. Such units include the AdTran ISU-128 and similar products from UDS/Motorola and INC. These units cost $1,500 each or you can upgrade an existing DXP/DXR. For music applications, Comrex offers the MusicLine DX200 series of stereo codecs featuring ISO/MPEG Layer II, an internal IMUX and three sample rates for $3,000 per unit.

CCS introduced its mega-featured CDQ PRIMA series of codecs. Unique to these five units are an extensive internal array of diagnostic, automation and logic interfacing options including spectrum analyzers, silence sensing, triggerable routines, multiple sample rates, multiple I/O standards and "virtual control lines" for remote operation of one unit from another. Pricing for these units varies with options and upgrades; call your dealer for details.

A respected vendor of T-1 systems and related transmission technologies, **Intraplex** of Westford, Mass., introduced an ISO/MPEG Layer II codec module for its highly regarded T-1 mainframe and unveiled its ISDN offering, the Series 4400 Codec. Incorporating Layer II and G.722 codecs with T-A, bonding and single stroke call setup, the Series 4400 is small, lightweight and offers 7.5k to 20k bi-directional audio.

Despite managerial snafus, which interrupted ISDN service to the convention center, this was the year when the potential of ISDN became more than a genie in a bottle.

Westlake, Ohio's **RE America** announced an upgrade to its 600 series codecs, which adds G.722 coding. In one of the most clever integrations of technologies, **Nagra/Kudelski** of Switzerland introduced the Nagra ARES-C, a portable stereo/mono newsgathering system, similar in size and construction to other Nagra products. The ARES includes an ISDN T-A, POTS jack, RS-422 control, the usual Nagra assortment of audio mixing and control features, analog and AES/EBU I/O, an internal editor utilizing edit decision lists (EDL) and PCMCIA flash memory cards for data storage.

Among the first to fully integrate ISDN-BRI-, PRI- and PC-based, user configurable workstations for audio and text delivery is **Digital Courier International**, based in Canada. Unlike some products that provide primarily unidirectional delivery (and were not on display at the show), the DCI system allows stations, production houses and advertisers to exchange materials in MPEG/II compressed form on a per-call basis via the provided internal codec and ISDN T-A.

The advertiser or production house uploads, via ISDN-BRI, its product to the DCI service bureau. DCI then redistributes the material via ISDN-PRI to similar BRI-equipped terminals at each station. A station may edit the audio and copy, then resend the material to sister or duopoly stations. The audio remains in digital form throughout the process. DCI talked with at least one major on-air/production workstation vendor about incorporating the DCI ISDN-adaptor and software into the product.

Speaking of ISDN-PRI, **Telos Systems** unveiled ZephyrNet, its PC-based audio switching and call management system. Based upon the Zephyr transceiver, the ZephyrNet may receive remote or local audio/data for redistribution to other Zephyr-equipped sites via either ISDN-BRI or SW-56.

Dolby Laboratories, based in San Francisco, Calif., introduced its Dolbyfax product. Using Dolby's AC-2 coding (existing DP502/501 product line) a PC or Palmtop controller and its own T-A, the DolbyFax can transmit non-real-time audio, video, CPU data or Group IV faxes over two ISDN-2 lines. Certain applications will require different or supplemental equipment to the AC-2 codecs.

APT introduced WORLDNET, which uses the new MCE/MCD 800 series codec to transmit up to eight channels of audio over ISDN, SW-56, fractional (E-1) or full (T-1) digital circuits using apt-X coding. Additional products allow for remote machine control via the data ISDN auxiliary channel (Model RMC240); a lightweight, portable, reporter terminal incorporating an internal T-A with IMUX for transmission of a reporter's audio and computer data (DRT-128).

Dalet Media Systems, which has offices in Paris and New York, displayed caller recording and editing software that may be used with an ISDN interface, also released this year.

I've tried to cover all those products featuring telephone and/or ISDN-related technologies as the primary function or method of interconnection. There were some items, such as satellite delivery technology, which either incorporated or allowed for use of telephone technology as a backup transmission system or other limited application.

Products & Services Showcase

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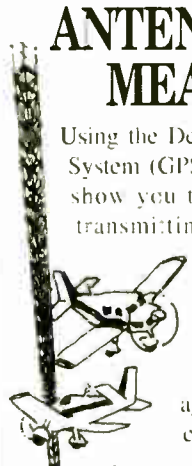

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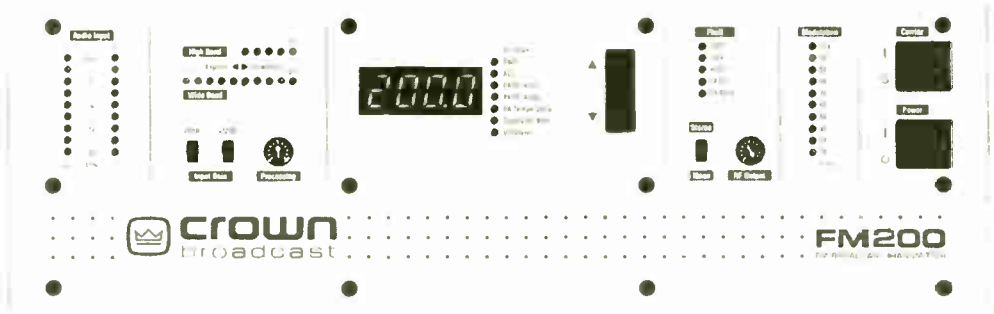

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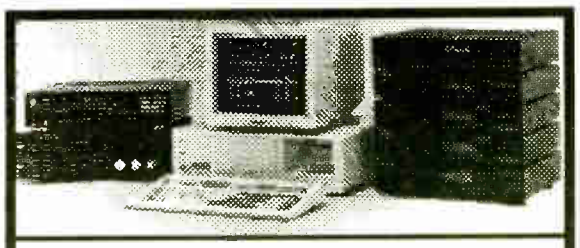

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READER SERVICE NO. 6

Consoles in Forefront Of Technological News

by Whitney Pinion

LAS VEGAS From the massive and high end to the compact and basic, consoles made a strong showing at NAB '95. Manufacturers emphasized the custom configurations of their products, as well as their flexibility in meeting a station's changing needs. And while some consoles are going digital, or offering digital features as an option, others remain analog.

The **Harris Allied** DRC1000 digital radio console, manufactured by **Zaxcom Audio**, made its appearance as part of the KUSA(AM) studio setup in the audio hall.

Soundcraft's RM 100

Designed to emulate the form, fit and function of analog consoles, the DRC1000 has a 10-fader control surface with an eight-character LED display on each fader, and an LCD display for controlling bus assignments and on-board processing. It also includes an audio processor unit with 11 stereo digital input channels (AES/EBU with sample rate conversion) and seven stereo digital output busses (AES/EBU 48 kHz), as well as seven stereo analog output busses (five with 18-bit D/A and two with 20-bit D/A).

Thoughts and feelings

According to **Wheatstone**, its D-500 audio console "thinks digital" but "feels analog." The D-500 can accept both analog and digital input signals, process them in the digital domain and then provide output signals from the console in both digital and analog formats. According to the company, the D-500 can accommodate future digital equipment as it is acquired. Also, both channel and machine status can be reported to an external PC, allowing the console to integrate with an even larger system. The D-500 also can accept simultaneous signals from several different data rates and mix them without dropout, noise bursts or sonic malfunctions.

Audioarts Engineering introduced its R-60 on-air audio console, which boasts more features than the A-50 at a lower price. The R-60 features a standard six-source line selector, module extenders, gold contact switches, Penny & Giles faders, Sifam meters and better-than-16-bit digital audio performance in the Simple-Phone module. Its open-bus architecture allows for accessory and input modules to be placed anywhere in the console.

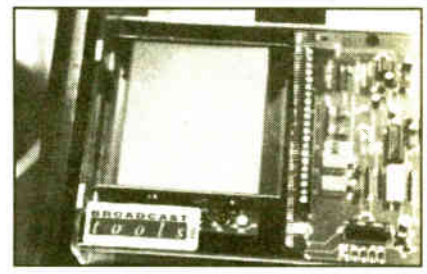
R-60 modules can be removed or replaced while the console is on the air. R-60s are available in 8-, 12- and 18-input module sizes, with all models having two additional input and/or accessory blank positions.

Audioarts also showed its MR-40 audio production console, along with the R-16.

The 2500 series footprint console made

continued on page 58 ▶

Radio World **Cool Stuff Award** NAB 1995



The Talking Duck by **Broadcast Tools Inc.** identifies any audio circuit. By connecting the wall transformer to the Talking Duck and pressing the Record button, the user can record an identifying message of up to 15 seconds. On playback, a five-second 1 kHz tone, along with the recorded message, runs continually. One common application is to connect the Talking Duck to a telco loop, with the user recording a message identifying a radio station, circuit number and location.

The Talking Duck appeared in the BSW booth. For more information, circle **Reader Service 63**.

Circle (76) On Reader Service Card

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Consoles on Leading Edge

▶ continued from page 57

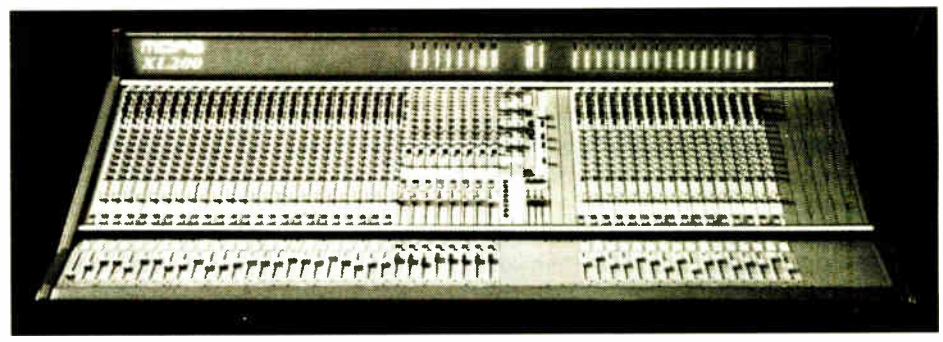
its debut at the **Auditronics** booth. This compact console offers solid-state switching of all signal paths, DC control of all level functions, a teleconferencing capability, 20 dB headroom and comprehensive A/B external logic control. Fully modular, the 2500 console is available in both desktop and drop-in models, with wooden or metal sides.

Bob Greenwald, sales engineer for Auditronics, said the market requirement is for high-quality consoles that are smaller, simpler and less expensive. Users still need a high-quality audio chain, he said, but they need fewer inputs. And spending less money on a console leaves more money to spend on digital storage.

Ten 2500 series consoles are to have shipped out by May 1.

Auditronics also featured its other consoles, including the AirMaster 90 series, the 210 series and the 801/851 series.

The key features of the new **Otari** B-10 broadcast mixing console, said Ken Sampei, broadcast specialist for the company, are its ease of use and its custom configuration. Customers can build their own system by selecting any combination of mono input, stereo input and group modules to master, monitor and talkback/oscillator modules, up to the capacity of the selected frame. Three frame sizes are available: 14 modules, 24 modules and 34 modules. The B-10 is compact, as each module is only 30mm wide.



Midas touch: the new XL200 mixing console

Otari also showed its Status digitally controlled analog console with console-wide image recall, as well as the Concept I 24-bus analog console, also digitally controlled, featuring fader and mute and snapshot automation.

In the **Mark IV Pro Audio** booth, **Midas** introduced the XL200, a mid-priced mixing console. The XL200 includes 40 mono input modules, four stereo input modules with mic preamps, eight auxiliary sends, eight VCA subgroups, six mono and two stereo subgroups, and eight mute groups, with room for an additional four input modules. The console is also available in 24-, 32- or 40-channel versions, with 16- and 24-channel extenders available. Also available is an optional MIDI automation system that allows the user to set up and use up to 10 groups of channels for simultaneous muting. Data can then be stored in any MIDI device for later recall.

In the Harman booth, **Studer** showcased its new 980 series of mixing consoles. The company designed these consoles to be easy to operate and familiar to broadcasters.

The 980 series consoles feature a redesigned input stage with eight aux outputs, direct channel out and n-1 mix-minus output per channel. A snapshot automation system records all switch functions, and these snapshots can be chained into sequences, which can then be stored on PCMCIA cards. The automation system, which acts on top of normal console operation, maintains full manual console functionality even if the central control unit is inoperative.

Studer displayed its D940 series of fully digital mixing consoles, including the D940 production console with 32 stereo input channels. Also on display was the 990 mixing console, an analog console with a digital control surface.

Soundcraft Broadcast, also in the Harman booth, showcased the RM100, a modular on-air console designed to fit the space and budget requirements of small facilities. Three frame sizes (8, 12 or 20 inputs) may be fitted with any combination of mono mic/line, stereo line or telco input modules.

In addition, Soundcraft displayed its new Series 10s modular mixing console, which can be custom-configured for almost any specialized on-air or production application. This series is available in three frame sizes.

Also making an appearance at the show were the GP1 portable stereo broadcast mixer and the SAC200 modular on-air broadcast console with VCA audio control.

Alongside its Series VI consoles, **Fidelipac** displayed its enhanced MXE console, which incorporates the new "DO" revision output board and a new single monitor control board in place of the old output board. The MXE now features a cue speaker mute circuit, allowing audio to be present on the cue bus so that it can be heard on headphones but not on the cue speaker. The available drive current of the on-air signal has been increased from 20 ma to 100 ma. All MXE consoles shipped after May 1 are capable of using the new monitor control

continued on page 61 ▶

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- The System can be expanded from a single basic configuration, incorporating more work stations.
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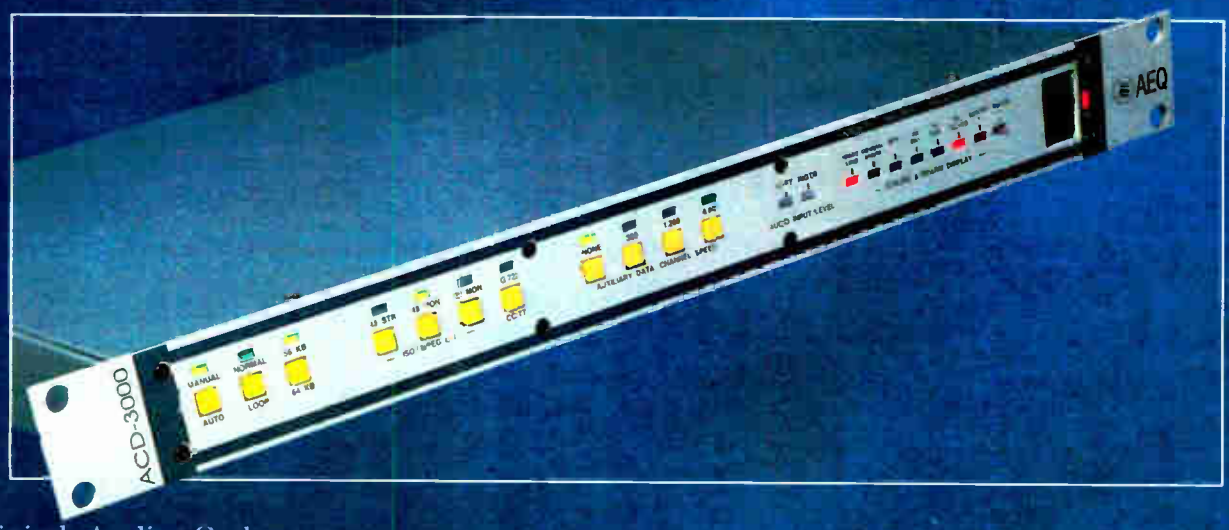

of the World's Greatest Sports event of 1994

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- The equipment uses CCITT G.722 and ISO/MPEG Layer II compression algorithms in a wide range of operating modes and combinations.

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- The ACD-3.000 offers the flexibility of user defined operating modes. The selection is made on the front panel keyboard, and is fully indicated by LEDs, as well as the communication status and alarms.
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Features:

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Consoles on Leading Edge

▶ continued from page 58

board and the new output board.

In both the **Harris Allied** and **BSW** booths, **Mackie** exhibited a range of recording/PA consoles in various sizes, including the 32•8 with 64 inputs for mixdown, the 24•8 with 48 inputs for mixdown and the 16•8 with 32 inputs for mixdown.

ATI (Audio Technologies Inc.) displayed its Vanguard series of broadcast consoles. Instead of conventional push-button and lever key switches for input selection and bus assignment, these consoles have a digitally scanned matrix of membrance switches. DC-operated VCAs are used for all level control functions, eliminating the need for audio faders.

Signature series

LPB displayed its 7000 series audio consoles in 12- and 18-channel configurations, as well as its Signature III series audio consoles. The 7000 series consoles feature two inputs per channel, three stereo output busses, illuminated VU meters and digital logic controls. The Signature III consoles feature plug-in signal processing circuitry on two mainframe assemblies. LPB also used its SALSA digital automation and production system to illustrate the use of the 7000 series consoles for additional automation functions.

Next door, **Logitek** showed its TR2 compact stereo console, which the company said has been selling in huge quantities lately. The TR2 features 12 mixers with up to 36 inputs in a 19-inch rack, although a second mixer frame can be added for up to 86 stereo inputs on 24 mixers.

Solidyne offered its 2500 series digital audio consoles.

Pacific Recorders & Engineering (PR&E) presented an assortment of consoles, including the BMX III, the AMX, the RMX RadioMixer and the ProductionMixer. The BMX III on-air console is designed to handle a talk show with two separate telephone mixes, record a stereo feed for later broadcast, and communicate with two studios and a remote—simultaneously. The AMX console takes the on-air functions of the BMX and adds stereo production features such as equalization, auxiliary sends and effects returns. RadioMixer handles challenging on-air tasks, from telephone talk and contest recording to guest interview shows. ProductionMixer combines RadioMixer's on-air features with production capabilities.

Ward-Beck Systems displayed its Renaissance series production consoles, which come in three standard mainframe sizes: the Mark I with eight-input modules, the Mark II with 16-input modules and the Mark III with 24-input modules. All models are automation-ready for live assist and feature Penny & Giles faders, four mix-minus outputs and programmable functions on individual modules.

Arrakis exhibited its three consoles lines for integrating and controlling equipment in digital studios: the 1200, 12,000 and 22,000 series Gemini consoles. The 1200 is designed for compact installations, while the 12,000 and 22,000 are modular consoles with mainframes that support up to 28 input channels. The 12,000 and 22,000 consoles also feature internal 8-bit data busses for interfacing with Arrakis workstations.

Broadcast Electronics showed its Air Trak 90 and Mix Trak 100 consoles. Tim Bealor, director of RF & Studio Products, said he has noticed a trend away from consoles as hard disk systems become more prevalent. Manufacturers are trying to cut console expenses to focus on new products, he said.

Solid State Logic unveiled its SL 9000 J Series Total Studio System, an analog mixing console that combines advanced audio circuitry and automation with the option of integral digital recording and editing. SSL also showcased its new Axiom digital production system, featuring an integral multitrack hard disk recorder/editor.

Radio World **Cool Stuff Award** NAB 1995

The DM-800 Multitrack Disk Recorder from **Roland** combines in a single chassis an eight-track recorder/player and a 12-channel mixing system. The DM-800 provides 100 layers-per-track recording, dynamic automation, MIDI integration and time compression.

The system is now available with a direct interface for the Tascam DA-88 digital multitrack recorder that provides eight channels of digital I/O plus full bidirectional machine control; the DM-800 can operate as either a master or a slave.

Pictured with the DM-800 are Erika Lopez and Tom Stephenson. For more information, circle **Reader Service 170**.

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Manufacturers Positive about RDS

by Alan Haber

LAS VEGAS Moving with a virtual low-key stride through the NAB '95 exhibit halls, Radio Data System (RDS) nevertheless exhibited several strong indications that its future is indeed healthy.

For example, the Electronic Industries Association (EIA) was resident in the lobby of the Las Vegas Convention Center (LVCC) with a booth promoting its year-long RDS promotional program, announced at the recently-held Mobile Electronics Show in Philadelphia (**RW**, May 3).

And perennial RDS supporter RE America, which recently announced it will supply encoders for the EIA program, was on the show floor—albeit in the video hall (where the company was also showing its video products). RE displayed its RE-532 and RE-533 RDS encoders (RE's RDS products were also on display at one of Harris Allied's booths). Denon Electronics was also on the show floor, extolling the virtues of RDS and showing its TU-380RD tuner.

Shot in the arm

The announcement that Axcess Global Communications will provide carrier service using RDS for a series of new Panasonic wireless messaging/paging devices can be seen as another strong shot in the arm for the technology, taking its rightful place next to EIA's program.

KEYV-FM believes in RDS

According to Panasonic, Matsushita Consumer Electronics Company, the United States' sales and marketing operation for Panasonic consumer electronics products, will sell Panasonic's proprietary RDS pagers directly to consumer electronics and other retail outlets throughout the country. Three models will be offered during the rollout, expected by the end of the year.

The devices will scroll extended messages; the top-of-the-line models' backlit LCD display can handle messages of up to 2,000 characters. Custom messaging services, such as real-time financial data, up-to-date weather forecasts and warnings, and sports scores are possible.

AEV, Circuit Research Labs, Modulation Sciences, and SCA Data Systems were also at NAB '95 with RDS product. NAB, for its part, limited its RDS activity to a single workshop session, "Radio Data Broadcasting: Present & Future Technologies," during which Advanced Digital Systems (ADS) President Mike McCoy presented a lively look at "FM Radio and the Information Skyway." ADS's new Radio Rock-It RDS, that combines an RDS decoder, FM stereo receiver, and a five-band graphic equalizer on a PC board, was on display in the EIA booth.

First product

Belar Electronics Laboratory debuted the company's first entry into the RDS arena, the new RBDS-1 RBDS Monitor, that displays a number of parameters such as RBDS and stereo pilot injection, RBDS/pilot phase error, radio text, alternative frequencies, and data channels. Standalone decoding and computer display capability via an RS-232 interface help complete the package.

Mark T. Grant, staff engineer, research and development, said the market for RDS seems to be growing. "We've had people asking us about it, and I guess we thought it was time to do something." The $2,500 RBDS-1 will be available around June 1.

Affordable

Radio stations constrained by tight budgets yet eager to add RDS to their broadcast chains could do worse than looking to Inovonics' new Model 710 RDS/RBDS Radio Data Encoder. The unit, which does not require the use of a personal computer, stores as many as 15 messages on an EPROM; the messages can be selected at the touch of a button or by remote command. Amazingly, this affordable product costs only $995.

Inovonics also showed the new standalone model 510 RDS/RBDS Radio Data Decoder/Reader that features an RS-232 interface and a large 80-character LCD panel on which digital measurement of RBDS injection is displayed; users can also scroll through station, format and program IDS, and alternate frequencies, radiotext messages and traffic flags. By using a tunable, off-air Mod-Monitor,

continued on page 64 ▶

Radio World
Cool Stuff Award
NAB 1995

Intended for control room nearfield monitoring, the new **JBL** 6208 bi-amplified studio monitor speaker features two discrete 50 W amplifiers and multiradial baffles. Each 6208 cabinet incorporates an 8-inch-high excursion woofer and 1-inch titanium dome tweeter,
with each transducer driven separately by a dedicated power amplifier module with discrete circuitry. For easy interfacing with different levels of studio equipment, the 6208 has rear-panel connectors for selecting either -10 or +4 input levels.

Holding the CSA for the 6208 is Dennis Goeltsch. For more information, circle **Reader Service 99**.

RDS Prevalent at NAB

▶ continued from page 63

RBDS data from other stations can be read. The model 510 is available now for $1,950.

New software

Circuit Research Labs (CRL) showed various features of a new version of the software it is developing for its SC-100 RBDS and Subcarrier Generation System. The software will allow users of the SC-100 to weave paging and electronic sign control, in addition to normal radiotext, into the broadcast mix. CRL Director Gary D. Clarkson said he heard from a lot of customers that were not aware they could include paging systems in their stations.

Current CRL customers will receive the upgraded software free; the SC-100 is available for $3,395.

The new RDS-X Professional Data Broadcast Receiver was on display at Modulation Sciences' booth. Applications include remote control of LED signs, highway signs and control of traffic signals—any dedicated low-speed reliable point-to-point data system. The company's PRD-3000 Precision RDS/RBDS Decoder/Monitor/Analyzer and RDS-1 RDS/RBDS System Generator, a board for personal computers, were also on display.

SCA Data Systems was showing its RD-57 encoder (the company was using Denon's TU-380RD tuner to display scrolling text). And AEV was showing its RDSM 3900 MIDI Coder, which can transmit radio text and other data. The product, which sells for about $2,000 and is enabled by an external keyboard, includes a software package.

Promotion

In addition to ADS's Radio Rock-It RDS, radios from Becker (a CD receiver that will be factory-installed in Porsche automobiles beginning in May, according to EIA), Denon (a car and home radio), Delco, Grundig, and JVC (a European model not for sale in the United States) were working from within the confines of a glass presentation case in EIA's booth.

ADS's Radio Rock-It RDS and radios from Becker, Denon, Delco, Grundig and JVC were working from EIA's booth.

A smaller version of Specialized Communications' MusicBoard Billboard sat atop EIA's booth, displaying pre-programmed messages targeted to visitors. CRL provided the antenna feed. Lisa Fasold, manager of communications for EIA's Consumer Electronics Group, reported that interest among radio stations in participating in EIA's program was very strong.

EIA's RDS presence at NAB '95 extended to its sponsored tour of the studios of Las Vegas radio stations KFMS-FM and KEYV-FM, both helmed engineering-wise by chief George Thomas. Thomas, who also steers KSNE-FM, demonstrated Specialized Communications' MusicBoard control room software that works in conjunction with RDS encoders and sends out radiotext, like song titles and artist names, to such serial devices as outdoor billboards.

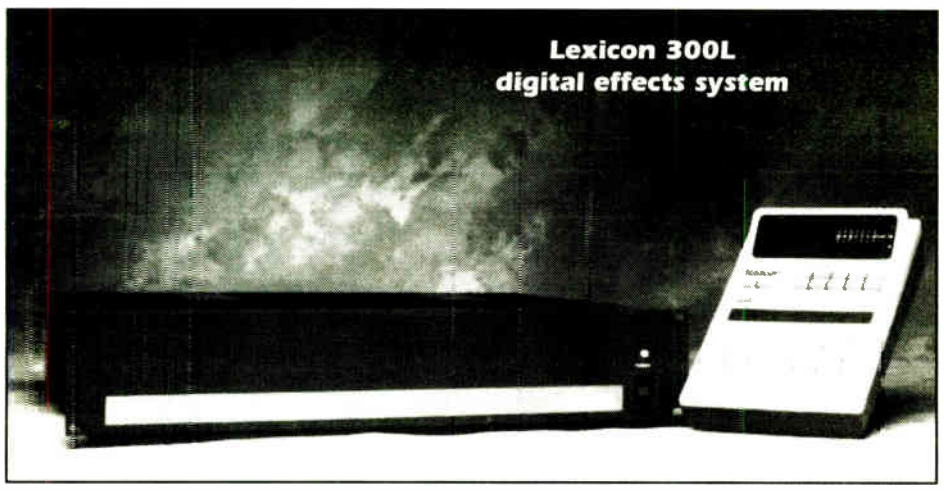
Thomas said the stations' staff did not understand the benefits of the MusicBoard software "until they got to see it in action." The mitigating factor was when country competitor KWNR-FM put up its MusicBoard Billboard at the intersection of Tropicana and

continued on next page ▶

Audio Processing Still Vigorous Craft

by Thomas Pear

LAS VEGAS Numerous displays of audio processing instruments underscored the rapid deployment of digital in all facets of broadcasting equipment. At the various manufacturers' booths, gear could be found fashioned to meet stations' digital and analog needs.



While many manufacturers merely upgraded existing systems, others displayed new products designed to push broadcasters into the digital age of broadcasting.

To help with the transition, several manufacturers offered processors capable of processing both analog and digital audio.

Special award

Case in point is **Orban**, whose founder Robert A. Orban received the radio engineering achievement award at a special NAB luncheon. The company introduced its 8208 stereo encoder, a compact standalone unit with all-digital processing. If no valid digital input is present the 8208 reverts to analog input.

The system has a variety of features. It accepts any sampling rate input from 32 kHz to 48 kHz, and its automatic switching of pre-emphasis and de-emphasis follows status bits in the AES/EBU signal.

The system also offers a separation greater than 70 dB; 20 Hz-15 kHz. The noise is less than -90 dB, de-emphasized and is 100 percent modulated. And distortion is at (20 kHz-15 kHz): 0.005 percent THD, 0.01 percent SMPTE IMD.

Orban also introduced software for its OPTIMOD 8200. The 8200 PC displays all the 8200's meters and processing controls on a computer screen via modem communications or direct connection.

Developing Technologies assists stations going through the analog-to-digital transition period. The company showcased its **dB Technologies** model AD 122 stereophonic analog-to-digital converter. It converts analog signals to a 22-bit audio datastream. It features a -122 dB noise floor, 0.00009 percent total harmonic distortion plus noise, optional SDIF interface multiconvertor synchronization.

Developing technologies displayed its dB Technologies model 3.000 digital optimizer, a multifunction digital audio processor for sample rate/data format conversion, monitoring and measuring.

Alesis introduced its Matica 500 audio amplifier that offers an extremely fast slew rate of 800 volts per microsecond, noted Alesis marketing director Jim Mack. Mack stressed that the higher the slew rate the better the performance, and that many amplifiers have slower slew rates, normally ranging from 15 to 40 volts per microsecond.

Alesis also displayed its Matica 900 audio amplifier. Both amplifiers feature high-speed bandwidth and dual-channel power amplifiers designed for production monitoring.

In addition, Alesis introduced its Q2, featuring dual-channel Octal processing master effects with digital I/O. It allows the operator to utilize up to eight audio effects simultaneously in any order using a digital patch that is visible on the display.

Hardware and software

Cutting Edge unveiled its Unity Version 4 software and hardware upgrades, the latest refinements for the Unity FM and AM family of processors. The upgrades increase the user's availability to tailor a station's sound to suit the most exacting standards, said Cutting Edge spokesman Neil Glassman.

The company also demonstrated its Unity 2000i FM and its Unity AM processors.

The Mark IV Audio Group introduced its Klark Teknik DN3600 programmable graphic equalizer. The DN3600 has an illuminated display that is the largest available for a chassis of its size, the company claims. It is digitally controlled and has 66 memories.

The unit also consolidates 30 individual selection keys that correspond to each of the frequency bands. In addition, the company said, each channel in the unit includes two notch filters with a maximum of 24 dB of cut adjustable in 1 dB steps. It also has sweepable low/high-pass filters 20 Hz to 400 Hz and 1K6 to 30 kHz, respectively.

Despite all its features, the system is consolidated into just two units of rack space.

Gentner displayed its Prism II FM and Prism II AM/Li processors. Both processors provide independent processing for low-, mid-presence and high-band audio. The AM system includes a limiter.

The FM Gentner can be used in any application requiring precise control over loudness and density of wideband audio, noted Gentner Broadcast Sales Manager Gary Crowder.

Circuit Research Labs introduced its DP-100. The DP 100 offers a large touchscreen display with an array of graphical menus. By touching the screen a user can make the unit change the desired fine-tuning function.

The processor is based on a 32-bit floating point DSP processor. CRL also demonstrated its Amigo FM and AM processors along with its Audio Signature, a digitally controlled processing system.

While many manufacturers merely upgraded existing systems, others displayed products designed to push broadcasters into the digital age.

Digital effects

Lexicon demonstrated its 300L Digital Effects system. The 300L is a new version of its mid-priced 300 processor, which now supports the LARC remote controller.

LARC controls all operations on the 300L. And Version 3.5L software allows LARC to control existing 300s with Version 3.x software.

The single rack-space LR4 Framelink enables one LARC remote controller to control up to four mainframes: any combination of 300L, 480L and 224XL.

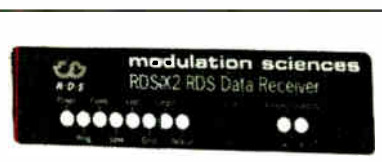
Lexicon also demonstrated its Dual FX

continued on page 67 ▶

RDS Prevails

▶ continued from previous page

Swenson. "(The staff) came to me, and they said, 'How come we don't have this?'" Thomas showed them the MusicBoard software in action and said, "Well, we do." One of KEYV's jocks, nighttime man Pat Garrett, thinks the



Modulation Science's RDS-X2

MusicBoard software and RDS are "really cool," giving people "a shot to see what is on the radio at the time, and they can flip it on if they like the song."

Thomas said he is "pretty much knocked out by" RDS. And, he is in it for the long run—"Especially now that receivers are getting out," he said. Thomas also sees RDS as a possible income generator for his stations, although he said it is not the stations' purpose to have RDS function primarily in that manner. "If you are looking at (RDS primarily) as an income producer... I think your priorities are wrong," he said. "...we are in this business to have fun. And we are."

Products & Services Showcase

For more information on the products shown below, circle the appropriate Reader Service No.(s) on the enclosed Subscription/Reader Service card or contact the advertiser directly.

Processing Still a Craft

▶ continued from page 65

Algorithm card for the PCM-80 Effects Processor. It features 25 new algorithms that offer two independent effects blocks, including five types of stereo reverb and five types of stereo multi-effects. The card also boasts 250 new presets.

Ward-Beck Systems (WBS) introduced its new M8207 audio compressor, which acts on input signal levels ranging from 0 to +8 dBu. The low-noise circuitry and gain control element result in 110 dB of dynamic range at unity gain. State-of-the-art common mode rejection provided by the instrumentation amplifier input ensures that the compliance output drive from the compressor allows a maximum of +30 dBu and +27 dBm to be delivered to the load, noted WBS Engineering Manager Scott Miller. The M8207 fits in a standard Ward-Beck MF 82 rack-mounted frame. It is fully compatible with all members of the M8200 series amplifiers, including preamplifiers, amplifiers and oscillators.

Harris Allied displayed its **NTI** EQ3 High Definition Sound Enhancement system. The EQ3 uses patented high-definition circuitry to achieve sound that is virtually free of hiss, noise, distortion and phase shift, the company noted.

Stereo processor

Inovonics Inc. displayed its David II FM stereo processor generator, model 716. The unit features digital synthesis of the composite multiplex signal for best separation and stable operation. It uses Feedforward Plus Width Modulation (PWM) audio processing to impart loudness and fullness to the program signal.

In addition, the company also introduced its model 708 FM stereo generator. The unit features digital synthesis of stereo pilot, and multiplex signals assure, the company said, optimum separation and drift-free operation. The 708 also includes accurate front-panel metering facilities generator setup and proper subcarrier injection.

The company also showed its NRSC AM audio processor Model 222 and its Models 250, 255 and 260 FM processors.

Audio Developments Ltd. demonstrated its FLEX-EQ fully parametric equalizer. Each filter in the equalizer uses constant-Q topology and non-critical circuitry. These features, along with the series connection of filters, ensure non-interaction between the control of each filter and final equalization that is the sum of that provided by each filter stage.

Each filter stage has its own LED indicator for monitoring overload at all critical points and a bypass switch for the shortest signal path.

Symetrix Inc. displayed the 528E, a new model of its 528 voice processor. 528E features phase rotator and a new rear panel layout. The system also works with any microphone or line input, enhances vocal intelligibility, increases perceived loudness and presence, reduces off-mic noises, and works with instruments and effects in addition to voices.

The company also displayed its 601 digital voice processor, a programmable digital processor for radio and TV announcers.

Group 1 LTD displayed the Focusrite Red Six mono mic-pre equalizer and Red Seven Mono mic-pre and dynamics compressor.

The Red Six is a single-channel unit. It features the same circuits included in Focusrite's ISA 110 module and studio console. The equalizer also includes filters, a line input and an output fader.

The Red Seven is a single-channel mic pre-coupled with a compressor, de-esser and exciter. It uses the same circuits found in the Red One and Red Three modules. In addition, it has a swept high-pass filter, a line input and an output fader.

Converting and interfacing

Apogee Electronics featured its DA-1000E-20, a reference standard D/A converter. It includes digital outputs that interface with AES/EBU, S/PDIF, Sony SDIF and SDIF II. Apogee filter technology, an award-winning item, is incorporated in the unit to alleviate high-frequency images found in many consumer and professional D/A converters.

Benchmark Media Systems displayed its Audioworld Interface. The system combines a two-way recorder interface with switch-selectable operation as a line amplifier or mono-mix amplifier.

Benchmark also introduced the JR Audio Director Plus, a stereo mode controller that has four switch-selectable inputs per channel. Benchmark brought back the System 1,000 that offers more than 14 different carts and four power supplies, the Microframe Series and a myriad general line products.

Cooper Sound System displayed its Cooper ENG-style four-channel audio mixer. The system features analog meters (Park/VU), Jensen coupled inputs and outputs, insert points and channel outs, PFL and an ergonomic design that allows for ease of operation.

In addition, Cooper brought back its CS 106+1 and CS 108+1 audio mixers.

Dan Dugan Sound Design showed its Model D automatic mixing controller, which is a live mixing assistant. It features an eight-channel automatic mixing controller that patches into the input insert points of an audio mixing console.

Euphonix presented its CS2000 B-Broadcast System, which is a digitally controlled audio mixing system suitable for on-air and post production. The system includes 12 mix/minus feeds and optional multiformat mixing busses that can be configured for Surround Sound mixing. Euphonix also returned its CS2000 audio mixing system to the exhibit floor. The CS2000 features digitally controlled analog audio mixing.

Solid Electronics Laboratories introduced its FM composite processor Model DCP-1. The unit performs the functions of instantaneous limiting and composite low-pass filtering in a single structure.

ATI-Audio Technologies displayed its new quad and dual 1x3 audio DA with XLR-type input and output connectors. The company also displayed its Vanguard Series Console, small mixers and headphone amplifiers and distribution amplifiers.

Auditronics Inc. showed its 1990 mix/minus system, a unique modular rack-mounted mix/minus/IFB audio system. It features unlimited input, output and IFB configurations.

The Neotek Corporation displayed the EQ4X-MH microphone and four-band parametric equalizer. The equalizer combines one section of the MPX-4A—a four channel microphone preamplifier—with a four-band parametric equalizer in a one rack unit.

Radio World **Cool Stuff Award** NAB 1995

Audio Precision's System Two is a comprehensive PC-controlled signal generator and analyzer for audio testing in both the digital and analog domains. This Dual Domain architecture provides complete facilities for measuring every parameter specified in AES3. Because System Two features hardware for analog and digital signals, it never passes analog or digital signals through converters, but generates and measures solely in the natural domain of the device being tested. The System Two comes with Audio Precision's APWIN Windows-based software program.

Shown here with the System Two is Bob Metzler. For more information, circle **Reader Service 71**.

RF Workshop Details Advances, Techniques

by Thomas R. McGinley

LAS VEGAS The work of RF broadcast engineers is being done by fewer and fewer people. This reality was corroborated by the sparsely attended, but otherwise excellent session covering a smorgasbord of radio RF topics during NAB '95.

Charles Cooper, staff engineer with duTreil, Lundin & Rackley (DL&R) Consulting Engineers, led the proceedings with an overview of a modern method of evaluating FM signal performance in the field. He said that stations need to know how their signals really penetrate and cover a marketplace, rather than relying on theoretical estimates found in license applications. The DL&R engineers put together a mobile field-strength measuring system using just a Radio Shack whip antenna attached to a passenger car to simulate what an actual listener's car radio would see, using the Tampa, Fla., market as the field test.

The equipment consisted of a Z-Technology R-501P signal strength meter, a Trimble GPS receiver to ascertain location, and a personal notebook computer to control all functions and record the results. The receiver sampled field strengths every three seconds in the moving car as data was collected on WUSA-FM and WKES-FM.

Parasitic elements

The use of parasitic elements to reduce costs in an AM directional antenna array was the topic of Karl Lahm's presentation, which described the VOA's 1548 kHz relay facility in Kuwait. The VOA had to rebuild this installation after the Gulf War, first as a 100 kW two-tower setup, and ultimately using seven towers with 600 kW and three different patterns. Lahm explained that by using a parasitic undriven tower, no phasor and only one transmission line is needed. The pattern is theoretically designed by computer, using tower spacing to set the ratio currents needed and a tuneable tower-base reactance network to set the required phase angles of the parasitic elements. The actual null positions were set by field "talk-down" measurements and agreed very closely to theoretical expectations. The patterns were designed to protect a station in Saudi Arabia and to concentrate most of the radiation across population areas, thereby not wasting it over uninhabited desert regions.

Clarence M. Beverage of Communications Technologies Inc. described three relatively new AM antenna design and installation techniques, including the use of elevated ground radial systems, center of tower "shunt feeding" of self-supporting towers, and using guy wires as parasitic radiating elements. Beverage cited six stations where elevated ground wire systems were installed and licensed by the FCC over the past several years, including WPCI Greenville, S.C.; WWJZ Mt. Holly, N.J.; WVNJ Oakland, N.J.; WGNY Newburgh, N.Y., and WYLI Marietta, Ohio. Such installations use four or six wires elevated 10 to 20 feet and achieve the same radiation efficiency as 120 buried wires and are much cheaper to install.

Beverage reported on KOBO's novel use of a cable, vertically suspended inside a self-supporting grounded tower and tapped to the tower 80 feet up, as the shunt RF feed for a non-directional tower. KOBO is located in Yuba City, Calif.

Full efficiency

This arrangement achieved full efficiency and eliminated directional effects of the usually employed "slant wire" feed method. The use of a support guy wire as a re-radiating parasitic element to form a directional pattern was briefly discussed. Much of the R&D work in this area has been done in England, in addition to Grant Bingeman's study at XEWB with Continental Electronics.

"RF phase response versus sound quality in AM broadcasting" was presented by Tim Cutforth of Vir James Consulting Engineers.

Cutforth cited the classic paper on this topic by W. H. Dougherty, published in 1947, and likened the poor performance of some transmission systems to a misaligned playback head on a cart tape machine. The degradation occurs because of excessive phase shifts and asymmetry in the sideband response. "Good phase response across the AM channel will be very important for AM DAB," Cutforth said. The remedies available include redesigning the phasor and LTU component values in an antenna system to achieve broadband performance, and the application of sideband equalization at the RF exciter level, as used in AM stereo generators and the Kahn ISB "powerside" equipment.

NRSC RF emissions compliance has been a hot topic for AM stations the past year as actual measurements are now

continued on next page ▶

Radio World **Cool Stuff Award** NAB 1995

Boasting minimal phase shift, the EQ3 from **Night Technologies Inc.** is an analog two-rack-space box containing two independent channels of EQ. Each channel has six fixed-frequency bands: 10 Hz, 40 Hz, 160 Hz, 650 Hz, 2.5 kHz and 10 kHz. Each channel also has its own front-panel In/Out switch and status light. The back panel of the EQ3 features balanced I/O XLR connectors, a spare set of quarter-inch unbalanced output jacks and an IEC standard power connector. Jim Woods appears here with the EQ3. For more information, circle **Reader Service 134**.

▶ continued from previous page

required instead of "presumptive compliance" merely by installing an NRSC 10 kHz filter. Greg Buchwald of Motorola revisited the evolution of the AM NRSC standard, citing the contributions of Bob Orban and others in establishing the 10 kHz pre-emphasis curve and stop-band limit. He then described the basic requirements of an NRSC compliance showing, best done with two spectrum analyzer photos or plots.

One is a narrowband or close-in shot, showing the defined shape of the 10 kHz "brick wall," and the other is a wide view to 100 kHz showing a fit within the complete NRSC mask. He also described the use of a Potomac field meter as a "quick check" for splatter beyond ±10 kHz. Buchwald noted that reducing transmitter IPM/IQM will be very important for AM DAB and also reported that the new AMAX AM radios do a wonderful job at creating good fidelity for AM but are slow in coming to market.

An excellent review of the trials and tribulations of solving serious FM blanketing problems was presented by Thomas Eckels of Hatfield and Dawson Consulting Engineers. This firm was hired by KBTI-FM, a Tacoma, Wash., station that received more than 100 complaints about RF interference and was directed by the FCC to resolve them.

Ridding RFI

All stations must comply with rule 73.318, which requires resolution of complaints within the 115 dBu contour for a period of one year after new or modified facilities are installed. Telephone interference triggered by far the most complaints, followed by TV on outside antennas, TV on cable, and VCRs. Other devices affected included AM/FM radios (boom boxes and clock radios), cassettes and CD players, and intercoms. Equipment specifically excluded in the rule includes wireless telephones, camcorders and non-RF devices (stereos, tapedecks, etc.).

Telephone interference was largely solved by either replacing the phone set or installing an external filter or internal ferrite beads. TV problems were generally solved by installing an external FM notch filter (microwave filter model 5K-FM), or by replacing the set in severe cases. KBTI purchased six average TV sets so that H&D engineers could evaluate interference rejection capabilities of each model. The best performer identified was a 20-inch Toshiba model 19C2D. H&D developed a corrective action report on each complaint and followed up until satisfaction was achieved. Stations having trouble with RFI may want to contact Hatfield and Dawson for a copy of their excellent booklet which thoroughly addresses this topic.

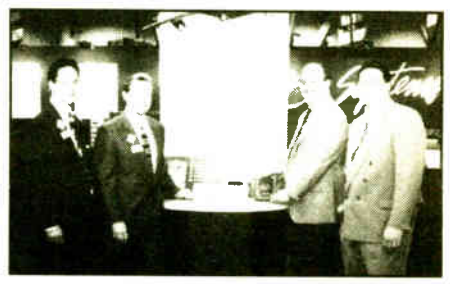
KDKA's new tower

The end of an era occurred on a summer day last year when KDKA dropped its original 1938 Franklin antenna tower north of Pittsburgh (**RW**, Aug. 24, 1994). The old tower was structurally deteriorating and was replaced by a new modified Franklin design, described by Jeff Bixby, project engineer with Moffett, Larson & Johnson Consulting Engineers. KDKA had problems for many years with near-field skywave fading in portions of the Pittsburg metro that were caused by excessive high-angle radiation mixing with the ground wave signal, 25 to 50 miles away.

The Franklin antenna is essentially a half-wave dipole turned up on its end with the feed point in the middle of the tower, achieving gain in excess of a 5/8 wave tower. By computer modeling with NEC, a modified design showed that by feeding the 720-foot tower 90 feet lower (1/2 wavelength from the base), high-angle components could be more effectively suppressed. A fine-tuning network across the base provided even more control of the suppression.

The new design appears to have largely solved the fading problem. However, even though it is grounded at the base, the new tower appears to be attracting more static electricity causing increased VSWR "bumps" at the MW-50 transmitter. Bixby showed some pictures of the impressive new installation and a video of "old Franklin" falling down.

Radio World **Cool Stuff Award** NAB 1995



The **360 Systems** Instant Replay hard disk audio player features immediate access to 1,000 audio cuts, 500 of them mapped to panel-mounted Hot-Keys and 500 in reserve. Instant Replay is completely self-contained and features an internal four- or eight-hour hard disk, sample rate conversion, D-NET file transfer network, AES/EBU and S/PDIF digital I/O, analog +4 dBu I/O and a printer port.

Steve Gordoni (l), Don Bird, Robert Easton and Sean Bowers pose here with Instant Replay. For more information, circle **Reader Service 101**.

Digital Makes Inroads Into RF Technology

by Thomas R. McGinley

LAS VEGAS NAB '95 was without question a digital extravaganza. While the "D" word was on virtually every new piece of equipment introduced here, the "SS" word was just as prominent in the arena of RF and transmission products.

Solid state transmitters have been around a long time, with at least four manufacturers offering AM all-solid-state models up to 50 kW. And now solid state has arrived in the super-power medium-wave world.

Harris Allied presented its new DX series solid state 200 kW water-cooled EPAC model for international applications. Not to be outdone, **Nautel** showed the NA series of AM transmitters, featuring a new integrated parallel combiner design for standalone power levels up to 300 kW. Engineers regarded reaching these power levels with all silicon virtually unthinkable only a few years ago.

Solid state reigns

All-solid-state transmitter power-level and efficiency enhancements appeared all over the exhibit floor for both AM and FM transmitters by most of the established domestic manufacturers, plus various European companies trying to attract new markets.

In the AM medium-wave field, Nautel introduced two new models in addition to the NA series of super power units which specifically address the needs of eventual conversion to DAB. The XL-12 (12 kW) and XL-60 (60 kW) both feature higher power output, 140 percent positive peak capability, a new RF module design that achieves 85 percent overall AC to RF efficiency, dual redundant exciters and a direct digital synthesizer option to facilitate DAB. The higher power outputs are in part a product of Nautel engineers believing that DAB will require up to 10- or 15-percent reductions in efficiency in order to achieve the linear phase response and low IQM demands of DAB.

Omnitronix of North Wales, Pa., jumped into the higher-power arena with the unveiling of its all new OMNI line of solid state AM transmitters from 1 to 50 kW. The Omni design features time-proven PDM modulation with 140 percent positive peak capability, extensive lightning and VSWR protection, redundant modular construction, diagnostic LEDs and world-common parts all at affordable prices.

Adding selection

Broadcast Electronics entered the AM transmitter market only several years ago with high-performance all-solid-state PSM models that featured no power transformers in output power levels from 1 to 10 kW. This year BE added the AM-500 to complete the line at the low power end. This unit features five separate switchable power levels, two sets of antenna equalizer adjustments, and BE's exclusive VSWR foldback circuit.

Continental Electronics again showed a planned 50 kW PWM all-solid-state model, but only in a dummy cabinet. It plans to release the design to market later this year. Continental teamed with **Sine Systems** with the introduction of EDU for its current transmitter line. The Embedded Diagnostic Unit is a microprocessor-based diagnostic device that automatically monitors and reports every critical parameter and operation of the transmitter. It feeds serial data via a telephone line modem for PC data acquisition, display and logging.

The new and enhanced product introductions in the FM transmitter world came from a rather crowded field. Virtually every known FM transmitter manufacturer showed something new or improved at NAB '95. If you are shopping for a new solid state rig up to 10 kW, there is now much to choose from. And of course, two 10 kW units can be easily combined to make 20 kW. Up until this year, Harris Allied was the only company to offer a standalone SS 10 kW FM transmitter with the Platinum PT-10. While still rather pricey, Harris reports the unit is selling well, especially internationally.

Solid state technology could be found everywhere in the arena of RF and transmission equipment.

All-digital leader

Harris was also the only source of an all-digital FM exciter, the Digit. While that unit took over a year to refine its performance capabilities after being introduced, Harris Allied reports worldwide sales of the Digit at almost 200 units. The new AES/EBU direct digital interface for the Digit was shown at NAB '95.

Nautel Maine followed the Harris Allied lead with its own introduction of an all-digital FM exciter and a 10 kW solid state transmitter this year. The company improved its existing 7 kW model by adding two more RF output FETs per module with more efficient heat dissipation to achieve 10 kW in its new model FM-10. The unit boasts 65 percent AC to RF overall efficiency using Nautel's patented 60 degree combiner, PA modules 8 MHz wide, a power factor of 0.98, plus VSWR protection and power reduction.

The new Nautel NE-50 digital exciter uses DDS (direct digital synthesis) and a 32-bit resolution NCO to create the digital FM signal. Both analog and digital (AES-EBU) inputs are available. The ultimate performance is limited by the A/D converter, yet Nautel claims SNR at

continued on next page ▶

Radio World **Cool Stuff Award** NAB 1995

Belar Electronics Laboratory stepped into the RDS arena with its new RBDS-1 RBDS monitor. The RBDS-1 displays various parameters, including RBDS and stereo pilot injection, RBDS/pilot phase error, radio text, alternative frequencies and data channels. The monitor features standalone decoding, computer display through its RS-232 interface and an interface for Belar's Wizard, all in a one-rack-unit chassis.

The RBDS-1 will be available around June 1 for $2,500.

Flanking the RBDS-1 from l to r are Carl Lewandowski, David Hirsch, Mark Gant and Arno Meyer. For more information, circle **Reader Service 186**.

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better than -90 dB and distortion less than .004 percent, exceeding analog exciter capabilities. The NE-50 does not include a digital stereo generator as yet and delivers up to 55 W RF output.

QEI Corporation unveiled the new Quantum series of all-solid-state FM transmitters in 17 different power level models from 75 W to 9.6 kW. Driven by either the new 300E or 600E exciters, the higher power models above 1 kW use 600 W FET redundant power modules combined as necessary for rated power output into a high efficiency cable-less Wilkinson combiner unit. QEI features VSWR protection via automatic power reduction and single-phase power supplies in all models.

While not listed in the specifications sheet, a QEI sales engineer reported the AC to RF efficiency of the Quantum series at about 62 percent. The retail price for the 9.6 kW Quantum was reported to be only $53,495.

QEI also introduced the long-awaited D-MAX modules to enable direct AES/EBU digital interfacing with the popular Cat-Link STL system. D-MAX features variable sample-rate technology and no audio compression or transcoding artifacts.

Several enhancements

Broadcast Electronics introduced several enhancements to its solid state FM transmitter line at NAB '95. Two new power levels unveiled were the FM2C (2 kW) and the FM5C (5 kW), featuring rugged compact construction, redundant RF modules and power supplies, plus automatic restart and zero warm-up time. No efficiency figures were given. The FM5C model incorporates the new FM250C analog exciter/transmitter—that is essentially the popular FX-50 with a larger PA device (MRF-151G) and power supply. BE also upgraded its FM1C and FM 500C models to C1 status that feature new front panel plug-in power supplies and higher efficiency power modules as used in the new higher power models.

Energy-Onix entered the medium power solid state FM derby with its Legend series with power outputs from 1 to 5 kW. Its design uses a proprietary combiner architecture with the Motorola MRF-151G FET PA devices producing up to 600 W per module. Overall efficiency is conservatively rated at about 58 percent. The new SST-100 100 W FM exciter/transmitter was also shown. Energy-Onix has also entered the STL arena, showing a new 5 W and 20 W composite STL system.

Svetlana Electron Devices's new products included two replacement tetrodes—the YC130 for 35 kW, and 4CX3500A for 5 kW FM transmitters, as well as the new 3CX3000A7 replacement high mu triode for FM transmitters and the 3CX2500F3 replacement triode for AM transmitters. NAB '95 attendees also could peruse the company's large selection of current model triodes and tetrodes for the radio broadcast market.

The new STABILINE SL series of uninterruptible power supplies, and SP series of standby power supplies, were unveiled at **Superior Electric**'s booth. The company also be displayed its STABILINE WHR series of automatic voltage regulators and WHC series of power conditioners, among other current products.

Bext Inc., an Italian manufacturer gaining popularity in the United States with marketing offices in San Diego, showed its all-new SF series FM amplifiers, available in 10 power levels from 150 W to 5 kW. Bext engineering features very durable and compact construction and uses high efficiency and stable MOSFET amplifiers. The entire SF-5000 transmitter stands in a four foot-high roll-around rack.

Completing the line

Bext now carries the full line of **EMR Corp.**'s RF filters, combiners and multiplexers that were on display.

Crown Broadcast, a division of Crown International (famous for audio amplifiers), has added to its complete low power FM transmission package line introduced last year with higher power models. Crown showed the new 500 W unit, complete with audio processor, stereo generator, exciter and RF amplifier, all in a portable case. And it is frequency agile for any emergency application.

CCA Electronics, long-time maker and champion of grounded-grid tube-type FM transmitters, has taken the solid state plunge in '95 by adding a 700 W solid state IPA driver stage option to all of its medium power transmitters. CCA is also now using the new 3CX-800A7 and 3CX-1200Z7 IPA tubes as grounded-grid IPA stages in many models, replacing the more temperamental 5CX-1500 pentode for improved AM noise performance.

Customers should take extra time to consider all the options and choices available in all transmitter classes before negotiating to buy anything new.

You can upgrade an existing model with an IPA update kit. CCA also unveiled its new LX-1 Digiciter, an FM digitally controlled exciter in power outputs of 60, 120 or 250 W. The model LX-2, which will be fully digital, is soon to follow.

Other manufacturers presenting new or improved FM transmission gear at NAB '95 included **Larcan-TTC**, showing its new FMS-500 500 W solid state transmitter, along with its current FM-4000 4 kW solid state model; **LDL** Communications with six solid state FM transmitter models up to 8 kW; **Itelco S.P.A.** of Italy unveiling its new all solid state 1 kW and 5 kW transmitters; **Elenos S.L.P.** showing the new SF series of up to 1 kW solid state FM transmitters; and **DB Elettronica** introducing its new 300 W solid state FM transmitter and exciter with a built-in digital stereo generator. Perhaps the cutest FM transmitter introduced this year was by **LPB Inc.** A complete low power transmitter, including stereo generator all packaged in a case the size of a paperback book, should be of special interest for limited range applications users.

One brand new STL/TRL product which cannot go unmentioned is **Burk Technology**'s new BDT-115 RF data transceiver. Operating at 3/4 W spread spectrum in the 900 MHz band, this impressive little system can handle the RF bidirectional path up to 20 miles for all remote control transmit and telemetry receive functions at only $2795 for both ends.

Inovonics's new product offerings included the model 540 AM Modulation Monitor and the model 716 DAVID-II FM Stereo Processor/Generator. Among the company's already-introduced products displayed were the Model 222 NRSC AM Audio Processor and the Models 250, 255 and 260 FM Audio Processors.

Accessorizing

RF Technology's new product offerings at NAB '95 included 1.5-15 GHz high performance Heterodyne fixed links, and "ultra portable" 1.5-15 GHz UPL series transmitters. The established D series of 1.5-15 GHz portable transmitters/receivers were also on display.

New high-voltage RF switches and new isolation units were featured at the **Phasetek** booth, along with a variety of current product offerings, including RF components, inductors and contactors.

"Flexible" composite audio/video cables and "extra-durable" multipair field cables were unveiled at **Nemal Electronics International**'s booth. The company's line of electronic cables, connectors, jackfields and accessories for RF applications will also be on display.

A variety of new "test quality" reducer/adapter devices for EIA rigid line to type N female and 7/16 were on view at **MYAT**'s booth, as was the company's current line of rigid coaxial transmission lines, components and accessories.

EEV's current line of broadcast tetrodes for AM and FM transmitters were on display at the company's booth.

A line of rebuilt power tubes for radio transmitters will be introduced by **Econco**.

Dielectric Communications's NAB '95 offerings from the company's current product lineup included a variety of FM broadcast components and associated RF components.

Altronic Research's new model 3500 digital calorimetry for air-cooled dummy loads and the current model 67150 150 kW MW air-cooled dummy load were also featured.

This is the author's 25th consecutive NAB Convention and I can never remember when so many companies were displaying new RF products. Today's customers should take extra time to consider all the options and choices available in all transmitter classes before negotiating to buy anything new.

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Tom McGinley is chief engineer at WPGC-AM-FM Washington and RW's technical advisor.

Radio World Cool Stuff Award NAB 1995

Pacific Recorders & Engineering's ADX Ensemble is a combination digital recorder and automated mixer in a standalone unit. The ADX Ensemble comprises an eight-channel version of the Doremi Labs DAWN II hard-disk recorder/editor, linked to a moving-fader mixing control surface with dedicated transport and editing functions. All 20-bit mixing, three-band parametric equalization and waveform editing functions are performed digitally within the workstation's signal-processing unit.

Holding the Cool Stuff Award for the ADX Ensemble is Steve Scoville. For more information, circle **Reader Service 141**.

Radio World Cool Stuff Award NAB 1995

The new **CCS** FieldFone allows a field reporter to get broadcast-quality digital audio back to the studio through a single, regular dial-up line. Because FieldFone is fully bidirectional, there's no need for encoders, decoders or return cue lines. It works anywhere in the world without ISDN. The user gets MUSICAM HQ digital audio from CCS from a single standard analog telephone line. And the box is rugged for rough field conditions. The two-unit set should sell for around $2,500.

David Lin (l), Art Constantine and Doreen Arleth appear here with the FieldFone. For more information, circle **Reader Service 58**.

Radio World
Cool Stuff Award
NAB 1995

A lot of excitement was generated by the new SAW Plus software from **Innovative Quality Software** displayed at the Broadcasters General Store booth. SAW (Software Audio Workshop) had been available as an 8-track mono/4-track stereo hard disk editor for around $600. SAW Plus offers an additional eight tracks for 16-track mono/8-track stereo for a suggested retail of $999. SAW Plus requires a PC 486DX-50 with at least 16MB RAM, Windows 3.1 or higher, a minimum 250MB hard drive and a 16-bit digital sound card.

Bob Lentini stands next to a computer running the SAW Plus. For more information, circle **Reader Service 199**.

Era of Digital Editors Showcased at NAB '95

by Mel Lambert

LAS VEGAS System connectivity and file-exchange formats between radio production and on-air workstation platforms figured strongly during discussions with broadcast and post-production users at this year's National Association of Broadcasters convention.

Akai Digital showed the new DD1500 modular recorder/editor that offers 16 tracks of record/replay from magneto-optical (MO) or Winchester-style hard drives. Components include the DL1500 controller, DD1500m mainframe, DD1500x drive housing, plus the DD1500a A-to-D and D-to-A I/O chassis.

Each drive unit houses up to two 1.3GB drives, and each I/O chassis can accommodate up to eight analog I/O pairs; users can hence assemble system formats to suit their specific requirements. The DD1500m mainframe provides digital I/Os, MIDI, word clock, video sync, RS-422 serial time code and other connections.

The DL1500 controller includes dedicated transport controls, a scrub wheel, level control, autolocator, edit-profile buttons and other functions. A separate VGA display provides color graphic displays of track layouts and waveform profiles. Future expansions will offer RAM-based sampling plus real-time EQ, time stretch, pitch shift and other DSP-intensive operations.

Also to be seen: the new DR8 multitrack hard disk recorder that extends the functionality of the firm's existing DR4d systems.

AMS-Neve unveiled details of the new Version 12 software for its AudioFile workstation that provides real-time display of audio waveforms plus the ability to ripple tagged events. Other features include 24-bit resolution for recording and editing (existing 16-bit files can also be replayed on the upgraded AudioFile systems); up to 24 tracks of replay from large format drives; the addition of virtual tracks (to provide 24 tracks of functionality on an eight-track AudioFile); multitransport machine control (9-pin and ES Bus); and the ability to save events lists to Exabyte or floppy diskette.

Key to the new enhancement, AMS-Neve says is WorkFlow, a concept that allows AudioFile projects to be connected to other stages in the production process. Version 12 software is described as furthering this cause through enhancements to Open Media Format (OMF) handling, and via live direct replay from Lightworks media.

Avid Technology unveiled V3.1 software for the AudioVision and AudioStation systems. Version 3.1 provides extra features and enhanced compatibility with the firm's Media Composer and Film Composer editors. Shipping with the new release are Digital Player/Recorder (DPR) models for recording, digitizing, transferring and integration with digital/analog mixers, including the Yamaha DMC1000 console.

Users now can store and retrieve automation data and browse DMC1000 setup parameters, as well as recall and assign effects directly from the workstation software. Also to be seen: enhanced connectivity with Digidesign Pro Tools systems via OMF and native file structures; plus AvidNet/ATM high-performance networking configurations that can now be expanded to WAN (wide area network) topologies utilizing Sprint Communication's Drums service to provide drag-and-drop media access from central servers.

Digidesign demonstrated Version 3.1 of its Pro Tools III software that now offers up to 48 tracks of record/playback and 64

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channels of I/O capability in 16-track and eight-channel increments, respectively. QuickPunch also allows punch-on-the-fly capability, while PostView random-access digital video and a new OMF function offer seamless exchange between Pro Tools and Avid Media Composer files. PostView's machine control via 9-pin and V-LAN protocols enables spotting and layback of audio from within ProTools.

Also to be seen: Session Software V2.0 that provides software-based multitrack recording, editing and mixing for more simple multimedia and related applications, with four to 16 tracks of playback, parametric EQ, synchronization to QuickTime video and other features; PostConform, that enables EDL import and auto-conformation; and DPP-1, a TDM-compatible plug-in that provides digital pitch shifting.

Doremi Laboratories introduced DAWN II/16, a replacement board for the original DAWN II processor, and now capable of replaying up to 16 tracks from a single SCSI-2 hard-disk chain. The new plug-in board is fully compatible with existing DAWN workstations. Also to be seen: Sync II and Out II, a pair of add-on boards for the DAWN systems that provide, respectively, synchronization with lower clock jitter, sample rate pull-up/down, and built-in DSP to provide digital level and fade control. The new DAWN IImx is described as a low-cost multitrack recorder/editor that offers fully integrated on-board digital mixing. Record media is either removable MO or conventional hard drives. A basic system offers eight tracks, two input ports, a mixed stereo output and two auxiliary sends and returns. Input/output file formats are fully compatible with existing DAWN as well as .AIFF and OMF structures.

Fairlight USA unveiled a powerful new event-based equalization tool to the firm's MFX3 series of workstation products that allows every clip in the system to possess its own independent setting. Now EQ settings are now stored for each clip, and are carried forward even if the segment or any part of it is copied or moved to another location. Each of the four EQ bands is fully parametric with adjustable frequency, gain and bandwidth. Each band is also selectable between 20 Hz to 20 kHz, and settings can be copied from clip to clip, or set across an entire range of audio.

A unique feature of the MFX3 equalizer allows an operator to select an entire range of clips and edit an individual band for the entire section. Having adjusted the individual band, all other settings within the range remain unchanged, even if they are all different.

Fostex Corporation demonstrated the new DFM Dancing Fader Mixing System for the Foundation 2000 that comprises an assignable mixer control surface fitted with moving faders and automation of all mixer/DSP settings. The DFM houses 10 servo-driven faders—eight channels, plus L/R and Monitor Masters—with individual LED readouts of each fader's current function and assignment.

A set of mode switches enables any Foundation mixer parameter, such as channel strips, monitor, aux sends/returns and mix bus outputs, to be recalled and reset. An LED menu screen provides more detailed control of DSP and mixer automation modes. Seven rotary encoders provide access to assignable parameters such as parametric EQ, panning, and compression/limiting. DSP and mixer parameters can be saved in one 999 snapshot; all fader and pan positions can be continuously automated against MIDI-based timing references.

Also shown: TimeFlex time-expansion and compression algorithms that allow users to stretch/shrink program material to fit a desired length of time, plus Release 4 software that now includes support of event grouping and patch bay routing functions for the Foundation's digital mixer.

Orban unveiled V5.0 software for the DSE-7000 digital audio workstation that now offers TimeFit time compression and expansion of up to 25 percent. Other features include pitch shifting, two-octave varispeed copy, two-octave varispeed play (that keeps the output sample rate constant), reverse audio and enhanced help functions. The DSE-7000 is also fully compatible with the **Enco** DAD486x digital audio delivery systems, enabling files from individual systems to be accessed via a local area network. Radio spots produced on a DSE-7000, for example, can now be saved directly in a DAD file server, and be immediately ready for on-air execution via a DAD workstation.

Otari Corporation unveiled the new RadarView software for the RADAR hard disk recorder, available in eight-track increments, that provides visual display of the contents plus timing relationships between audio cues recorded across multiple system components, and which is said to greatly simplify the editing and slipping of individual track-elements recorded into the system.

Also being shown: the UFC-Universal Digital Audio Format Converter, which handles up to 24 channels of Alesis ADAT Optical, Tascam TDIF-1, ProDigital PD, SDIF-2 and (optionally) AES/EBU-format I/Os. Multiple units can be interlinked to handle larger configurations.

Pacific Recorders unveiled the ADX Ensemble, a version of the popular ADX workstation that comes complete with an automated mixing surface. ADX Ensemble comprises an eight-channel version of the **Doremi Labs** DAWN II hard-disk recorder/editor, linked to a moving-fader mixing control surface with dedicated transport and editing functions. All 20-bit mixing, three-band parametric equalization and waveform editing functions are performed digitally within the workstation's signal-processing unit. Full time-code compatibility features, along with time compression/ expansion, 32/44.1 and 48 kHz sample rates, AES/EBU-format digital I/Os, 18-bit Delta Sigma A-to-D and D-to-A converters.

Roland Corporation showed the DM-800 multi track disk recorder that combines in a single chassis an eight-track recorder/player and a 12-channel mixing

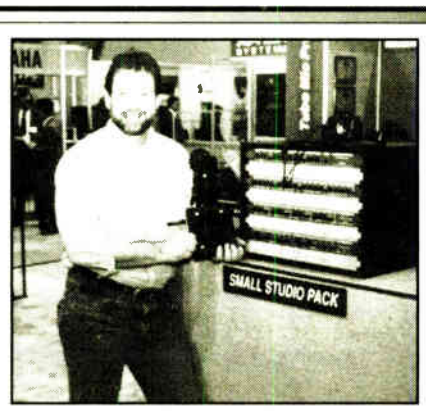
continued on page 74 ▶

Radio World **Cool Stuff Award** NAB 1995

Both the **Crown** CM-311HS and CM-312HS are headworn microphones that mount on either Sony MDR-7506 or MDR-V6 headphones. Worn with lips touching the mic, the CM-311HS cardioid condenser works well in traffic-copters or at sporting events with high noise levels. Response is 50 Hz to 15 kHz. The CM-312HS, a lightweight hypercardioid condenser mic, is similar to the CM-311HS, except that the mic is worn to the side of the mouth. Although it has slightly less isolation than the CM-311HS, the CM-312HS is less conspicuous.

Tom Lininger and Bob Herrold appear here with the mics. For more information, circle **Reader Service 32**.

Radio World **Cool Stuff Award** NAB 1995



The **Aphex** 107 dual channel tube microphone preamp combines solid state circuitry with the warmth of tube technology in a unique tube circuit that Aphex calls Tubessence. Priced at $595, the 107 has switchable 48 V phantom power, continuously variable gain controls and very low noise and crosstalk. The unit also features talent-activated muting using a remote footswitch, a handy feature for studio recording applications.

Pictured here with the 107 is Marvin Caesar. For more information, circle **Reader Service 139**.

Radio World
Cool Stuff Award
NAB 1995

The **Yamaha** ProMix 01 is a full-featured programmable digital mixer that benefits multitrack recording facilities and post production facilities using hard disk systems. The ProMix, shown here with Lon Brannies, is also ideal for live sound setups and as a submixer for a large conventional console. Features include 18 input channels with gain trim, eight balanced XLRs with 48 V phantom power and motorized faders on all channels, with four fader groups for multichannel control. ProMix snapshots allow instantaneous storage and recall of all mix settings. MIDI control enables real-time automation.

For more information, circle **Reader Service 53**.

Era of Digital Editors

▶ continued from page 73

system; total weight is slightly more than 12 pounds. The DM-800 provides 100 layers-per-track recording, dynamic automation, MIDI integration and time compression.

The system is now available with a direct interface for the Tascam DA-88 digital multitrack recorder that provides eight channels of digital I/O plus full bidirectional machine control; the DM-800 can operate as either a master or a slave. The new RS-422/DA-88 interface also allows direct connection to a video editor, with the DM-800 appearing as a slave to the editor. The interface is a single-space rack-mount device that can be connected directly to the DM-800 via an RMDB bus cable. A complete set of DA-88 interface connectors is provided for digital audio I/O and machine control.

Solid State Logic unveiled the new Axiom Preparation Station, a desktop unit providing shared access to Axiom's DiskTrack for audio recording, editing and pre-lay, plus video recording. The APS system can select up to 24 audio tracks from the maximum 128 available with DiskTrack. Use of an APS unit as an extension to DiskTrack frees up the master Axiom Production System for large-scale mixing projects, while allowing program preparation to be conducted in a cost-effective manner through shared resources.

As SSL points out, one of Axiom's major features is the built-in hard-disk multitrack recorder and editor. While full-scale recording and mixing is central to the system's Axiom for a number of applications—such as video and film post-production—there exists a need to record, edit and pre-lay audio independently of the mixing process. Hence the new APS, which also provides audio conforming and reconfirming to standard EDLs, plus Open Media Interchange via import/export of audio in both .AIFF and .WAV formats.

Sonic Solutions demonstrated real-time connectivity and file exchange between a Sonic System, a Silicon Graphics system, Radius VideoVision and a Data Translation system via MediaNet, the firm's high-speed network. Also on display: the new UltraSonic Processor (USP) card for the Sonic System that offers 16 channels of I/O, up to 32 tracks of disk playback and full DSP; up to three cards fit into a Macintosh controller, providing a total of 48-track record/replay. A low-cost Sonic Power Station now offers two to four channels of digital I/O, eight to 12 channels of disk playback, background loading and on-board DSP.

In addition, a new Sonic Radio Workgroup Architecture allows broadcasters to configure networks of radio-production systems for preparing news, commercials, trailers, IDs, jingles, PSAs and longer format programming.

Spectral Inc. showed the new Prisma Music workstation that has been optimized for music and related production. The system's Edit Panel simultaneously displays from two to 16 tracks, each of which comprises four layers; the foremost layer is the one currently capable of replay mode. Up to 99 Virtual Tracks are available on the system; up to eight assigned tracks can be replayed together while mixing down to any pair of tracks. The Mixer Panel provides a full-color visualization of an eight-input stereo console with moving faders, EQ sections, aux sends, panning and related functions.

Full object- or waveform-oriented editing is provided, with up to 10 levels of undo. Alternate controllers include the J. L. Cooper CS-10, or any full-featured MIDI-based systems. Also to be seen: the new Translator eight-channel digital audio format converter that sports Alesis ADAT Optical ("LightPipe"), Spectral SMDAI, Tascam TDIF-1 and Yamaha Y2 formats.

Studio Audio & Video unveiled Version 2.2 software for the Sadie disk editor that adds an automatic speech edi-

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Keeping Pace with Developments

LAS VEGAS Manufacturers promised and delivered on a profusion of studio source gear during this year's NAB show.

Denon Electronics introduced the DN80R portable MiniDisc (MD) recorder, built for the rigors of location recording, but containing many of the features found in better DAT and reel-to-reel portable recorders. It uses a RAM buffer with capacity for 40 seconds of stereo audio. The optical pickup incorporates a proprietary vibration-absorbing suspension.

The company also debuted the DN790R professional tape recorder with Dolby S Noise Reduction, suitable for cassette mastering applications, and a 200-CD jukebox, the DN1400F, which quickly accesses any CD by employing two separate transports. A new professional double cassette deck, the DN740R, was on display as well. It is a rack-mount, two-well cassette deck, suited to applications in which long playing time, convenient cassette-to-cassette dubbing, pitch control and quality audio are requirements. A wristwatch-style remote provides control over both decks.

360 Systems introduced the Instant Replay hard disk audio player. It features immediate access to 500 audio cuts—as mapped groups of 10 to 50 panel-mounted Hot-Keys. Instant Replay is completely self-contained and features an internal four- or eight-hour hard disk, sample rate conversion, D-NET file transfer network, AES/EBU and S/PDIF digital I/O, analog +4 dBu I/O and a printer port.

The company also displayed its line of digital audio products for use in storage and retrieval applications requiring high audio quality.

Otari Corp. showed its RADAR multitrack hard disk recorder as well as its MR-10 MiniDisc recorder/player and the CDC-600 dual drive 360 capacity CD changer. RADAR, which stands for Random Access Digital Audio Recorder, is manufactured by Creation Technologies of Vancouver; Otari holds exclusive worldwide marketing and distribution rights. RADAR is available in 8-, 16- and 24-track configurations. The optional remote is fully functional, with 99 cue points, scrub/jog wheel, QWERTY keyboard, keys for track arming and soloing, and dedicated edit function keys. Its time code synchronizer will chase lock to 24, 25, 29.97, 29.97DF, 30 and 30DF rates (offsettable), and will also support 32, 44.1, 44.056, 47.952 and 48 kHz sampling frequencies.

Scott Studios' booth displayed the Scott System '95, a new touchscreen hard disk digital audio system with 9GB hard drives, an on-screen telephone recorder/editor, hot keys to start hundreds of recordings at a touch, and Wall of Carts, which provides audio at a touch.

AKAI Digital unveiled its newest hard disk recorder, the DR8. Other established products on display included the SR4 hard disk recorder, the DD1500 digital audio workstation and a full line of digital samplers.

Tascam-TEAC Professional Division had several new products on display, including the DA-P1 portable DAT recorder and ES-61 audio edit controller. The DA-P1 is a rugged, portable DAT recorder featuring a two-head design and two direct drive motors. It uses XLR-type mic/line inputs, complete with phantom power. It also offers unbalanced RCA connectors for both input and output, and S/PDF digital I/O for direct digital transfers. The ES-61 audio edit controller, suited as the main controller in audio editing (and audio-for-video) situations, can control up to six machines simultaneously.

On display while in action was the Radio Systems Inc. DDS, an expandable multi-user multichannel digital delivery system that emulates a cart machine.

Bradley Broadcast Sales also showed **Tascam**'s DA-P1 portable pro DAT machine, in addition to the IQS SAW computer-based audio editing software and 360 Systems' Instant Replay Morning Show Sampler.

Nagra Kudelski introduced a new solid state recorder, the ARES-C, with PCMCIA support. This portable machine is mono or stereo, with a single channel recording time of 40 minutes on a 20MB card.

Harris Allied displayed an operating digital radio station, configured and demonstrated with standard off-the-shelf components, including source equipment. It demonstrated new digital studio products, digital editors and hard disk systems. The company's CD-10 CD cartridge machine now has "orange book" capability and other enhancements.

On display while in action was the **Radio Systems Inc.** DDS, an expandable multi-user multichannel digital delivery system that emulates a cart machine. It operates in real time, handles multiple functions simultaneously and plays up to 16 channels simultaneously.

continued on page 76 ▶

Radio World Cool Stuff Award NAB 1995

The P1500 from **Hafler**, rated at 75 W per channel at 8 ohms, is one of several new professional amplifiers that contain Hafler's trans-nova circuitry. Housed in a 3.5-inch rack-mount chassis, the P1500 is constructed of heavy gauge metal. The rear-panel input jacks accept both quarter-inch phone and XLR plugs. Because the P1500 is convection-cooled, there are no fans to service or filters to clean. The P1500 is equipped with a unique electronic fuse and features new LED indicators for real-time visual monitoring of each channel's signal, clip, short and thermal status.

Rick Gentry, Marge Williams and George Stasky appear here with the P1500. For more information, circle **Reader Service 103**.

Digital Editors

▶ continued from previous page

tor for time-domain DSP of spoken materials (and is described as being specifically applicable in radio production); direct interface to SCSI-based CD-R recorders for creating fully-compatible Red Book Masters; a MIDI-based hardware controller card for the J. L. Cooper CS-10 system that provides faders, transport controls, mute, solo, scrub and programmable function keys; support for Exabyte 8mm archiving at up to five-times playback speeds; and connection to MO disks for 20-bit stereo editing and instant backup.

Studer-Editech unveiled Dyaxis IIbv (broadcast version) that offers the major features of the existing Dyaxis systems, but without synchronization and expansion capabilities. The IIbv version features a built-in digital mixer that provides dynamic level control, panning, five-band EQ and level metering. The systems' unique VirtualMix feature is said to allow a large number of virtual tracks to be output simultaneously, thereby eliminating the playback restrictions imposed by disk bandwidth or dense edits.

Also to be seen: PostTrio, a new integrated system optimized for post-production, with eight to 24 tracks of simultaneous record/reply, 16 to 72 freely-assignable I/O channels and 16 to 48 automated mixer strips; a new Edit Controller for the Dyaxis Series of workstations with a dedicated edit/scrub wheel, transport functions and edit buttons; plus VideoMix, a new option based on the Radius VideoVision Studio system that offers up to 60 minutes of full-motion, synchronous digital video playback in both NTSC and PAL formats.

The **Synclavier Company** unveiled S/Link 2.0, a batch audio file transfer and conversion utility for Macintosh-based workstations that is compatible with different sampling rates, file formats and resolutions. S/Link 2.0 supports .WAV, VOC, AIFF/AIFF-C, QuickTime, SoundEdit, MOD, IFF/8SVX, .SND/.AU, Sound Designer I/II, plus Open Media Framework (OMF) formats.

Also to be seen: EditView 4.0 Cross-platform Audio Interface; and a version of AutoConform 3.0 for users of Digidesign products.

TimeLine Vista was demonstrating several new developments for its DAW-80 system and StudioMaster V6.01 software, now compatible with faster Pentium-based PC platforms. Available in configurations that provide up to 24 tracks of record/replay capability, each disk drive provides access to four tracks with real-time punch in/out functionality and full graphics-based editing.

The firm also announced the formation of a strategic alliance with **Computer Concepts Inc.** that will enable the latter to market a radio production and post production version of the DAW-80 digital audio workstation. Using eight-track Studioframe software, the new system marketed by Computer Concepts will maintain a majority of the system's functionality, including editing, mixing and manipulation of audio data. This new radio edition of Studioframe will also be interfaced via AES/EBU-compatible I/Os, to Computer Concepts' hard disk-based Digital Commercial System (DCS).

Now, instead of recording, editing and assembling spots on multitrack analog tape and mixing them down prior to transferring them to broadcast carts, the Studioframe/DCS system will allow all of these functions to be handled within a single digital environment. The DAW-80 will also be available in the near future in a format that incorporates the Peavey Media Matrix channel assignment, DSP and mixing firmware.

Yamaha Corporation of America unveiled the modular, low-cost workstation system, based on the new CBX-D3 Digital Recording Processor—a four-channel system that provides two channels of simultaneous recording and four of playback. System operation is controlled from a Windows-based-on-Mac platform, running editing third-party software (EMagic Logic Audio CBX, Mark of the Unicorn Digital Performer, Opcode Studio Vision Pro or Steinberg Cubase Audio).

The DBX-D3 features an integral sample-rate converter, and can be connected directly with the firm's ProMix 01 16-channel digital mixer to provide an integrated recorder/editor/mixer. Also available: the new CBX-D5 upgrade which, in addition to the D3 features, adds balanced XLR analog I/Os; AES/EBU-, S/P DIF- and Y2-format digital I/Os; plus parametric EQ and a collection of digital reverb and special effects.

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Mel Lambert, principal of Media&Marketing, a Los Angeles-based consulting service for the professional audio industry, can be reached at 818-753-9510.

Studio Equipment Brings It All Together

LAS VEGAS No matter what your station may need, the right type of studio gear can make a difference; the latest and best choices were on display at NAB '95.

Furniture

How you pull it all together in the studio depends largely on how you can set up the equipment and how user-friendly, comfortable and appealing the furniture is.

Arrakis Systems displayed its line of radio studio furniture, both modular and custom designed.

Arrakis Systems displayed its complete line of radio studio furniture: Desk*Star includes every type of radio studio furniture needed, whether modular (from stock) or custom designed.

Harris Allied introduced its own line of private label studio furniture. The AudioMetrics line is a completely modular system of furniture that lets broadcasters mix and match standard components. Components are available in stand-up or sit-down heights in a variety of light and dark standard colors.

Audio accessories

Sescom displayed a variety of audio accessories, as well as its current Rackem 'N' Stackem audio products. And **Radio Design Labs** proffered its new RC-1U rack chassis and JP-1 universal jack panel.

A number of interconnect components, such as coax connectors, patching systems, panels and assemblers, were on display at the **Trompeter Electronics** booth. **Switchcraft** showed its DSX panels, offered in both hardwired and modular configurations from eight to 84 circuits, as well as patch cords and other accessories.

A line of multiformat tape storage products, both mobile and static, and storage for small formats such as CD, were the order of the day at the **Storeel** booth.

Routers were in the spotlight at the **Sandar Electronics** booth. The new AD-2000 16x16 AES/EBU router in 1RU, and the new PESE 2.3 software for PC-control of routers, were displayed. Established products from the company at NAB '95 included the AA-2000 16x16 stereo audio router in 1RU.

Ward Beck Systems displayed a new stereo router, the RS 8216 16x1.

Making a connection

DGS Pro-Audio was on the show floor with its new universal panel mount XLR connectors (latching and non-latching) and gold contacts, that are available in nickel or black chrome. A series of Deltron XLR connectors were among the company's established products on view.

The new D-2800 routing switcher system for analog and digital audio was displayed by **Datatek**; the company's standing D-2500 series of 20x10 and 20x20 routing switchers for analog and digital audio, and a selection of analog and digital audio distribution amplifiers, were also on display.

Autogram's NAB '95 product offerings included a number of products, including the RTV-20 20 slide pot, the Pacemaker 1032 10 slide pot, and the Autocount count-up clock.

New from **Audio Accessories** was Project Patch, a reconfigurable interface system for fast and easy studio wiring through pre-terminated patchbays and cables. A host of audio jack panels and jacks, and pre-wired audio patch panels, numbered among the company's existing products on display.

Acoustical Solutions showcased its new AlphaSorb acoustical wall panels

continued on next page ▶

Radio World **Cool Stuff Award** NAB 1995

Designed to facilitate high-fidelity audio broadcasts over new switched digital networks, the **Intraplex** Series 4400 digital audio codec/transceivers comprises four models. The Series 4400 units are about the size of a book, yet include a simultaneously operating ISO/MPEG Layer II encoder and decoder, G.722 encoder and decoder, an ISDN terminal adapter, with S/T and U interfaces for universal compatibility.

Christine Doyle, Roger Shaw and Bob Band are pictured here with the award-winning product. For more information, circle **Reader Service 182**.

Source Gear At NAB

▶ continued from page 75

The Harris Allied booth also featured **Register Data Systems (RDS)** Phantom, a digital audio system that allows virtually unlimited control of multiple satellite or network input sources. The system can replace carousels and cart machines in live operation as well as tape-based or CD-based automation, and has a recording storage capability from 90 minutes to more than 10 hours. **Enco**'s DAD 486x digital audio delivery system was also at the Harris Allied display. This hard disk storage system uses off-the-shelf hardware and provides unlimited expansion capabilities.

Alesis Corp. brought its ADAT 8 track modular digital multitrack audio recorder.

At the **Synclavier** booth, the EditView 4.0 and S/Link 2.0 debuted alongside the well-established PostPro random-access hard disk-based multitrack recorder/editor.

International Tapetronics Corp. (better known as **ITC**) unveiled some important additions to its DigiCenter Digital Audio Management System. These include expanded networking management, with an Audio Data Base Management Tool Box and full bidirectional .WAV file support, the ability to carry out multitasking operations in workstations, multivolume HDD backup, new recording templates to set up a customized audio file structure and expanded integrated mixer operations, including Virtual Console, programmable inputs and event-driven input switching.

Prophet Systems Inc.'s Wizard for Windows boasts several new features to help automated stations sound live, including time and temperature announce modules that automatically announce the time of day and/or temperature when called for by liner pulse or an easily inserted log command. Also new is a Backtime feature that times out music to the top of the hour.

The Management displayed new versions of its AXS digital audio automation system, the DCM Digital Cart Machine, the DCE Digital Clip Editor and the DLR Digital Longform Recorder. The AXS system sports new extended features for time announce, linked announcer intros, a remote access telco/RPU interface for attachment to standard audio interfaces and Powerfull, designed to produce a real-time audio segment fill for CD and hard disk music systems. The DLR Digital Longform Recorder can record up to four events simultaneously for later editing or replay.

Among digital editors capable of playing direct-to-air is the VoxPro editor from **Audion Labs**, designed to replace reel-to-reel machines in control rooms and newsrooms.

Radio Computing Services Inc. (RCS) was on hand with the new ProSonix, a full-featured, digital multitrack audio editor, and NewsLink, which the company describes as a "computerized newsroom," with the option for digital audio. RCS also brought its Master Control all-digital, paperless, cartless radio studio.

Fidelipac Corp. displayed its Dynamax DCR 1000 Series machines with magneto-optical drive systems. Also at the booth was the CTR 10 Series cartridge machine.

Broadcast Electronics' booth was stocked with its established source systems, including the AudioVAULT digital audio storage system, the CORE digital automation system, the Disc Trak digital cart machine and the Dura Trak 90A cart machine.

Audi-Cord Corp. displayed its NAB cartridge machines.

On the recording media front, **Maxell Corp. of America** offered its tape products, including audio cassettes, R-DAT and reel-to-reel products, and **HHB Communications Ltd.,** debuted **Advanced Media Products** blank CD-R discs. HBB also showed the PortaDAT professional portable DAT recorders, accessories and tape.

▶ continued from previous page

and hanging baffles, and the company's current model Alpha Pyramid, Alpha Wedge and Sonex acoustical foam absorbers.

Preco showed its Model 220 Weircliffe metal tape eraser, offering a Hi8 or DAT throughput of 270 tapes per hour. **Neutrik USA**'s NAB '95 products included the new A/B Series XLR connector; the Neutrik connector, featuring

Mager Systems' custom design furniture for KOOL-FM Phoenix

up to 12 poles in a miniature configuration; and the new Easy Patch patch panel, offered in 96 Bantam and 48 "B" gauge styles. The company's established line of

DYNAIR Electronics displayed its new System 200 routing systems.

XLR audio connectors, patch cords, jacks, plugs, speaker connectors, and a full line of XLR accessories were also on display.

Meters

Stations looking for a high-resolution audio meter could stop by the **Logitek** booth, where the new Ultra-VU model was displayed. The company's new Mini RateGate digital audio sample rate converter was exhibited, as was the line of current model Bright-VU LED bargraph audio meters, and the Pre-10 10x2 routing switcher.

Leitch showed its new 32x16 and 32x32 audio routers, and its current line of audio routing switchers. **Kay Industries** displayed its Phasemaster Rotary Phase Converter. And the new STC 64 Noise Lock Acoustic Door was available from **Industrial Acoustics**, as was the company's current window and wall system that isolates noise.

A variety of new and established products were on display at NAB '95 by **ESE**. On the new side, the ES-996 Six Digit two-inch red slave clock, and the ES-126/ES-127 half-inch and one-inch time and date displays were shown. Also new: the ES-181 modem-based master clock/time code generator, and the ES-185 GPS master clock/time code generator. Established products from ESE included a variety of digital clocks and timers, audio level indicators and impedance matching interfaces, and SMPTE time code generators.

DYNAIR Electronics displayed its new System 2000 routing systems, available in digital to 400 Mbps, new configuration sizes, and stereo audio. Among the company's established products at the show was the Genesis modular line of digital interfacing and conversion units.

A selection of audio level meters, with peak and average for analog and digital, was shown by **Dorrough Electronics**. And **Spectral** displayed new products, including the MediaFiler digital audio file converter and the Translator, an eight-channel digital audio signal format converter for Alesis, Yamaha and Tascam equipment.

Wohler Technologies showed its new AES/EBU digital level meters for powered monitor speakers and as many as 10 standalone units in a one rack space, and its AES/EBU routing switcher, from 8x1 to 16x4.

Radio World **Cool Stuff Award** NAB 1995

Tascam's DA-P1 is a portable DAT recorder offering the full-featured power of a studio model. Featuring a two-head design and two direct drive monitors, the DA-P1 maintains sound quality and recording capability away from the studio using XLR-type mic/line inputs, complete with phantom power. The inputs accept a broad range of signal levels from -60 dBm to +4 dBm. The system also offers unbalanced RCA connectors for both input and output, and SPDF digital I/O for direct digital transfers.

Holding the DA-P1 is Fred Allard. For more information, circle **Reader Service 195**.

Honorable Mentions

Radio World
Cool Stuff Award
NAB 1995

The Polaris from **MPR Teltech** is a portable MPEG Layer II/G.722 reporter's terminal. The unit is designed to enable broadcasters to deliver real-time, studio-quality audio from the field. Recorded audio can be sampled at up to 48 kHz stereo, compressed at bit rates up to 384 kbps, edited and saved on a storage device on a laptop computer. Polaris features real-time direct-to-disk transfer and storage, a built-in ISDN terminal adapter, microphone inputs, a headphone output with volume control and an internal speaker. Mary Ann Seidler and Dave Ashworth appear here with the Polaris. For more information, circle **Reader Service 190**.

★ ★ ★

The DN80R portable MiniDisc (MD) recorder from **Denon Electronics** is constructed for the rigors of location recording, but contains many of the features found in better DAT and reel-to-reel portable recorders. It uses a RAM buffer with a capacity for 40 seconds of stereo audio. The optical pickup incorporates a proprietary vibration-absorbing suspension. Denon offered customers who purchased DN990R MD cart recorders and/or DN980F MD cart players before Jan. 1 a free upgrade to cut track access time in half.

Mike Stelts poses with the new DN80R. For more information, circle **Reader Service 166**.

★ ★ ★

The **Nagra** ARES-C, also called Flash, is a portable solid state RAM recorder weighing less than six-and-a-half pounds. Aimed at radio news reporters, the recorder uses G.722 digital compression, which offers a frequency resonde of 30 Hz to 7 kHz (-3 dB). However, the on-board compressor electronics are designed to accept up to 20 kHz. The recorder therefore can be upgraded later to ISO/MPEG Layer II or better compression to allow greater bandwidth. The Flash recorder, pictured here with Dan Grimes (l) and Tom Knox, uses PCMCIA cards for storage, records in mono or stereo, and includes outputs for ISDN, standard phone lines and AES/EBU equipment. For more information, circle **Reader Service 152**.

The new **Nautel** NE-50 digital exciter, shown here with David Grace, uses DDS (direct digital synthesis) and a 32-bit resolution NCO to create the digital FM signal. The NE-50 delivers up to 55 W of RF output. Both analog and digital (AES/EBU) inputs are available. The ultimate performance is limited by the A/D converter, yet offers a signal-to-noise ratio at better than -90 db and distortion less than .004 percent, exceeding analog exciter capabilities. The NE-50 does not yet include a digital stereo generator. For more information, circle **Reader Service 91**.

★ ★ ★

CCA's new LX-1 Digiciter is an FM digitally-controlled exciter in power outputs of 60, 120 or 250 W. The model LX-2, which will be fully digital, is soon to follow.

Shown here with the Digiciter are Paula Tebbe, Darrin Tebbe, Howard Ginsberg and Steve McElroy. For more information, circle **Reader Service 180**.

RW Cool Stuff Awards are selected annually by an independent panel of engineering experts. Criteria used in judging includes technical, cost and design issues.

USER REPORT

Harris DX Pair Proves Trouble-Free

by Will Koeller
Maintenance Engineer
WTMJ-AM

MILWAUKEE Recently, WTMJ-AM moved to a new transmitter site south of Milwaukee. We installed a 50 kW Harris DX-50 AM stereo transmitter at this new site, as well as a DX-10, which we used at our old site for four years, to be used as a backup transmitter. The DX-10 has been very reliable. We have been hit by lightning several times. Three coils in the tower base coupling house collapsed and jumpers were blown off, but there was no transmitter damage.

Installation

The installation of the DX-50 at the new site was a breeze—after we figured out how to put 3,500 pounds of transmitter in its place. We happened to have a Skytrack forklift on the site when the transmitter arrived. If it had not been for the tower crew of Warmus and Associates, with Jerry Smith as foreman, the transmitter might still be on the truck.

The transmitter turn-on was flawless. There was an intermittent arc in one of the coils to ground in our new phasor cabinet. The DX-50 transmitter killed the RF for 0.1 second to extinguish the arc. We have only been on the air a few weeks with the DX-50. I am confident that this transmitter will be as trouble-free as the DX-10 has been.

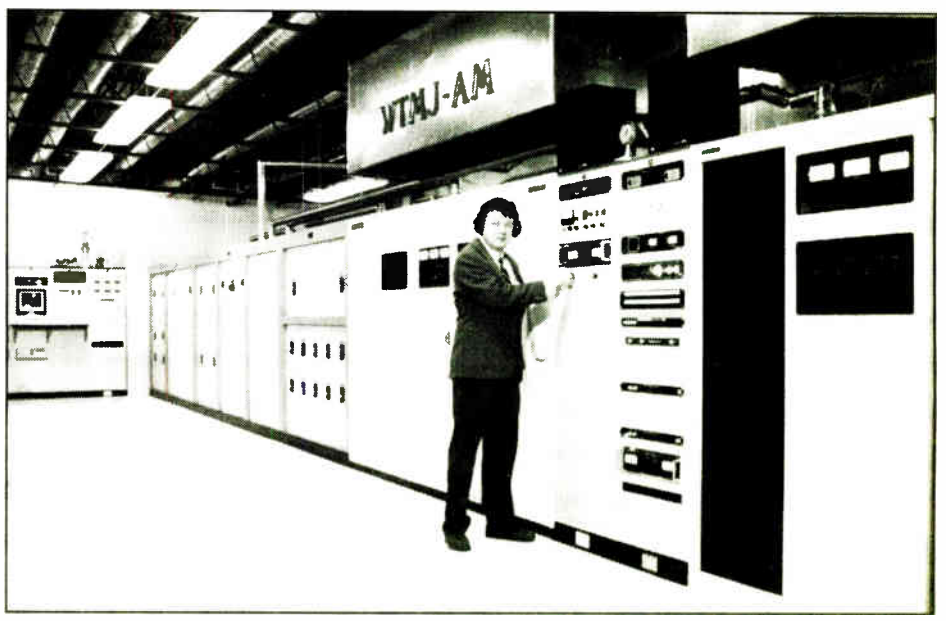
Four years, one loss

In the four years I have had the DX-10, I have lost only one RF amplifier module. Not until I saw the indicator light did I realize that the module fuse was blown. Nobody complained about the added distortion. It turned out that an input coil of the module touching a grounded frame caused the problem.

Of course, the modules are not replaceable while the transmitter is on the air. But with the handy patch plugs on the modulation encoder board you can jump around a bad RF amplifier module, using one of the 48 RF amplifier modules that would only be used if one were to modulate at 140 percent. I used a patch to bypass the bad amplifier until there was a more convenient time to swap the board with the spare.

Having lost only one board in four

continued on page 80 ▶



Will Koeller considers the inner workings of the DX transmitters ingenious.

USER REPORT

BE AM-10 Eliminates Downtime for KACY

by Tony Evans
Chief Engineer
KACY(AM)

LAFAYETTE, La. When I was first asked to write this article, I thought back to the days when we were a station with two transmitters, six towers and a directional array that would kill. In fact, I had been a contract engineer in the Lafayette market for a number of years and had always let someone else take care of KACY(AM) because of its setup. But the right price can persuade a person.

Antiquated equipment

One of the first things I did when I went to work at the station was check out the AM site. (Our company also has a sister FM station, KSMB.) Much to my dismay, the station was using a transmitter that was more than 25 years old and another old 1 kW transmitter for nighttime power. These units used enough tubes to light the neighborhood close by. And when the remote control switched from one transmitter to another... Let's just say that it worked, but I would rather not have been in the room when the remote control accomplished the feat.

After three years of countless downtime and replacing expensive tubes, management decided to replace the transmitters with a new **Broadcast Electronics** AM-10. They also replaced the old remote control with a dial-up BE VMCC-16. We decided on the AM-10 because it was solid state and would save us on our electric bill. Talking with other stations and engineers in the market, we knew that BE made a quality product that it would stand behind. The only thing that bothered me was that the transmitter was new, and I did not want to be a guinea pig.

Staying on-air

Located at 1520 on the AM dial, KACY is 10 kW nondirectional daytime, 10 kW directional at critical hours and 500 W directional at night. All readings, patterns and power changes are now accomplished by telephone. The transmitter uses 6030 bn high-voltage MOSFETs in the amplifier stage. The AM-10 has 16 modules, with four MOSFETs in each, that are quickly removable and very easy to work on. The transmitter stays on the air, although at a lower power output, while you repair the defective module. Each module and power supply has fault LEDs that help locate and repair a problem with incredible efficiency.

So far, the only problem we have had is an occasional blown fuse in one of the PA modules. Not only do we now stay on the air, but we can modulate the transmitter up to +125 percent without any noticeable distortion. With the old transmitters, you could not even get to 100 percent. Now you can hear the station at night, meaning that the general manager and the program director are my friends, not my enemies.

Real savings

When you combine the savings in tubes, repairs and electricity, we have saved an average of $7,000 per year using the new transmitter. But the elimination of downtime is the real money-saver. Chuck Wood, the vice president/general manager, says that marketing an AM station is difficult at best, but marketing an AM station that will not stay on the air is impossible.

In the past year and a half, KACY has experienced zero downtime, and generated a great amount of confidence and pride among our staff. A once-failing AM station is now a successful sports talk station recognized as a competitor in an overcrowded market.

To me, even as an engineer, that is the bottom line.

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For information, contact Bill Harland in Illinois at 217-224-9600; fax: 217-224-9607; or circle ***Reader Service 41****.*

USER REPORT

Nautel ND25: No Backup Required

by Chuck McLeod
Chief Engineer
Sunbelt Broadcasting Co.

HOUSTON Three years ago, Sunbelt Broadcasting took delivery of a new 25 kW **Nautel** transmitter for talk station KSEV(AM), which had just upgraded power from 2.5 kW to a DA-2 at 15.8 kW. Incredibly, the transmitter looks the same as it did the day we took it out of the box and installed it at KSEV's Tomball, Texas, transmitter site.

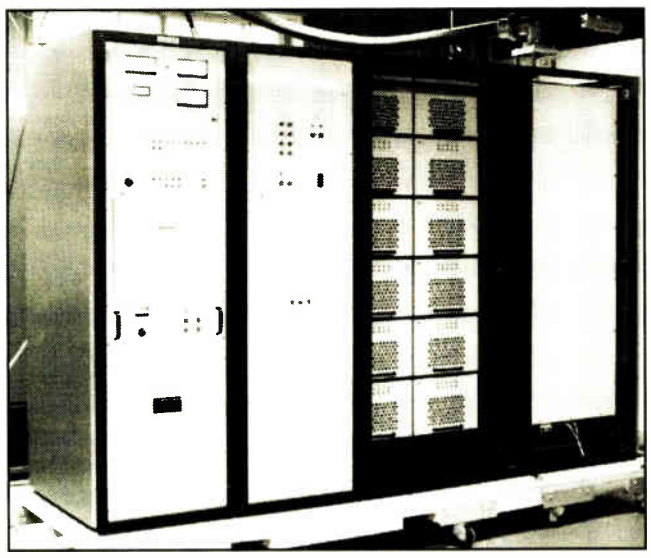
In fact, our AMPFET ND25 has all its original parts from the factory, except for a resistor, and an LED that was jarred during transportation. That is quite a testament to reliability, even for solid state technology.

No loss of carrier

Our previous transmitter, a 2.5 kW installed in 1987, was also a solid state, but I was having to change a defective transistor every six to seven months. Worst of all, its power modules were dependent on each other, unlike the ND25 that has power modules in the same circuit so there's no loss of carrier during a typical power or power module failure.

When a power module goes down on our 2.5 kW, we must shut the transmitter down in order to replace the transistor. I thought this was the best that could be expected in transmitter reliability, until I installed our Nautel ND25.

The biggest problem we had during installation of the ND25 was getting it through the door. (I suspect this is how we damaged a front-panel LED, which Nautel replaced.) That aside, the rest of the installation went smoothly. It took me less than seven hours to get it fired up on the dummy load and no time at all to set up transmitter monitoring.



KSEV(AM) is impressed by the reliability and simplicity of the ND25.

All the metering and control voltages in the ND25 are at logic levels, either 12 or 24 V, so it was easy to set up remote control of the transmitter's ON/OFF, reflected and forward powers, fault lights, SWR shunt and all panel LEDs to our studio in Houston.

Because the ND25 has a high overall power efficiency, I didn't have to put in a large air-handling system for our power upgrade (we are using a five-ton air conditioner). Such a system not only would have been costly to install, but also would have added to our utility bill every month.

As for maintenance, I go by the manual and clean the transmitter once a month and switch between exciters every couple of months. The ND25 has redundant exciters, one of which is AM stereo C-QUAM, a nice feature even for talk stations.

Nautel designed its transmitters' output filters to cover a broad bandwidth without external tuning that eliminates having to tune the load controls and makes them quite reliable even when the antenna system changes impedance, as our four-tower directional sometimes does.

I'm still impressed by Nautel's simplicity of design. Nautel incorporates a combining technique that reduces the circuitry and number of components. The ND25 has 1 kW amplifier modules that ventilate heat independent of each other through DC-powered fans, and they are configured in parallel, enabling us to service the transmitter while it's on the air. If one power module fails, the remaining modules continue to operate unaffected, meaning our chances of staying on the air are greater with this transmitter than with any other. Plus, I didn't have to invest in another transmitter for backup.

I also like that the ND25 has a high tolerance to carrier and sideband SWR, making it ideal for lightning-prone areas like ours. Should a transient occur, the transmitter adjusts its output accordingly and continues monitoring reflected power incidents in order to automatically return to full power. Also, the transmitter has transient suppressors and shutback circuits for lightning protection.

When I visited Nautel's Bangor, Maine, plant to look over our new ND25, Nautel technicians showed me how easy it is to change out a power module without taking the transmitter off the air. It really is as simple as taking out one and putting in another. And it's a low-voltage transmitter. When removing a power module for replacement, the maximum voltage of the DC supply is only 72 V, so no more nervous trips to the transmitter site.

I haven't had to change a defective module in the three years since we installed the transmitter...

Lightning hit

I haven't had to change a defective module in the three years since we installed the transmitter, simply because one hasn't failed. In fact, during a particularly fierce storm, one of the utility buildings for our four-tower directional took a lightning hit that charred the building and would have knocked any other transmitter off the air. We remained on the air with 5 kW shunted power. Later, Nautel recommended a resistor modification that changed the SWR sensitivity circuit to match our 15.8 kW power output and to shut down the transmitter for such extreme situations.

We expected the superb sound quality of the ND25 (IQM -42 dB, THD less than 1 percent at 95 percent modulation, and IMD less than -53 dB below a 60 Hz tone), but the modulation headroom was a pleasant surprise. The ND25 puts out 150 percent positive peak modulation with ease. This modulation capability, plus the quality and reliability of the transmitter, makes a world of difference in my job.

□ □ □

For information, contact Gary Manteuffel in Nova Scotia at 207-947-8200; fax: 207-947-3693; or circle ***Reader Service 210.***

Dependable Harris Duo

▶ continued from page 79

years, the ability to swap boards while the transmitter is on the air has not made it to my wish list.

Efficiency

Besides being highly reliable, the DX transmitters are also power efficient. Using Class D amplifiers on the RF modules, the transmitters run at 86 percent efficiency. At our old site, it cost more to light the towers at night than to run the transmitter.

The RF kill circuit is very fast in the DX transmitters. U66 on the LED board monitors some drive levels, voltages and the carrier kill commands during pattern switching times. If for any reason a drive point is set at the ragged edge, you can have carrier cutoff spikes in the audio that look like amplifier-switching glitches. It is easy enough to check. Using a scope, check the output of U66. If you have an RF kill command present, just determine which input command is causing it.

Digital conversion

The audio moves through an A/D converter, making a digital word out of the level of audio plus power at a given time. This information is transferred to RAMs and gates, which turn on or off the correct number of RF amplifiers at any given instant.

In the DX-50, each RF amplifier is about 1 kW. The sample rate is at our carrier frequency. In between each 1 kW big-step RF amplifier, Harris uses the same module in a binary amplifier section.

The difference lies in the voltage applied to each amplifier. There are eight binary amplifiers: one each at 1/2, 1/4, 1/8, 1/16, 1/32 and 1/64 big-step power levels; this fills the gap between any two big-step power levels. In between each big-step power change during modulation or power level change, these binary-stepped amplifiers do their thing.

Ingenious, and it all works exceptionally.

In the dummy load I have run square waves in at 140 percent positive modulation with excellent results. The point is that no matter what power or modulation level you use, you are not stressing any one RF amplifier. You just turn on more of them.

The tech support and Harris school are also excellent. I recommend the school, even if you do not own a Harris transmitter, and I thoroughly recommend the DX transmitters.

□ □ □

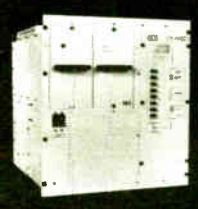
For information, contact John Delay in Illinois at 217-222-8200, ext. 3103; fax: 217-224-1439; or circle ***Reader Service 136.***

BROADCAST ELECTRONICS

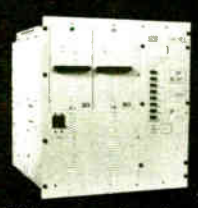
FX50-Industry Standard 50 watt transmitter/exciter

FM100C-100 watt transmitter/exciter

FM250C-250 watt transmitter/exciter



FM500CI-500 watt transmitter, featuring the FX50 exciter



FMICI-1kw transmitter, featuring the FX5C exciter

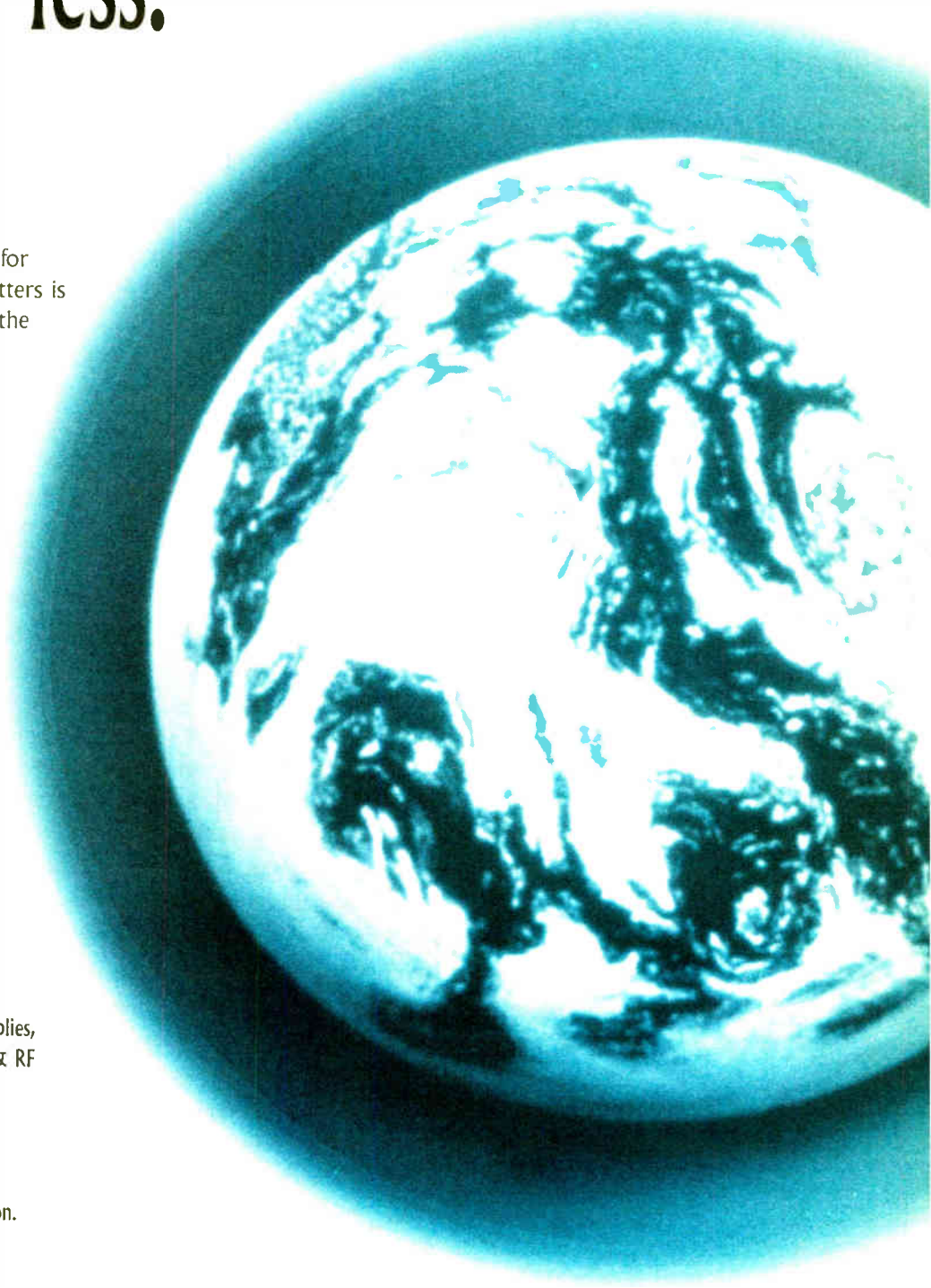
FM2C-2kw transmitten, featuring the FM100C exciter

FM3C-3kw transmitter, featuring the FM100C exciter

FM5C-5kw transmitter, featuring the FM250C exciter

The world's most reliable line of Solid State FM transmitters now costs less.

From 50 watts to 5kW, Broadcast Electronics delivers value.



Broadcast Electronics' reputation for building quality solid state transmitters is known world-wide. And now with the addition of three new models. Broadcast Electronics' line of solid state FM transmitters is complete. But that's not all. We've permanently lowered the prices on several of our exciters and transmitters...as much as 15%.

Every Broadcast Electronics solid state FM transmitter combines superior audio performance, built-in redundancy, and low operating costs for years of trouble-free operation. Now, more than ever, you can afford to be a leader in your market... from 50 watts to 5000 watts, Broadcast Electronics delivers the world, at down to earth pricing.

BE SOLID STATE FM TRANSMITTERS FEATURE;

- Redundant RF modules and power supplies,
- Front panel removable power supplies & RF modules,
- Auto restart after AC power failure,
- Complete broadband RF amplifier,
- Remote control interface,
- And compact design for easy installation.

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Circle (122) On Reader Service Card

USER REPORT

Power Increase Starts with AMSTUDY

by Timothy Sawyer
President
T.Z. Sawyer
Technical Consultants

CHEVY CHASE, Md. When the financial health of the broadcast business improves, stations begin to explore options for improving or correcting signal coverage deficiencies in their service areas. The increase in inquiries my firm has received concerning power upgrades and the record attendance figure at the recent NAB Convention confirm the general improvement in the financial health of the radio broadcast industry.

It pays for you to be aware of the technical changes to AM broadcast allocations as they pertain to your station's operation. Stations change sites, change their antenna pattern or simply cease operations and turn in their licenses. These changes may be beneficial to your operation and allow an increase in power that previously was not possible.

Raised the limits

Other potentially beneficial changes include modifications made to FCC rules. The FCC has raised the power limit on Regional Class III stations from 5 kW to 50 kW. Perhaps more significant than the raising of the maximum power limit is the FCC's acceptance of various operating power levels—what I like to call "dial-a-power."

Essentially, stations are no longer being held to the usual operating power increments of the past. You can now file an application for a power level of any value if it meets the minimum power level for the class of station proposed. Protection and interference requirements must be observed as well. Another requirement is that the proposed increase in operating power be at least 20 percent. A station operating at 5 kW would be required to file an application for an operating power of at least 6 kW.

The 20 percent minimum power increase rule provides a 10 percent increase in the radiated field, and an increase in signal strength available at the radio receiver. Think of this as a possible way to reduce background or other man-made noise. Keep in mind that to double an AM station's coverage area the power must be increased by the square of the present power (5 kW to 25 kW).

As a starting point in the quest for a power increase, **Dataworld** offers a computerized AM frequency study program called AMSTUDY. AMSTUDY allows a station to quickly determine the nature of the protection requirements to other stations on the channel and on the three adjacent channels above and below the operating frequency, as required by the FCC.

It pays for you to be aware of the technical changes to AM broadcast allocations as they pertain to your station's operation.

Only two bits needed

Only two items of information are needed to run AMSTUDY on an existing facility—the frequency to be studied and the station's call letters. If using AMSTUDY on a proposed new operation, you need to determine that station's geographic coordinates.

Dataworld's AMSTUDY program retrieves and uses a digitized version of the FCC's M-3 map of soil conductivity values to compute the protected and interfering contours. The program also allows for the inputting of actual measured conductivity data.

The program uses these values and the operating characteristics of the station to compute the maximum allowed radiation values in five-degree increments of azimuth. It is from this table that the allocation engineer can begin his or her work.

For example, Station WAAA operates on 920 kHz with a power of 5 kW using a nondirectional antenna system that produces a 682 mV/m per kilometer radiated field.

Using the table (Figure 1) as a starting point in our analysis, we can see that Station WAAA can increase power in a span beginning at 105 degrees and ending at 255 degrees. This permissible table is constructed from the FCC's M-3 soil conductivity values. The use of measured soil conductivity values towards stations WCCC and WDDD may allow for further increases in radiated fields toward those stations. If its desired service area lies toward the south, this particular station is a good candidate for a power increase using a directional antenna system.

Measured soil conductivity values are available in the FCC's Public Reference room in Washington, and are found in all directional AM station license applications in which the FCC required a full proof of performance of the antenna system. Additionally, many nondirectional stations have taken field measurements over the years to determine the measured soil conductivity for their area or to prove the radiation efficiency of their antenna.

Soil conductivity data

Soil conductivity values can vary over the path between stations and over a span of degrees in azimuth and can differ from those predicted on the FCC's M-3 map. Typically, four or five stations' engineering files must be reviewed to ensure that you have used the most current data concerning soil conductivity values.

The FCC rules require that measured soil conductivity values be used if that data exists in the FCC files. The FCC's staff engineers will do their own search for measured values in their analysis and review of your application, so it is very important that your application contain those values if they exist.

AMSTUDY can provide you with the answers you need to determine if a power increase is possible for your station at a reasonable cost. Once you have the data produced by the program, you can then make a more informed choice concerning possible changes to your antenna system or its operating power.

□□□

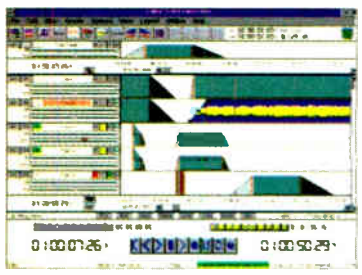
For more information, contact John Neff in Maryland at 800-368-5754; fax: 301-656-5341; or circle ***Reader Service 14.***

Figure 1.

Daytime Permissible Horizontal Radiation

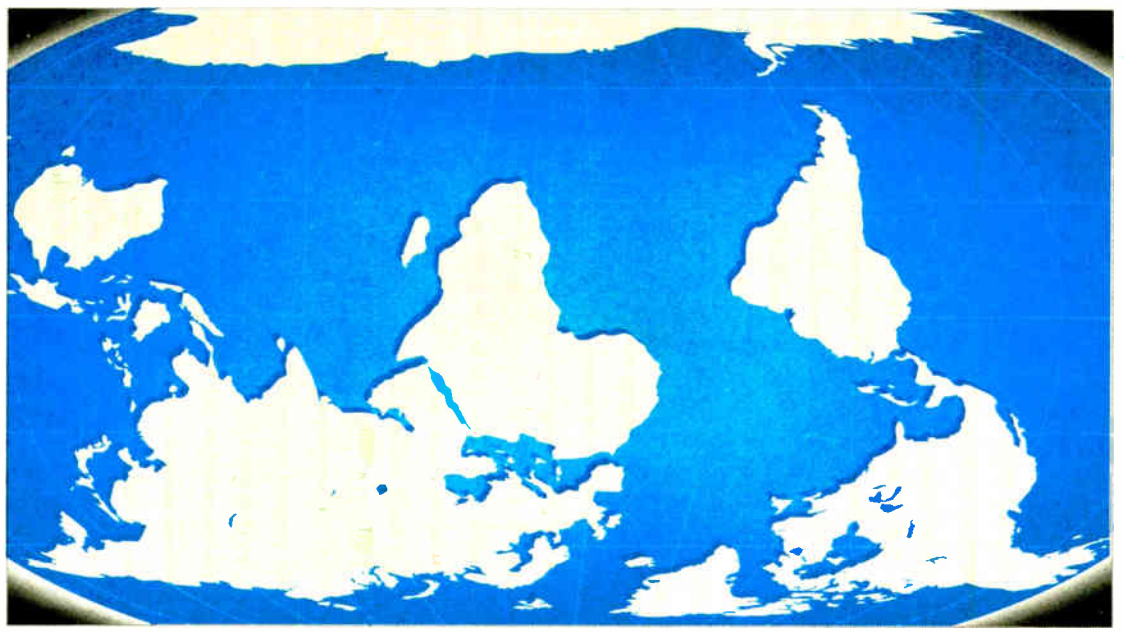
Title: WAAA (not a real station)
Frequency: 920 kHz
Latitude: 34-02-10
Longitude: 82-18-32
Database: DW 04/12/95

Permis. Az. (deg)	Prop. Rad. @1 km	-Limiting Station- Cont. mV/m	Cont. mV/m	Call/ City	Auth.	Permis. Az. (deg)	Prop. Rad. @1 km	-Limiting Station- Cont. mV/m	Cont. mV/m	Call/ City	Auth.
0	690.6	.500	.250	WCCC	Lic	180	1148.6	.500	.250	WYYY	Lic
5	698.7	.500	.250	WCCC	Lic	185	1147.8	.500	.250	WYYY	Lic
10	700.6	.500	.250	WCCC	Lic	190	1151.4	.500	.250	WYYY	Lic
15	754.5	.500	.250	WCCC	Lic	195	1162.3	.500	.250	WYYY	Lic
20	708.1	.500	.250	WCCC	Lic	200	1168.3	.500	.250	WYYY	Lic
25	733.3	.500	.250	WCCC	Lic	205	1169.8	.500	.250	WYYY	Lic
30	777.7	.500	.250	WCCC	Lic	210	1174.9	.500	.250	WYYY	Lic
35	723.4	.500	.250	WCCC	Lic	215	1184.0	.500	.250	WYYY	Lic
40	720.0	.500	.250	WCCC	Lic	220	1198.1	.500	.250	WYYY	Lic
45	720.7	.500	.250	WCCC	Lic	225	1218.9	.500	.250	WYYY	Lic
50	721.8	.500	.250	WCCC	Lic	230	1251.2	.500	.250	WYYY	Lic
55	748.5	.500	.250	WCCC	Lic	235	1189.9	.500	.250	WYYY	Lic
60	709.5	.500	.250	WCCC	Lic	240	1150.2	.500	.250	WYYY	Lic
65	700.2	.500	.250	WCCC	Lic	245	1126.8	.500	.250	WYYY	Lic
70	714.3	.500	.250	WCCC	Lic	250	1102.7	.500	.250	WYYY	Lic
75	690.8	.500	.250	WCCC	Lic	255	1184.3	.500	.250	WYYY	Lic
80	691.4	.500	.250	WCCC	Lic	260	693.3	.250	.500	WZZZ	CP
85	718.5	.500	.250	WCCC	Lic	265	696.4	.250	.500	WZZZ	CP
90	843.0	.500	.250	WXXX	Lic	270	699.9	.250	.500	WZZZ	CP
95	893.8	.500	.250	WXXX	Lic	275	699.8	.250	.500	WZZZ	CP
100	964.3	.500	.250	WXXX	Lic	280	689.6	.250	.500	WZZZ	CP
105	1144.6	.500	.250	WXXX	Lic	285	690.9	.250	.500	WZZZ	CP
110	1131.3	.500	.250	WXXX	Lic	290	688.4	.250	.500	WZZZ	CP
115	1122.6	.500	.250	WXXX	Lic	295	694.3	.250	.500	WZZZ	CP
120	1117.3	.500	.250	WXXX	Lic	300	750.0	.500	.250	WDDD	Lic
125	1114.6	.500	.250	WXXX	Lic	305	746.9	.500	.250	WDDD	Lic
130	1112.5	.500	.250	WXXX	Lic	310	744.8	.500	.250	WDDD	Lic
135	1112.7	.500	.250	WXXX	Lic	315	743.5	.500	.250	WDDD	Lic
140	1115.1	.500	.250	WXXX	Lic	320	742.9	.500	.250	WDDD	Lic
145	1120.6	.500	.250	WXXX	Lic	325	742.9	.500	.250	WDDD	Lic
150	1129.4	.500	.250	WXXX	Lic	330	743.7	.500	.250	WDDD	Lic
155	1142.2	.500	.250	WYYY	Lic	335	695.1	.500	.250	WDDD	Lic
160	1160.2	.500	.250	WYYY	Lic	340	697.5	.500	.250	WDDD	Lic
165	1185.6	.500	.250	WYYY	Lic	345	685.9	.500	.250	WDDD	Lic
170	1166.2	.500	.250	WYYY	Lic	350	685.8	.500	.250	WDDD	Lic
175	1154.2	.500	.250	WYYY	Lic	355	682.7	.500	.250	WCCC	Lic



STUDIOFRAME PRODUCTION IS FAST, EASY.

In the production studio, time equals money. For the fastest, easiest multi-track production for commercials and station promos, Computer Concepts introduces the StudioFrame™ the complete audio workstation, "studio in a box." Every production feature from true 8 track input and output (expandable to 24 tracks) to time compression, digital EQ and filters is built into StudioFrame. Best of all, with its direct integration with DCS, produced spots can be on the air seconds after completion.



COMPUTER CONCEPTS IS TURNING THE WORLD OF RADIO UPSIDE DOWN

LAS VEGAS- Visitors to the 1995 NAB convention were amazed to see no fewer than six new products for radio from Computer Concepts, makers of DCS™, the world's leading hard disk system. For the first time, one company offers proven products for stations of every size — from 100% live major market powerhouses to fully automated local stations — all working together through the DCS architecture. Some of these new products, while new to the US, have been in use for years in international markets... another advantage of Computer Concepts' world-wide scope. With so many products to choose from, Computer Concepts can now custom-tailor a profit-making system for every radio operation.

COMPUTER CONCEPTS - THE POWER BEHIND THE RADIO REVOLUTION.

What makes Computer Concepts stand out of the pack of companies now offering hard disk products for radio? We're customer-driven, and we have been since we started over 20 years ago. We maintain direct contact with our customers before, during and after the sale. We're so proud of our customer relationships that unlike most other vendors, we'll be happy to supply our entire customer list to any prospective purchaser.

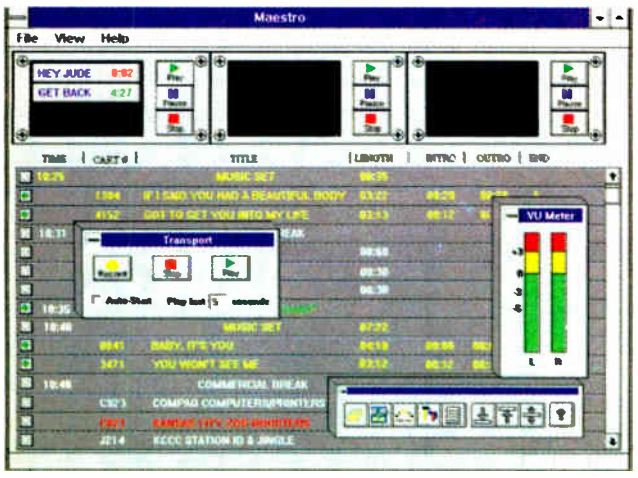
DCS from Computer Concepts has long been the leader in automating commercials and spot insertion for stations of all sizes. But the big news this year is an unprecedented array of new products for every facet of on-air operations, and every kind of radio facility. All are field-proven and backed with the kind of customer service that has been instrumental in the success of Computer Concepts.

As your needs change, so can your DCS-based system. For example, DCS systems can be configured to store music, commercials, jingles and other audio cuts either centrally on an audio server or distributed on individual DCS workstations. A new option, Audio Central+ distributed audio, offers both capabilities plus complete fail-safe redundancy.

Another new DCS option developed in response to customer requests allows the system to start playing back material while it is still being recorded. Perfect for delaying network news-on-the-hour for a few seconds or minutes while giving local headlines first.

All the new and exciting Computer Concepts products integrate seamlessly to DCS. It's your assurance that — whichever components you choose to make up your DCS system today — your system can be expanded tomorrow.

Large stations or small, simple system or very complex, today more than ever, there's one place to call for total expertise and total customer responsiveness in hard disk systems. Call Computer Concepts at 1-800-255-6350 and profit from our experience.



MAESTRO BRINGS MUSIC AND SPOTS TOGETHER.

DCS has always managed commercials and spots flawlessly. Maestro™ now does the same for music, integrating all music and commercial information and control with a Windows™-based on-screen interface. Maestro is the key to accessing music directly from hard disk. It interfaces directly with music scheduling database systems and gives on-air talent total flexibility to execute perfect song-over-jingle-over-song crossfades. Music search by type, artist, etc., intro and outro countdown display and instant access to news and weather info are just a few of the many features which make Maestro the perfect DCS interface for creative on-air control.

Newsroom keeps you up-to-the-minute.

Radio news can be a profit center with Newsroom™, the complete electronic news operation from Computer Concepts. The key word with Newsroom is *efficiency*. The system automatically takes both text and actualities from wire services, networks and other sources. A news person writes and edits copy on screen, linking sound bites to the copy — playing the wrong "cart" is a thing of the past. Editing of audio actualities is fast and precise. On-screen prompting lets talents read final copy right off the screen. Newsroom is fully integrated with DCS and Maestro and can be added to an installed system at anytime.

CARTRACK TAKES THE HASSLES OUT OF LIVE RADIO.

CartRack™ is a field-proven "front-end" to DCS which puts right on the screen all the carts your morning (or other) talent could ever want, for instant, no-hassle access. Individual "racks" of carts can be programmed for each show — there's no limit. Talent uses a touchscreen, trackball or mouse to "point and play" carts to three on-screen graphic "cart machines." Events played from DCS can be controlled by CartRack. It's the easiest way to handle live shows offered by any hard disk system. Let CartRack bring order into your hectic, live, money-maker drivetime shows, and then let DCS automation take over to handle other dayparts.

Computer Concepts CORPORATION

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Circle (64) On Reader Service Card

USER REPORT

Making Wise Choices with CDS Maps

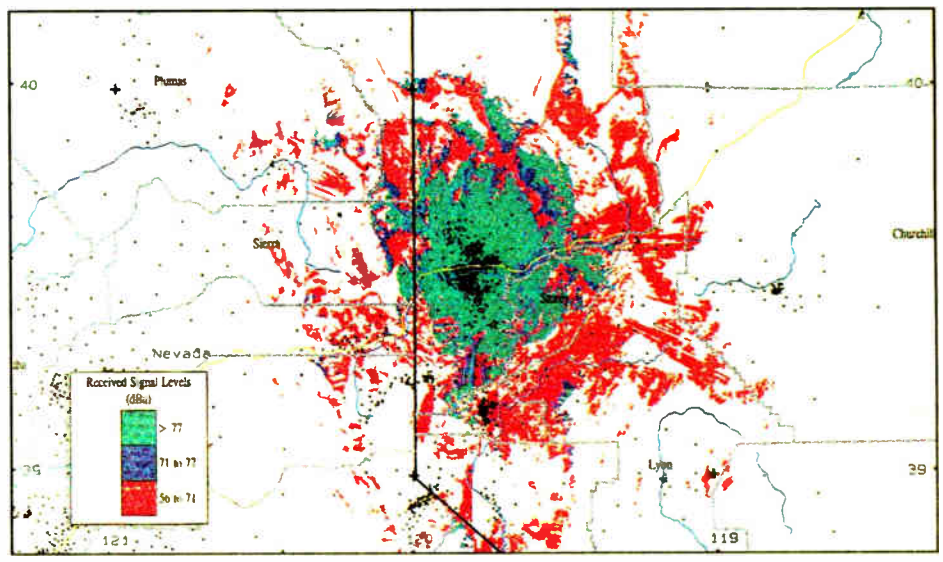
by Gray Frierson Haertig
Principal
Gray Frierson Haertig & Assoc.

PORTLAND, Ore. Haertig & Associates provides a full range of broadcast engineering consulting services, with particular emphasis on the needs and concerns of public radio. Based in Portland, Ore., we have been serving clients for more than 20 years.

In response to our clients' needs for a more cost-effective method of planning signal expansion and extension projects, Haertig & Associates turned to **Communications Data Services** of Falls Church, Va., to develop a new tool to help us assist clients in making informed decisions about facilities' growth.

Today, Haertig & Associates offers a new service that puts people in their proper places and lets clients know where those places are.

Most of our clients—especially those in mountainous areas—understand that the 1 mV/m contour that was submitted as part of their license application does not reflect their actual coverage. This discrepancy occurs because the 1 mV/m contour fails to take into account either the terrain outside the average 3 to 16 kilometer area, or the effects of local terrain shadowing. We decided that the best solution was to provide our clients with a clear visual depiction of actual station coverage, and to relate this depiction to where their listeners actually live.



CDS's overlays depict a station's coverage in relation to where its listeners live.

We asked Communications Data Services to combine its existing FM propagation prediction software with information from the U.S. Census database. The company's propagation prediction software integrates terrain data taken at three arc-second intervals and the U.S.G.S. ground use/cover database with a VHF propagation model developed by CDS principals Richard L. and Richard P. Biby. We asked them to generate a Mylar overlay in which field strength levels are represented by different halftone areas. This overlay can be then placed on any convenient map of the same scale, or on a computer-generated map that CDS can provide.

We then asked CDS to develop a second Mylar overlay representing population density. The company plotted a small black dot at the center of each census block. A cluster of black dots on the overlay marks a densely populated area. In addition, CDS can provide actual population counts with demographic information for any particular field strength level.

These so-called "pop-and-prop" plots are very useful in working with station owners and managers who can instantly see how their station's coverage relates to where their potential listeners live. Unserved or underserved areas can be identified easily. Different scenarios for adding translators or repeaters, or improving existing facilities, can be readily compared.

The first Haertig & Associates client to use the pop-and-prop capability was KZYX(FM), a small, community-licensed public radio station in Philo, Calif. Philo lies on the rugged Coast Range of northern California. The majority of the population lives in river valleys nestled between 1,500-foot mountain ranges. While plenty of high mountaintops are available on which to place transmission facilities, determining which will prove most cost-effective is no easy task. By comparing several pop-and-prop studies, the station was able to narrow the choices, select four final sites for additional facilities and prioritize development. The first of these repeaters should be going on the air as this article is published.

Having the capability to provide pop-and-prop studies not only makes working with clients easier, but it also allows them to stretch their consulting dollars further by being able to consider a number of possible scenarios in a more economical fashion.

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For information, contact Roger Skinner in Virginia at 703-534-0034; fax: 703-534-7884; or circle ***Reader Service 173.***

MARKETPLACE

Recently Introduced Products for the Radio Broadcast Professional

Power Supplies

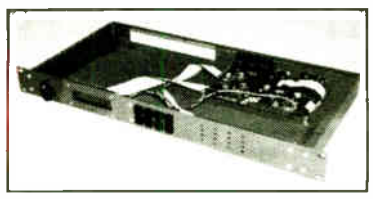
Superior Electric's SL Series STABILINE uninterruptible power supplies are available in 12 models with power ratings between 400 and 2200 VA, and in styles that permit user-selectable configurations of 110, 120 or 127 VAC, 60 Hz operation.

An SL series unit is compact and easy to move, install and operate. It uses a boost/buck tap system for tight output regulation control over chronic low- or high-input voltage conditions. An SL series unit also uses a bidirectional surge diverting/filtering circuitry for protection of electrical noise generated from either the AC input or the protected load. The advanced battery management technology the SL units utilize prolongs battery life, speeds recharge times and provides advance notice of impending battery service.

For information, contact the company in Connecticut at 800-787-3532; fax: 800-821-1369; or circle **Reader Service 189**.

MIDI Instrument Kit

Pavo introduces the MIDItools Custom Instrument Kit, allowing you to build a MIDI controller. The kit includes a painted rackmount enclosure, backlit LCD, all components and complete instructions

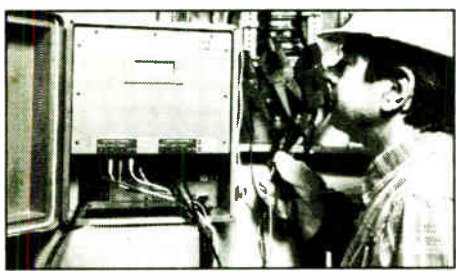


for selecting and connecting a variety of sensors and switches. Assemble the kit, attach up to 64 switches or sensors and connect it to a MIDI sound module. Assembling the kit takes less than five hours. No soldering experience is required.

For information, contact the company in Pennsylvania at 800-546-5461; fax: 215-413-2355; or circle **Reader Service 194**.

Power Evaluation System

BMI's new Power Evaluation System Model 7100 can switch between monitoring power quality, power flow and har-



monics. The basic unit performs three functions, saving installation costs, equipment costs and personnel time.

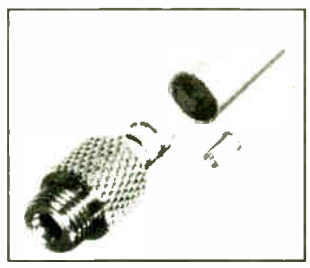
Each 7100 includes four voltage and four current channels, an optional internal modem, 1.5MB storage capacity, enclosure for indoor and outdoor monitoring, and one firmware package for monitoring either power quality, power flow or harmonics. The user can easily add firmware packages so one 7100 provides all three types of data, simply by clicking between modes.

Power Evaluation software for Windows controls an unlimited number of 7100s and accepts automatic data downloads.

For information, contact the company in California at 408-970-3700; fax: 408-970-3720; or circle **Reader Service 163**.

Cable Crimp-on

The RFX-3056 crimp-on from RF Industries enables a technician to connect to a remote antenna, thereby providing greater transceiver gain. The RFX-3056 can be incorporated into a boot, enabling it to be used as the base of an antenna. The unit is manufactured to NEC P300 interface specifications.



The RFX-3056 is comprised of a nickel-plated body, teflon dielectric and a gold pin. It is designed to operate at an impedance of 50 ohms with a voltage rating of up to 500 V at a frequency range from 0 to 3 GHz.

For information, contact the company in California at 800-233-1728; fax: 619-549-6345; or circle **Reader Service 33**.

Subcompact Speaker

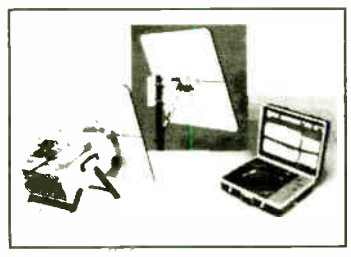
Galaxy Audio, manufacturer of the Hot Spot compact personal monitor, offers the Micro Spot speaker. The Micro Spot is a subcompact controlled-bandwidth speaker featuring Galaxy's proprietary five-inch driver and an 8-ohm impedance. At 6 inches x 6.75 inches x 6 inches, the Micro Spot is designed to reduce space requirements in speech monitoring systems, such as board rooms, courtrooms or other places where high volume levels must be achieved in a small space.

With a power-handling capacity of 100 W RMS and a sensitivity of 92 dB, the Micro Spot is compatible with virtually all power amps. Bandwidth is focused from 200 Hz to 18 kHz with a peak at 3 kHz to enhance speech or vocals.

For information, contact the company in Kansas at 316-263-2852; fax: 316-263-0642; or circle **Reader Service 73**.

Remote Antenna Option

Mobile Satellite Products Corp. offers an Inmarsat-B type-approved remote antenna option for its LYNXX trans-



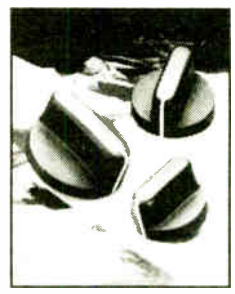
portable Inmarsat-B Earth Station. This remote antenna kit comes with everything needed to relocate the existing LYNXX antenna up to 50 feet away from the LYNXX unit, allowing the operator to place the LYNXX unit indoors, while its antenna remains outdoors and in an optimum location.

The antenna can be mounted to the remote kit case, a pipe, a railing, a tabletop or a wall. When these objects are not readily available, trees, fences, sign posts, planks, vehicles or almost any stationary object can become a remote base for the LYNXX antenna.

For information, contact the company in New York at 516-273-4455; fax: 516-273-4583; or circle **Reader Service 132**.

Control Knobs

Rogan Corp. offers a new series of Pure Touch control knobs with a raised bar pointer. These sleek, functional knobs add a contemporary look and feel to audio products.

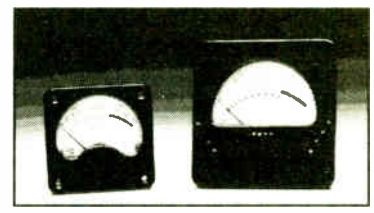


The raised portion reveals the knob's status or position at a glance and is ergonomically designed for accurate, non-slip actuation. The knobs are molded of a soft thermoplastic outer surface and a tough plastic body, and combine a comfortable operating grip with rugged construction.

For information, contact the company in Illinois at 800-428-1543, or circle **Reader Service 46**.

Vintage Meters

Responding to current trends in vintage-style products, Selco offers Vu meters in two sizes with gloss phenolic front molding and glass windows. The meters, Type No's R20ASQ and R25ASQ, have a buff scale with black and red markings. They are self-contained low range as voltmeters suitable for connecting across a 600-ohm line requiring an external 3.6 kilo-ohm external resistor.



For information, contact the company in California at 800-229-2332, or circle **Reader Service 36**.

TECHNOLOGY UPDATES

PENTA LABS

Penta Strengthens Tubes With Cermet Technology

CHATSWORTH, Calif. One benefit of the end of the Cold War is the availability of technology that was once classified. An example of this once-guarded technology is Cermet, originally developed for use in defense applications. As a result of a cooperative effort between aerospace manufacturer Martin Marietta and **Penta Laboratories**, a supplier of broadcast transmitter tubes, these companies are using Cermet technology to enhance the performance and reliability of electron tubes.

Present manufacturing processes do not fuse metal and ceramic on a molecular level. Exposure to extreme conditions can cause thermal shock and surface fractures that can lead to cracks and component failures.

Cermet technology consists of an interlaced metal and ceramic composition, co-fired with a ceramic insulator. The resulting monolithic structure has the ability of both conductor and insulator to expand and contract at virtually the same rate, enabling the Penta Cermet tubes to withstand extreme temperature differentials. Other benefits include improved metal-to-ceramic seals and superior conductivity.

Future designs will eliminate the need for tube pins, as sockets contact the body of the tube directly via feedthroughs.

For information, contact the company in California at 800-421-4219; fax: 818-882-3968; or circle ***Reader Service 191.***

ECONCO

Econco Rebuilds Tubes to Equal or Exceed Life, Performance of New Tubes

WOODLAND, Calif. The 4CX5000A, 3CX2500F3 and 3CX3000A1 power tubes can be rebuilt to new tube specifications for considerable savings.

Econco Broadcast Service provides power tube rebuilding for first-generation tubes used by many AM broadcast transmitters. These tubes and transmitters are still in wide use due to their reliability and efficient output.

Throughout its existence, Econco has tested and evaluated the failure modes of every tube sent in for rebuilding. The extensive database of information collected allows us to incorporate the latest improvements into every tube rebuild.

Econco's advanced rebuilding techniques provide tubes that equal or exceed the performance and life of newly manufactured tubes.

Econco purchases dud tubes of all types from stations.

All Econco tubes are delivered with a 3,000-hour, full-replacement guarantee against defects in materials and workmanship. The warranty goes into effect when the tube is installed, regardless of purchase date.

For information, contact Econco in California at 800-532-6626; fax: 916-666-7760, or circle ***Reader Service 82.***

SVETLANA

Svetlana Introduces Power Triodes for AM, Offers Replacemant AM Tetrodes

PORTOLA VALLEY, Calif. The new **Svetlana** 3CX2500F3 power triode for use in AM radio transmitters features a modern mesh filament, ensuring better mechanical rigidity and long-lasting concentricity.

The 3CX2500F3 is manufactured with high alumina ceramic doped with chromium and molybdenum, a combination resulting in a true metal/ceramic chemical bond. This stronger bond withstands high processing temperatures; high-temperature bake-out drives gasses from internal electrodes during vacuum processing. And clean processing means a long operating life. Each 3CX2500F3 is full-power RF tested at the factory.

Svetlana also has expanded its AM radio triode line by introducing a replacement for the 833, used in classic 1 kW AM transmitters. The 833 can be replaced with either the improved 833A or the 833C, the carbon anode version.

In addition, the company offers a line of drop-in replacement power tetrodes for AM broadcast transmitters. This line now includes the 4CX15000A, the 4CX10000D, the 4CX5000A and the classic 4X150A and 4CX250B.

Svetlana also offers products for FM broadcasters, including the new YC130 and 4CX3500A, and the 3CX3000A7, 3CX10,000A7 and 3CX15,000A7.

For information, contact George Badger in California at 415-233-0429; fax: 415-233-0439; or circle ***Reader Service 123.***

CONTINENTAL

Continental 317D AM Transmitter Comprised of Two Identical 25 kW Parts

DALLAS Continental Electronics' 317D AM broadcast transmitter is made up of two identical 25 kW sections combined for a single output of 50 kW. Each 25 kW section consists of 16 power blocks and its own power supply.

The power blocks consist of five RF amplifier assemblies and five PWM modulator assemblies. Each RF amplifier assembly is capable of providing 350 W.

The solid state amplifiers are identical and broadband. There are no frequency-determining parts, making them interchangeable.

The output filter of the 317D adds in phase the outputs of the two 25 kW sections and permits the operation of a single 25 kW transmitter. The filter also presents a high impedance at harmonic frequencies and blocks any DC component that may be introduced in the antenna by electrostatic charge.

The combining unit contains the RF networks necessary for combining the two transmitters. This unit also allows the operation of one transmitter into the antenna while the other transmitter is de-energized for maintenance or operation into a customer-furnished test load.

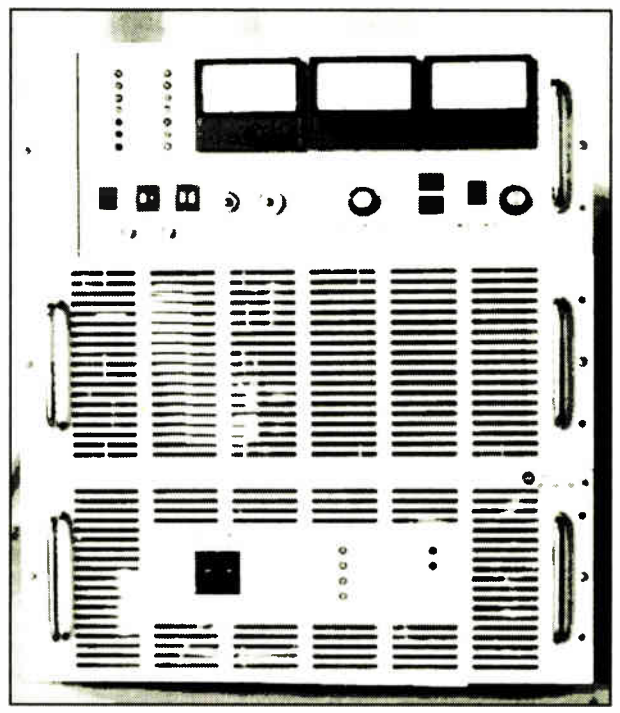
Control and monitoring for each 25 kW section are centralized to permit the simultaneous operation of all of the power blocks. Metering of the combined system, low-level electronics and output filtering are also part of the center cabinet.

For information, contact Steve Clatterbaugh in Texas at 214-381-7161; fax: 214-381-4949; or circle ***Reader Service 165.***

OMNITRONIX

Omnitronix Packs 1 kW into 21-inch-high Solid State Broadcast AM Transmitter

NORTH WALES, Pa. **Omnitronix Inc.** has introduced a new generation of solid state AM broadcast transmitters. New Omnitronix technology has significantly increased the power density of the amplifier modules allowing greatly reduced packaging requirements. The OMNI-1000A is a 1,000 W AM transmitter that occupies only 21 inches of standard rack space.



Because of the small space requirement of this unit, an external cabinet is offered as an option. The OMNI-1000A, as well as the 2.5 kW and 5 kW units, are available in either fixed-frequency or frequency-agile configurations. Optional C-QUAM stereo is available on all models.

Standard features on this new series of Omnitronix transmitters are a hinged contoller front panel for ease of access, full metering and LED status arrays, five field adjustable power settings and front panel RF power output trim. Frequency-agile units have front panel switches, allowing instant frequency changes in 9 kHz or 10 kHz steps.

For information, contact Brian Morgenweck in Pennsylvania at 215-699-2400; fax: 215-699-2323; or circle ***Reader Service 205.***

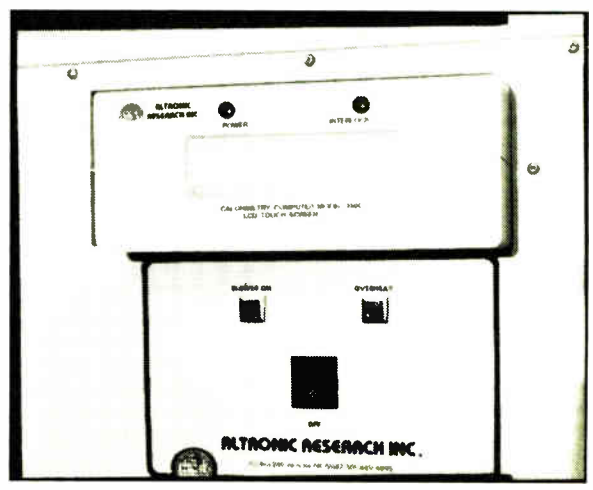
ALTRONIC

Digital Calorimetry from Altronic Measures RF Power Dissipated in Dummy Load

YELLVILLE, Ark. **Altronic Research Inc.** is now accepting orders for its Model 3500 Touch Screen Digital Calorimetry for Altronic air-cooled dummy loads. This product is the first calorimetry of its kind for measuring RF power dissipated in an air-cooled dummy load. The system calculates the RF power by measuring air flow, difference of air temperature from inlet to outlet, humidity and barometric pressure.

The unit also features a projected power reading that enables the user to see a projection of power in the system until the main readout has had sufficient time to make its calculation. The Model 3500 is available for use in Altronic air-cooled dummy loads from 5 kW to 75 kW. A water-based system is also available.

The Model 3500 features a single-chip microprocessor (of the Motorola HC 11 family), remote sensors digitized to reject RF interference, a backlit LCD display, a touch-screen keypad entry interface, programmable alert and alarm set points, and audible and visual alert and alarm indicators.



For information, contact Doug Starkey in Arkansas at 501-449-4093; fax: 501-449-6000; or circle ***Reader Service 28.***

VARIAN

Varian Tetrode Generates up to 800 kW Carrier Power

SAN CARLOS, Calif. Varian Associates, manufacturer of Eimac power grid tubes and Klystrode IOTs, offers a new superpower tetrode for AM broadcast use. The 4CM1000KG is capable of generating carrier power of up to 800 kW. The 4CM1000KG is a multiphase cooled tetrode with pyrolytic graphite grids. It is one of the highest power output tubes available today and features a simple base and easy-to-use cooling connectors for efficient installation.

Another new product, the 4CM100,000A, is available for shortwave transmitters and features high gain, allowing the realization of a compact, transportable shortwave transmitter capable of delivering 100 kW of carrier power.

In addition, the Eimac 4CX5000A, 4CX15,000A and 4CX35,000A line of broadcast tubes retains the tradition of high quality established through 60 years of continuous improvement.

For information, contact the company in California at 415-592-1212; fax: 415-592-9988; or circle ***Reader Service 54****.*

ELECTRO IMPULSE

Electro Impulse Dummy Loads Conservatively Rated, Feature Optional Voltage Divider-Type Circuit

NEPTUNE, N.J. Selecting proper dummy loads for AM transmitters involves special consideration. Of utmost importance is power rating. AM transmitters are normally rated in terms of carrier output, but a dummy load must be rated for the full carrier plus 100 percent modulation. Otherwise, the load could overheat when the transmitter is modulated. **Electro Impulse Lab Inc.** loads are conservatively rated so no further upgrade of the power rating is necessary.

A user also should be certain to run a heavy ground strap to the load cabinet, in addition to the input connector ground. All Electro Impulse loads have a heavy brass ground stud for this purpose.

For power measurement in the AM band, Electro Impulse offers an optional voltage divider-type circuit for many of its loads. In this circuit, a part of the signal is attenuated by a voltage divider network and then rectified with a diode; a meter circuit is carefully matched and calibrated to the network impedance.

Electro Impulse dry dummy loads require little or no maintenance. They only require periodic checkups to see that the air-cooling path is unobstructed and clean, to verify the operation of the air flow interlock and to check the input resistance.

For information, contact Mark Rubin in New Jersey at 908-776-5800; fax: 908-776-6793; or circle ***Reader Service 94****.*

KINTRONIC

Kintronic Isocoupler for Paging Setup on AM Tower

BRISTOL, Tenn. Since the FCC has begun licensing paging transmitters with an output power of 500 W, **Kintronic Labs** has experienced a growing demand for a solution to isolate the associated antenna and transmission line across the base insulator of hot AM towers. As a result, the Model FMC-0.1 isocoupler has been upgraded in throughput capacity to address the new requirements for the 931 MHz 500 W paging transmitters.

This upgraded version, designated as the Model FMC-0.5P, is currently installed and operating reliably in several locations. The simplicity of the isocoupler with regard to installation and operation makes it an expeditious and low-cost solution for implementing a high-power paging operation on an AM broadcast tower. Typical insertion loss of the Model FMC-0.5 is less than 0.5 dB, and the capacitance presented across the base insulator is 65 picofarads.

For information, contact Tom King in Tennessee at 615-878-3141; fax: 615-878-4224; or circle ***Reader Service 29****.*

WORKBENCH

Tips to Prevent Tower Painting Woes

by John Bisset

SPRINGFIELD, Va. Our query into tower painting woes brought out some great horror stories—painters climbing towers drunk, carrying a six-pack instead of a can of paint, partially painted towers, crushed coaxial lines that were used as foot rests. The list goes on.

Matt Rule wrote a two-page letter outlining his experiences with a painting job in Ithaca, N.Y. A painter crushed a sampling line on the reference tower of a four-tower, close-coupled, high impedance array. The sampling loop current shifted 10 percent, and the phase changed too. Bridging the towers showed no effect, but sweeping the sampling lines disclosed the problem.

Matt swept the lines both from inside the building as well as at the base of the tower. When measuring from inside the building, Matt terminated the line at the doghouse. To make the circumstances similar, all the towers were grounded. The lines were measured, and each line was similar except the one with the crushed connector. Matt offered the following top ten painting tips:

• Budget a little more time than you schedule.

• Make sure the contract calls for the crew to look for any problems, and have them corrected before paint is applied.

• Schedule the work in moderate weather; the crew will do a better job.

Plan on being on-site to inspect the work. Your station has quite a lot of money involved so it's worth your time.

• Specify the extent things will be covered. It has been Matt's experience that static discharge balls attract orange paint like lightning seeks out McMartins!

• Painting costs are determined by scraping efforts. A contractor that doesn't climb a tall tower for a pre-bid inspection is suspect.

• Have the climbers carry up a can of high zinc chromate paint to prime any rusted metal.

• Plan on being on-site to inspect the work. Your station has quite a lot of money involved so it's worth your time.

• Painters work very hard; the work is nasty and dangerous. Treat them well. Pick up some sodas and keep them in a cooler, or order pizza for lunch one day. They'll see you as a decent person, doing more for them than most customers. The result is they will work harder.

• After the painting is completed, have all the tower weep holes checked. No matter how careful, you will find some painted over.

Matt has since left the chillier climes of up state New York for Carmel, Calif. He can be reached at 408-595-0067.

★ ★ ★

It is spring cleaning time, and time to ask "what's wrong with this picture?" (see photo). You're looking at a satellite mount, with a Fairchild downconverter mounted on the left. The answer is found at the end of this column.

★ ★ ★

Public radio stations worried about the end of federal funding are finding themselves in the position of their commercial brothers and sisters—do more with less. To that end, Mike Chunn of Digital Research Corporation has developed a computerized system to expand the revenue generation of translators. Mike's system allows stations to remotely transmit digitally-generated sponsorship or underwriting announcements on specific translators.

What this means to the radio station is the ability to sell additional underwriting for specific areas covered by certain translators. Mike's black box, called the LYNX, mounts in a rack and connects to a telephone. An IBM PC can be used to access the translator site, and digitally transmit the sponsoring announcement intended for that specific coverage area.

For more information on Digital Research's LYNX, circle **Reader Service 121**.

★ ★ ★

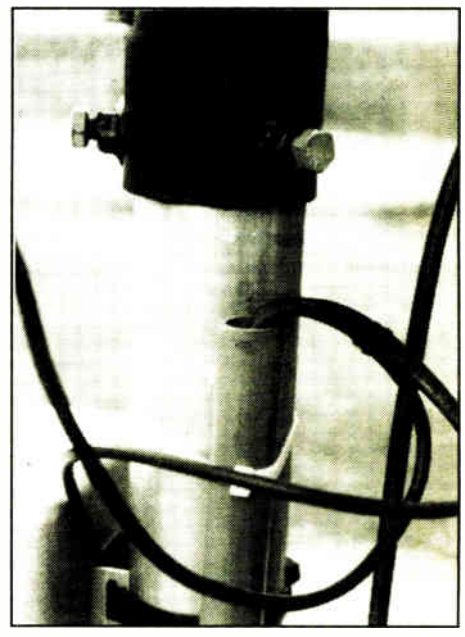
I alluded to spring cleaning earlier. Now is the time to tackle that equipment manual file drawer. With the help of an intern, you too can become organized. Art Crane of Desert R.F. Engineering offers an interesting way to organize manuals by computer. Art uses a location code, starting with the file cabinet drawers 1 through 5.

Positionally number each manual from front to rear as 01 through 99 (or whatever). Using this scheme, the 13th manual from the front of drawer number 2 would be location 2-13. Writing the location code on the manual ensures that it gets placed back in the same location.

In addition to organizing your manuals, location coding permits multiple descriptions to be used for a single book. For example, some of the BELAR modulation monitors were manufactured by BELAR but with an RCA label. Harris/Gates products are another example where multiple descriptions can help. Should you enter the description of a manual for a carousel system as Carousel, Sono-Mag, or Sono-Mag Carousel.

It is very easy to create files on an IBM or compatible PC using the DOS "EDIT" or "EDLIN" routines. Start with your description in column 1, and end each record with the location code in columns 76 through 79. Keep all the location codes vertically aligned. Then, sort the raw data file (filename 1) and create a second sorted file (filename 2) with the DOS command: SORT <filename1> filename2. Print out the sorted file and the raw unsorted data file.

The two lists will make it very easy to locate any document in the files. The unsorted list also has the benefit of helping you locate manuals that are only one or two sheets of paper. For example, once you determine the document is in location 3-78, you can look at the unsorted list and



What's wrong with this picture?

see that it is the next document behind your manual for the Harris FM-20K transmitter.

Art Crane can be reached in Lake Havasu City, Ariz., at 602-453-3546.

★ ★ ★

As to what is wrong with the photo, if you spotted the open piece of PVC pipe, give yourself a star. In addition to serving as a conduit for rain, open pipes can attract insects. Make sure such openings are plugged with waterproofing compound or at the very least, wrapped with electrical tape. We'll give extra credit for anyone who spotted the white tie-wrap. On outdoor installations of any kind, always use black tie-wraps.

Exposure to the sun and the elements will weaken the white tie-wraps, and they will eventually break. The black tie-wraps are not affected by the ultraviolet rays of the sun. One last thing, take a Sharpie permanent ink marker, nail polish, or paint and paint a vertical orientation strip on the pole and rotating mounting collet. If your dish is visited by vandals, having some starting reference mark makes realignment easier.

□□□

John Bisset is a principal with Multiphase, a contract engineering and special projects company based in Washington, DC. He can be reached at 703-323-7180. Fax submissions for the Workbench column to 703-764-0751. Printed submissions qualify for SBE Certification credit.

RadioWorld

Broadcast Equipment Exchange

"Broadcast Equipment Exchange" accepts no responsibility for the condition of the equipment listed or for the specifics of transactions made between buyers and sellers.

AMPLIFIERS

Want To Buy

Tube HiFi/Commercial amplifiers, preamplifiers, compressors, speakers etc. Altec, JBL, McIntosh, Marantz, Western Electric, Pultec, Ampex, etc. 405-737-3312 FAX: 405-737-3355.

ACOUSTICS

Want To Sell

ANTENNAS/ TOWERS/CABLES

Want To Sell

ERI 300', 3-1/8" rigid transmission line, $2000. WHWL, Marquette, Michigan, 1-906-249-1423.

AUDIO PRODUCTION

Want To Sell

UREI 1122 SS stereo xscription preamp. $75. R Sumner, CAVU, 44632 Guilford Dr, Ashburn VA 22011. 703-450-2288.

CRL Dynaflex DX2 NR unit; Aphex Compeller; Moseley PLC303 STL set; Eventide Harmonizer 949; Technics SL-P101 #610 expander/compressor; Orban 111B dual band reverb; CBS Audimax AGC; CBS Volumax 400; Gates Solid Statesman (2). M Ring, Black River Bdcting, 134 Mullin St, Watertown NY 13601. 315-788-0790.

Furman PQ-4 parametric EQ, 1 yo, exc cond, $190. Ron, 206-839-9414.

Roland DM 80-8 digital audio workstation, 8 indep recordable tracks w/built-in audio mixer automation, factory HDs & newest version software to date, totally self-contained, w/wave edit, video sync, mixer panel, remote, digital I/Os & SMPTE lock, easily expandable via SCSI HDs, all manuals, exc cond, one scratch, $9,500. H Lam, South Coast, 5234 Elm, Houston TX 77081. 713-664-9904.

UREI LA4 mint pr, $1095; Lexicon Alex, $295; bulk eraser, $49; Stewart direct boxes mono, $50; 4 Ch, $95; Cue command decoder, $125; ABC Network decoder, $125; NEW Tascam midiizer MTS1000, $750; Dyna stereo 120 rack mount amp, $229; Sherwood FM tuner, new tubes, $49; Infonics 7" reel copier 3 copies, $125 ea; Crown & Furman elec crossovers, $95. W Gunn, POB 2902, Palm Springs CA 92263. 619-320-0728.

Good used studio tape 1/2" $15, 1" $30, 2" $55. W Gunn, POB 2902, Palm Springs CA 92263. 619-320-0728.

ADC 1/4" patchbays and cords, NEW, UNDER HALF PRICE. ADC TT patchbays, $129 up, NEW cords, $9.95. W Gunn, POB 2902, Palm Springs CA 92263. 619-320-0728.

Want To Buy

Ampex tube mixers, plug-in mic preamp modules for PR10's. W Gunn, POB 2902, Palm Springs CA 92263. 619-320-0728.

AUTOMATION EQUIPMENT

Want To Sell

IGM Comm event controllers (2), Best Offer. G Price, WCVR, POB 249, Randolph VT 05061.

FS-12C to ITC 48 tray Instacart interface with cables, 19" rack mnt, exc cond, BO; IGM 48 tray/mono Insta-cart, operating but with 3 bad trays, could be repaired easily using parts from mach, BO; IGM 48 tray/mono Instacart, parts only, BO. M Watson, WSCZ, POB 1247, Greenwood SC 29648. 803-223-8553.

Sentry Systems FS-12C Format Sentry w/cables, connectors, etc, xlnt cond, BO. M Watson, WSCZ, POB 1247, Greenwood SC 29648. 803-223-8553.

Valley 400 mic processors with phantom power, Best Offer. **Scott, DS Communications, 5859 Shany-mist, #3, Cincinnati OH 45239. 513-385-0130.**

Want To Buy

ABC Netcue II automation cntrlr that is programmed for ABC News, Rush Limbaugh, ESPN radio or can be re-programmed for above svcs. R Mahaffey, KTTR/KZNN, Box 727, Rolla MO 95401. 417-883-9180.

CART MACHINES

Want To Sell

Harris Criterion 90-2 (2), mono PB, good condition, $200/ea. M Anthony, WENG, POB 2908, Englewood FL 34295. 813-474-3231.

Fidelipac CTR10 stereo R/P cart with 3 tones, excellent condition, $900; BE 5400C 3 stack stereo PB with 3 tones, excellent condition, $1000. J Arzuaga, WQQZ-FM, POB 980, Quebradillas PR 00678. 809-895-2725.

BE 5 stack 5 stereo cart playback unit, including extra unit for parts, $250+shipping. G Dunn, NoCA News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

Tapecaster 700-P & 700-RP (2) play & rcrd/ply cart machines, BO; ITC PD-II rcrd/ply cart machine, BO; Audi-Cord E11 & (2) E-31s ply only cart machines, BO; Sono-Mag Corp cart carousels, (7) 350s & (2) 452s, BO. G Price, WCVR, POB 249, Randolph VT 05061.

ITC S/P stereo PB single stereo with 3 tones, $395/ea. D Matyis, KVET/KASE, 517-495-1300.

CART MACHINES...WTS

ITC Delta (3) plybk only cart machines, like new, $600/ea. R Statham, WSTW/WHLG, 1000 Alice Ave, Stuart FL 34994. 407-692-1000.

IGM 48 tray Go Carts (3) model 4216, $300/ea; IGM 12 tray Insta Cart model 12 STK, $300; SMC 250 Carousel, $150; Master carts, varius lengths, 70 cents/ea; cart racks, hold 24 carts, table top, $10; Harris Criterion 90 play mono cart machine, $300; BE 2000 cart machine parts, $25; BE cart rewinder, $200. T Wortmann, 402-371-0780.

BE 5300C tripledeck, stereo, PB, mint less than 50 hours, Best Offer. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

ITC System 99B stereo record/play: tones, ELSA, auto head: $1200/firm. C Scott, WKYU-FM, (502) 745-5489.

Want To Buy

Audi-Cord A-10 mono play only, gd cond. D Williams, KLLV. 14780 Hwy 140, Breen CO 81326. 303-247-8955.

ITC, BE, Fidelipac cart machines: single, triple, mono, stereo play & record/play. Call M O'Drobinak @ 619-758-0888.

CASSETTE & REEL-TO-REEL RECORDERS

Want To Sell

Otari MX5050 4 track with rolling floor mount, excellent condition, low hours on heats, 4 year old, BO. **Scott, DS Communications, 5859 Shanymist #3, Cincinnati OH 45239. 513-385-0130.**

Ampex 300 R-R 12-track recorder, no electronics, $400. CJ Scheppers, 816-221-0231.

ITC 850 R-R 2-track unmounted with manual, excellent condition, $650/BO. D Charles, WLOQ, POB 2085, Winter Park FL 32790. 407-647-5557.

Scully 270 R-R stereo tape machine, play, $200; ITC 750 stereo R-R play, $500; Scully 280 R-R play/rcd stereo, $400; Ampex 440 R-R stereo ply model 4020293-01, $200. T Wortmann, 402-371-0780.

Revox B77, mint condition, 3 3/4 & 7 1/2 ips, 2 track, $600. B Meuse, Muse Audio Arts, 600 Rainbow Dr Ste 107, Mountain View CA 94041. 415-969-2433.

Revox A77 good condition, $350; Revox PR99 (3), reproduce only, good condition, with 1 manual, $250/ea; Otari ARS 1000 (5), reproduce only, 3 with manuals, $250/ea; Tascam 22-2, good condition, with manual, $350. D Noe, KNID, 316 E Willow, Enid OK 73701. 405-237-1390.

ITC 1/2-track stereo R-R repros (8), all operating, Best Offer. M Watson, WSCZ, POB 1247, Greenwood SC 29648. 803-223-8553.

Ampex/Schiffer AG440 2-track R-R repros, 7 1/2/15ips, good condition, $100/ea. D Bailey, Rock Shoppe Productions, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Revox PR-99 R-R PB (4) w/25 Hz, excellent condition, $500/ea or $1500/all. J Arzuaga, WQQZ-FM, POB 980, Quebradillas PR 00678. 809-895-2725.

Otari Mark II-IV 1/2" 4-track, multi-track, mint, less than 50 hours, Best Offer. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Otari 5050-SHD 8 track 1/2" newly rebuilt, heads have full, life left, $1800. W Gunn 619-320-0728.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 4646 Houndshaven Way, San Jose CA 95111. 408-363-1646.

Uher CR134 cassette, $195; DAT decks with new heads $550, Tascam ATR 60 8 track with stand, remote, $3250; Otari 5050-8 no hours on heads, $1595, Ampex 440B-8, $2450; Tascam 25-2, $695; Ampex ATR700, $695; Scully 16 track 2", $3450; Tascam 52 top of line, $950; M79-24 fully rebuilt, $11,500; Tascam locator for 85-16, $495; Fostex E22 1/2" timecode deck, $1400; Fostex A80 8 track with 450 mixer, $1350; Tascam 5, $450; Nagra 10" reel adaptor, $950. W Gunn, POB 2902, Palm Springs, CA 92263. 619-320-0728.

Want To Buy

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

Tascam 122MKII in good condition. Price negotiable. Fax info to (719) 531-3301.

COMPUTERS

Want To Sell

Okidata Microline 84 printers (2), BO. G Price, WCVR, POB 249, Randolph VT 05061.

TI 700 ASR data terminal, $40; Harris Encoder 992-5118-001 for System 90, $50; Anderson AJ1256 modem, $20; TEC F10 daisy wheel printer, $90; Extel AH11R printer, $40; TI 810 printer, $90; Quantum Q2040 32MB HD for Wang LVP2200 computer, $25; 8" floppy drives for Wang LVP2200 computer, $10; 8" Dysan computer disks, cheap. T Wortmann, 402-371-0780.

BBS syst, 7 CD-ROMs online, multi-gig HDs, currently online with 8 hi speed nodes, $20,000 or trade for production equipment. FAX 219-257-2135, Modem 219-257-2138.

Epson Equity II+ computer, keyboard, monochrome monitor with 1.5x5.25 floppy drive, DOS 3.3 & FS software, perfect to drive the FS-12C, excellent condition, BO. M Watson, WSCZ, POB 1247, Greenwood SC 29648. 803-223-8553.

CONSOLES

Want To Sell

McCurdy 18x4x2 console, side car, patch bay, P&G faders, manuals, $1000. CJ Scheppers, 816-221-0231.

Soundraft Delta 200 18 x8x2 sweep EQ opt, exc cond, $2200. M Schackow, 307 4th Ave E, Lemmon SD 57638. 605-374-3424.

Mackie 1604, $575; Soundcraft Spirit 24x24, $3950; Ramsa 820 20x8x16 with meter bridge, $1950; Quantum 23x16x24 as used by LA Philharmonic, $4950. W Gunn, POB 2902, Palm Springs CA 92263. 619-320-0728.

Want To Buy

API/NEVE, whole or parts, working or not. T Coffman, Rolltop Music, POB 17203, San Diego CA 92177. 619-571-5031.

RCA BC-6A console, WE 23-C console, want for collection, not stripping & selling to Japan! S Horner, KPRZ, 9255 Town Centre, San Diego CA 92121. 619-535-1210.

DISCO-PRO SOUND EQUIPMENT

Want To Sell

Ensoniq EPS sampler, sequencer, synth, with all manuals & many sample disks, MIDI, pedal, very good condition, $600/BO; Sansui PCM Tricode X-1 & Sony SL2000 VCR, PCM digital stereo audio recorder, encodes & decodes 14-bit digital stereo onto any VTR, great shape, all manuals, with Sony SL2000 Betamax port video recorder with all adapter plugs for PCM X1 good shape, $550/both. H Lam, South Coast, 5234 Elm, Houston TX 77081. 713-664-9904.

Shure M610 feedback cntrlr, $100; Teac 1/2" calibration tape, $30; Roland Boss RV1000 digital reverb, $140; Ampex 456 7" reels, $5/ea. D Kolher, Digital Sound, 1919 Hanover Ave, Allentown PA 18103. 610-776-1455.

Roland SRV 2000, $525; dbx 503 expander/comp, $290; Shure SM-57, $70; UA 565-filter set, BO. T Coffman, Rolltop Music, POB 17203, San Diego CA 92177. 619-571-5031.

Aphex Dominator 723C with pre emphasis de emphasis, Best Offer; Aphex Compellor, excellent condition, used 6 months, Best Offer. **Scott, DS Communications, 5859 Shanymist #3, Cincinnati OH 45239. 513-385-0130.**

Want To Buy

MXR-NEVE-API EQs, mic-pres, delays, etc. T Coffman, Rolltop Music, POB 17203, San Diego CA 92177. 619-571-5031.

EBS EQUIPMENT

Want To Sell

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Want To Sell

CRL complete systems w/SPP-800, stereo prep processor, SEP-800 spectrum energy processor, SMP-850 stereo mod processor and SG-800A stereo generator, $3500 + shipping. L Dupree, KQID, 1115 Texas Ave, Alexandria LA 71301. 318-445-1234.

CBS 411 stereo Volumax & Audimax, $50/echa/Best Offer. Don Charles, WLOQ, POB 2085, Winter Park FL 32790. 407-647-5557.

Orban 418A stereo limiter w/manual, $300. D Noe, KNID, 316 E Willow, Enid OK 73701. 405-237-1390.

Want To Buy

Instruction manual or Schematic for RCA BA-146 limiter amplifier. J Graham, POB 242, Sandy Springs SC 29677. 803-242-1005.

FM Optimod with XT or compl audio proc system with stereo gen; Tascam 32 R-R or equivalent; audio dist amps; mic audio processor unit. R Coleman, 309-944-4633.

Langevin Progar limiter, RCA BA-6. BA-86 limiters, Universal Audio 610, 1008, 1016, 508, 509, etc. M Linett, 818-244-1909.

Orban Optimod 9100. Robert, 904-477-6688.

Fairchild 670 or 660 tube compressor/limiter, Teletronics LA-2A tube compressor/limiter or UREI LA-3A solid state compressor/limiter, call after 3PM CST. 214-271-7625.

MICROPHONES

Want To Sell

Neumann U-89 with windscreen & phantom power supply, $1600. J Lappard, Sunspots Production, Box 403/Westside Station, Worcester MA 01602. 508-755-0732.

EV RE20's, $275-325; Sony ECM377 large dia. condition microphone, $495; RCA 44BX matched set of 3, $3950; Shure new SM7, $395; AKG new D112, $295; Crown GLM200 lavalier like new, $125. W Gunn, POB 2902, Palm Springs CA 92263. 619-320-0728.

Neumann U-89 condenser mic with battery, 2-system phantom power supply, windscreen & shock-mount, $1600. J Laprad, 508-755-0732.

Want To Buy

AKG 414 EB or equivalent, also need shock-mount/windscreen. J Laprad, 508-755-0732.

77-DX's, 44-BX's, WE KU-3A's On-Air lights, recording lights & audition lights. Top price paid. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131, FAX: 615-292-3434.

RCA 77DXs/44BXs ribbon, chrome/TV grey, good condition, Best Offer. R Kaufman, Pams Prod-uctions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

RCA ribbons, AKG 451's, Neumann KM84's, EV 635A. W Gunn, POB 2902, Palm Springs CA 92263. 619-320-0728.

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Panasonic Easa-phone KX-T61640 phone switching systs (2), BO; (2) equip racks, 5 1/2', BO. G Price, WCVR, POB 249, Randolph VT 05061.

Mark Century production library. 385 vinyl albums including Radio A La Carte, Festival & Limited Edition series. Send large SSAE for inventory: Ed Brouder, Man From Mars Productions, 159 Orange St., Manchester, NH 03104-4217.

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Want To Buy

Jazz record collections, 10" LP/12" LP be-bop, swing, dixie, highest prices paid. B Rose, Program Recordings, 228 East 10th, NYNY 10003. 212-674-3060.

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RCA FM stereo monitor type BW85A, RCA FM SCA monitor type BW95A, $150/ea. CJ Scheppers, 816-221-0231.

TFT 785/763 724A, 730A, FM monitoring system at 96.9, incl mod monitor w/preselector, stereo monitor and SCA monitor, $900. D Noe, KNID, 316 E Willow, Enid OK 73701. 405-237-1390.

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CCS CDQ-1000 Motorola TA-220 K, used twice, sold as pkg, $2900/BO. G Nord, Sound Hound, 212-575-8664.

Wegener 1601 - Westwood One oldies. Gwen Perry, 915-550-0558.

Studer auto hybrid, 2-line phone interface with manual, $595. R Sumner, CAVU, 44632 Guilford Dr, Ashburn VA 22011. 703-450-2288.

Gentner EFT-3100 3-line frequency extenders, like new, $5000/pair. Steve Kirsch, Silver Lake Audio, 2590 Hillside Ct. Baldwin NY 11510. 516-623-6114.

Want To Buy

Gentner SPH3A phone interface. R Coleman, 309-944-4633.

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Giant radio boom box trailer with 4 kW generator, BO. D Matyis, KVET/ KASE, 517-495-1300.

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REPAIR SERVICES

SATELLITE EQUIP

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Chaparal C Band LNB 20 degree p hemt LNB, 950 to 1450 MHz block, $50+shpg. G Dunn, NoCA News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

Zephyrus receiver for Jones Satellite Network. Like new condition, complete w/all options. $1,000. Michael Tracy, KMOR/ KOAQ/ KOLT. POB 532, Scottsbluff NE 69363-0532. 308-632-5667.

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Comstream ABR-200 KY band satellite receiver, $1595 + shipping. L Dupree, KQID, 1115 Texas Ave, Alexandria LA 71301. 318-445-1234.

Scientific Atlanta SEDAT card, $705. D Jackson, Radio South Burlington, Inc. 203-762-9425.

Want To Buy

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Want To Buy

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Want To Sell

CRL SCA 300B SCA generator, Rob, 813-377-1488.

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Want To Sell

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Various tapes, 1" (2), unopened hubs, (3) used reels, 1/2" (1) unopened reel, $20/ea. D Bailey, Rock Shoppe Productions, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Pams Jingles ref tapes, 1951-1976, BO. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625.

Want To Buy

Phonographs from 1950 to 1970, all types of music, 45s, 33s, 78s and transcriptions. B Berry, Karavan Bdctg, 13 Montgomery Place, Conroe TX 77384. 409-321-2920.

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TEST EQUIPMENT

Want To Sell

Tektronix 2215A 60 MHz oscilloscope, new, $1200. Armando, KSJV Radio, 209-498-6972.

Tektronix 1401A/323 portable RF spectrum analyzer; H.P. 353A gain set/patch panel; Heath IG-1272 low dist oscillator; B & K 1471B scope; H.P. 1740A scope, needs CRT. Rob, 813-377-1488.

Hewlett Packard 332A distortion analyzer w/AM detector, $595; HP 333A distortion analyzer, $695; HP 334A distortion analyzer w/AM detector, $795. R Sumner, CAVU, 44632 Guilford Dr, Ashburn VA 22011. 703-450-2288.

Black Box FS-12C to Sony CDK-006, interfaces w/cables & power splys, exc cond, BO. M Watson, WSCZ, POB 1247, Greenwood SC 29648. 803-223-8553.

Potomac Instruments AA-51 audio analyzer & AG 51 gen: $1500/pr. C. Scott, 502-781-5301.

Want To Buy

Belar FM stereo mod monitor syst or equiv. R Coleman, 309-944-4633.

TRANSMITTERS

Want To Sell

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Harris HT3.5FM 4 kW FM transmitter with THE-1 exciter on 107.7, new 9/89, $18,200. L Collins, WJYY, POB 1923, Concord NH 03302-1923. 603-228-9036.

RAC BTA-5H AM transmitter, works well, BO, you p/u. J Gomez, WGGH-1150 AM, POB 340, Marlon IL 62959. 618-993-8102.

Harris FM 5 kW 1988 model, used only 18 months in 7 years, $17,000. K Smith, Eclectic Enterprises, 111 Marquette Ave #100, Minneapolis MN 55401. 612-338-6022.

BE FX-30 30 W exciter, excellent condition, $3495. J Arzuaga, WQQZ-FM, POB 980, Quebradillas PR 00678. 809-895-2725.

Used equipment for sale: Belar SCM-1, Belar RFA-1, Belar FMS-1, Belar FMM-1, Moseley MRC 1600 system, TFT EBS receiver/gen, Gentner patch panel, and Harris racks. Call Transcom Corp 800-441-8454 or 215-884-0888.

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New McMartin 20 W, BIM-5800 FM exciters. New McMartin IBM1005D FM relay rebroadcast recvrs; also some used McMartin B910 exciters 15W. Goodrich Enter., 11435 Manderson St, Omaha, NE 68164. 402-493-1886 fax 402-493-6821

Want To Buy

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American Electronic Labs AEL FM5KB, manual with schematic or complete copy. Mack, 804-836-9217.

5 kW AM transmitter, prefer Harris MW-5 or comparable/better. Robert, 904-477-6688.

McMartin AM/FM xmtr, any model, exciter or stereo modules. Goodrich Ents., 11435 Manderson, Omaha NE 68164. 402-493-1886.

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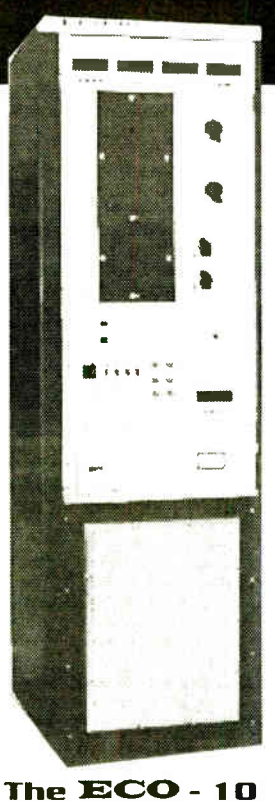

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Fine Used AM & FM Transmitters
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ADVERTISERS!
Radio World

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UPCOMING DEADLINES

Deadline for June 28 issue:
June 6
Deadline for July 12 issue is:
June 16

TUBES...WTS

Want To Buy

EMPLOYMENT

To place ads in this section, use the ActionGram form. To respond to box numbers, write Radio World, PO Box 1214, Falls Church, VA 22041. Attn:_____

POSITIONS WANTED

20+ yr pro skg solid pos in radio-all areas, 11 yrs w/Muzak, solid individual w/gd attitude, Christian, Lite Hits, etc. E Pulaski, 909-881-3812.

Bdct grad skg fast-paced, highly re-warding pos, dynamic on-air, tight prod, creative copy, authoritative news, OK, MO, AR. Tim, 405-258-0403.

Decades of solid exp as PD, Op mgr and news, excellent prod skills, yearning for FL. Bob, 210-724-1525.

JANET (502) 895-5888; versatile, intelligent, great for start ups or existing stns, want F/T airshift, first PD gig, never promoted, tired of unrated markets, uncompetitive pay.

Give her any format and this lady can deliver, good voice, very creative writing & prod, ready to work hard for your station! T Caldwell, 918-321-5710.

Chief Engineer, corp technical director, career technical background, small and major markets and consulting firm, w/DJ, prog, op mgr and stn mgr reality seasoning, resume and ref, Ted, 409-863-7651.

7 years on-air experience ready to relocate with my huge collection of R&B classics, love programming & production, tape, resume & references. John, 910-545-8060.

Chomping at the bit to rock the west coast, killer prod & copywriting, w/a real rock 'n roll attitude! G Brown, 918-341-7929.

Looking for a talented individual for prod, voice overs or announcing? Recent grad ready to work, OK preferred. 405-733-7736.

From DJ to sales to management to owner, ready for new challenge, I know radio. Anthony, 800-779-4737.

Medical/Health News reporter will relocate anywhere, copy writing, on air production, narration, interviews health professionals, FT or PT. Larry, 702-361-7018.

Creative comic to straight man, I'm your man, many character voices, tops in writing & prod, work well alone or as side-kick! B Griffin, 918-743-7679.

Morning sidekick, killer production including MIDI and DM-80 digital, SBE cert pending, very visible, easy to work with, NE, Midatlantic only. Allen, 717-541-5154.

Recent grad willing to relocate to any state, people say she is an amazing worker, find out if it is true. Marlissa, 405-273-9122.

Young, energetic, currently employed, play-by-play man with 6 years experience & strong production skills looking for better opportunity, can work alone, willing to relocate. Derek, 505-392-5367.

HELP WANTED

CE for 10 kw AM DA 2 contemplating new studio construction. Resort community, western state. Competency in AM DA's, PC computer systems, PC computer networks, TVRO studio/RF construction, maintenance, FCC compliance. Minimum five years experience and FCC General Class Permit. Resume, references, salary expectations, and credentials to: "Resumes" at 2950 SW 2nd Avenue, Fort Lauderdale, FL 33315 or FAX to 305 524 8734. EOE

ELECTRONICS ENGINEER

Minimum 3 years broadcasting experience, customer service experience, and electronic assembly/repair experience. Will need to provide technical support of products including application, specification, theory of operation, troubleshooting, etc.
Send resume to:
J. Murray
ORBAN
A Harman International Company
1525 Alvarado St.
San Leandro, CA 94577
EOE

RADIO CHIEF ENGINEER

Colfax Communications is accepting applications for the position of Chief Engineer at its Washington DC facility. Applicants must have a minimum 10 years of experience in a similar position, SBE certification and or FCC General Class Radio Telephone Certificate required.

Mail resumes and references to James Stanley, Director of Engineering
Colfax Communications, Inc.
60 South 6th Street Suite 920
Minneapolis, Minnesota 55402

Colfax Communications is an Equal Opportunity Employer

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The world's #1 radio industry publisher is looking for a dynamic individual to handle Midwest advertising sales for Radio World Newspaper, Radio World International and The Radio World Magazine.

This job requires five or more years of radio industry experience (station experience preferred), and a strong background in advertising, sales and marketing. You must be energetic, aggressive, creative, organized and (most important) LOVE RADIO. You must also live within the territory and be able to travel.

We offer a competitive salary/commission package, plus benefits. Send resume (in confidence) with salary history to:

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Radio World
PO Box 1214, Falls Church VA 22041
FAX: 703-998-2966
**** No Phone Calls Please***

WANTED:
TECHNICAL EDITOR FOR RADIO WORLD

- Writing/editing experience required
- Strong background in radio production
- General knowledge of broadcast equipment and industry trends
- Must be willing to relocate to Washington, DC metro area

Send resume, clips, salary requirements (a must) to:
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Personnel Dept., P.O. Box 1214
Falls Church, VA 22041
No phone calls, please

Advertise!
Call your advertising representative
1-800-336-3045

ADVERTISER INDEX

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Page No.	Advertiser	Reader Service No.
28	360 Systems	161
59	AEQ	80
68	AEV SNC	85
7	ATI	11
66	Air System Technologies	217
7	Altronic Research	113
53	Arrakis	149
67	Arrakis	105
77	Arrakis	172
78	Arrakis	218
42	Audi-Cord Corporation	13
66	Audio Broadcast Group	128
36	Audio-Technica US Inc.	62
95	Auditronics	124
20	Autogram	114
30	Autogram	197
42	Avcom of Virginia	151
65	BSW	148
69	BSW	83
3	Belar	106
54	Benchmark Media Systems	168
44	Bext	61
30	Broadcast Devices, Inc	107
60	Broadcast Electronics	15
81	Broadcast Electronics	122
4	Burk Technology	138
94	C&N Electronics	211
1	CCA Electronics	25
82	CRL	129
54	Circuit Werkes	176
73	Clark Communications	108
44	Coaxial Dynamics	19
30	Comet North America	65
17	Communications Data Service	92
83	Computer Concepts Corp	64
42	Comrex	89
3	Continental Electronics	127
56	Cool-Amp	135
15	Corporate Computer Systems	111
42	Cortana	181
29	Crown Broadcast	98
56	Crown Broadcast	8
11	Cutting Edge	156
72	DCI	22
18	DHK/Audisk	212
8	Dataworld	185
25	Denon America	5
13	Dolby	115
94	Econco	10
44	Econco	21
66	Electro-Impulse	44
54	Electronic Research Inc.	177
44	Electronic Research Inc.	43
10	Enco Systems	68
93	Energy-Onix	188
21	Eventide	74
44	Excalibur	200
16	Fidelipac	45
49	Fidelipac	59
26,27	Fostex Corp.	117
45	Gentner	100
79	Gepco International	104
32	Ghostwriters	81
54	Gorman Redlich	155
89	Hall Electronics	23
12	Harris Allied	70
40	Harris Allied	120
48	Harris Allied	77
84	Harris Allied	79
6	Hnat Hindes	179
68	Holaday Industries	131
54	IFR Systems, Inc.	178
57	ITC	119
43	Inovonics	130
58	International Datacasting Corp.	102
74	Intraplex	38
56	J Squared Technical Service	201
17	Jampro	48
30	Joslyn Jennings Corp.	2
24	KRK Monitoring Systems	49
84	Kintronic Laboratories	150
22	Korg	72
55	MPR Teltech	47
92	Marathon Products	4
85	Marti/Broadcast Electronics	86
31	Micro Technology Unlimited	30
50	Modulation Sciences	35
64	Moseley	147
42	Myat Inc.	24
19	NSN	159
63	Nautel	148
38	Neumann USA/Sennheiser	17
9	Orban	133
33	Pacific Recorders	215
42	Phasetek	154
66	Pike & Fischer	110
66	Popless Voice Screen	67
56	Pristine Systems	6
61	Prophet Systems	144
57	QEI	76
54	Radio Design Labs	12
89	Radio Resources	69
39	Rane	146
2	Register Data Systems	203
34,35	Roland Corp.	57
70	SWR Inc.	167
76	Satellite Systems	52
46	Scott Studios	20
56	Shively Laboratories	16
44	Silicon Valley Power	213
70	Sine Systems	162
56	Stephens Communications Inc	216
87	Superior Electric	187,40
30	Svetlana Electron Devices	214
93	Svetlana Electron Devices	56
23	Symetrix	7
52	TM Century	75
42	Technet	209
66	Telefax	206
37	Telos Systems	9
30	The Management	202
38	The Management	219
62	Tiesseci Snc	169
93	Transcom	50
89	USAFoam	207
56	Universal Electronics	90
93	Varian	171
14	VirteX	26
51	Ward Beck	208
47	Wheatstone	175
96	Wheatstone	84
88	Whirlwind	196
42	Wind River Broadcast Center	109
66	Zercom	34

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Associate Publisher ..... Carmel King
Marketing Consultant ..... Al Leon
Marketing Assistants ... Regan Deatherage, Annette Deutscher
Production Director ..... Lisa Stafford
Publication/Desktop Systems Mgr ..... Julianne Shannon Stone
Classified/Showcase Production Coordinator ..... Vicky Baron
Ad Traffic Coordinator ..... Kathy Jackson
Ad Production Coordinator ..... Lisa Lyons
Production Assistant ... Cristina Strigel, Laurie Anne Tarkington
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Circulation Director ..... Eleya Finch
Circulation Manager ..... Steven Bowman
Accounts Receivable ..... Steve Berto

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U.S. West: Dale Tucker ..... 916-721-3410 Fax: 916-729-0810
International: Stevan B. Dana ..... +1-703-998-7600 Fax: +1-998-2966
Europe: Dario Calabrese ..... +39-2-753-0274 Fax: +39-2-753-2697
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Radio World

FREE Subscription/Renewal Card

I would like to receive or continue receiving **Radio World** FREE each month. ☐ Yes ☐ No

Signature _____ Date _____

Please print and include all information:

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Company/Station _____

Address _____

City _____ State ____ ZIP _____

Business Telephone ( ) _____

Please circle only one entry for each category:

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D. Combination AM/FM station
A. Commercial AM station
B. Commercial FM station
C. Educational FM station
E. Network/group owner
F. Recording Studio
K. Radio Station Services
G. TV station/teleprod facility
H. Consultant/ind engineer
I. Mfg, distributor or dealer
J. Other _____

II. Job Function

A. Ownership
B. General management
C. Engineering
D. Programming/production
G. Sales manager
E. News operations
F. Other (specify) _____

Reader Service

May 17, 1995 Use until August 17, 1995

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Purchasing Authority
1. Recommend 2. Specify 3. Approve

001	023	045	067	089	111	133	155	177	199
002	024	046	068	090	112	134	156	178	200
003	025	047	069	091	113	135	157	179	201
004	026	048	070	092	114	136	158	180	202
005	027	049	071	093	115	137	159	181	203
006	028	050	072	094	116	138	160	182	204
007	029	051	073	095	117	139	161	183	205
008	030	052	074	096	118	140	162	184	206
009	031	053	075	097	119	141	163	185	207
010	032	054	076	098	120	142	164	186	208
011	033	055	077	099	121	143	165	187	209
012	034	056	078	100	122	144	166	188	210
013	035	057	079	101	123	145	167	189	211
014	036	058	080	102	124	146	168	190	212
015	037	059	081	103	125	147	169	191	213
016	038	060	082	104	126	148	170	192	214
017	039	061	083	105	127	149	171	193	215
018	040	062	084	106	128	150	172	194	216
019	041	063	085	107	129	151	173	195	217
020	042	064	086	108	130	152	174	196	218
021	043	065	087	109	131	153	175	197	219
022	044	066	088	110	132	154	176	198	220

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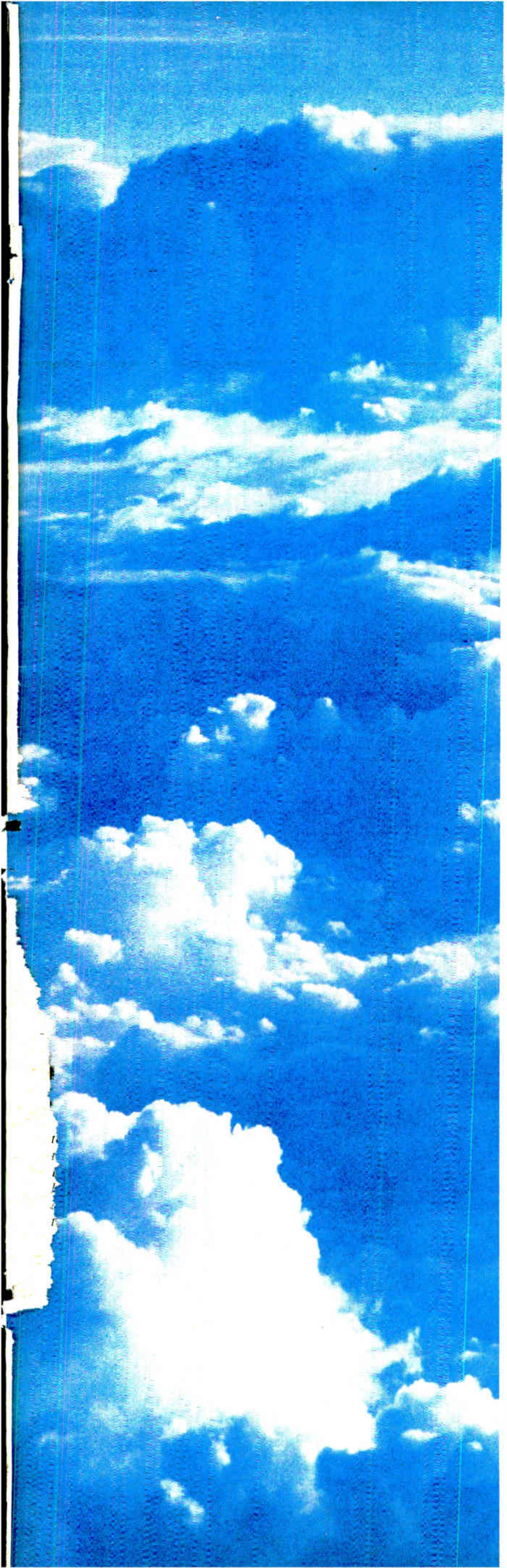

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Wheatstone Corporation

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