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Radio World®

See pp. 25-41

Vol 19, No 26 | Radio's Best Read Newspaper | December 27, 1995

## Portland radio enjoys "Beatles Anthology" on ABC-TV.

Thirty years later, the Fab Four still have what it takes to excite listeners on both radio and TV.

See page 16.

# Ampex, 3M Shake Up Recording Tape Market

**by Frank Beacham**

**NEW YORK** 3M announced it will cease making its Scotch brand tape products while Ampex sold its tape manufacturing division to a group of its creditors.

Both companies were tape recording pioneers with roots extending to the earliest days of magnetic audio recording in the United States which began just after World War II.

Ampex — using a $50,000 advance from the singer Bing Crosby — based the first professional American tape recorder design (the Ampex Model 200) on the German Magnetophon, a machine brought to the United States after the war by Jack Mullin. After studying a paper-based tape created by the Germans, 3M produced the first professional quality magnetic recording tape in 1947.

### Reorganization

As part of a company reorganization, 3M said it will discontinue its historic audio and video tape business in about a year.

"Despite strong efforts and many successes — including a leading market position — this business has not been able to achieve a satisfactory return on investment in recent years because of intense price competition," said L.D. DeSimone, chairman and CEO of 3M.

"And we don't see the prospect for significant improvement," he said. "While this is a decision we are not happy to make, it is the right thing to do."

3M said the audio and video tape business, as well as 3M's data storage and imaging systems businesses, will be treated as discontinued operations for financial reporting purposes.

### Surprise departure

"Customers of all businesses can count on 3M's full attention and support during this transition," DeSimone said.

The surprise departure from the tape business by 3M will result in the reduction of 5,000 jobs, most within 12 months, the company said. Of the 5,000, about 3,000 will be in the United States — about 2,400 in Minnesota.

However, taking advantage of growth, attrition and other options, 3M said it expected a much smaller number of involuntary layoffs, perhaps 1,000 to 1,500 in the United States and half of

continued on page 14 ▶

# *What Was; What's to Come*

**by Lynn Meadows**

TOP stories of 1995

**RW** came up with 15 top stories for 1995. We look forward to the conclusion of several of these stories in 1996.

Actually, seven stories are about non-events. Take the story on Digital Audio Broadcasting (DAB). Sure lab tests were completed this year, but it may be 1997 before the standard meant for early 1996 is announced.

Likewise, the new Republican Congress created a stir this year when members discussed the merits of National Public Radio and ownership caps for radio. But NPR received funding through 1998 and the telecommunications bill is not a law yet.

WJDM(AM) made it to the AM Expanded Band, but the allotment plan released in 1994 is being redone for 1996. Integrated Services Digital Network (ISDN) lines are becoming more available. But the FCC's aborted attempt to charge per channel left broadcasters with a confusing variety of Subscriber Line Charges.

The industry is close to a High Speed Data Subcarrier standard, but DAB test problems delayed the HSDS lab tests by hogging the testing room at NASA Lewis Research Center in Cleveland.

The fate of spectrum allocation for Satellite Digital Audio Radio Services (DARS) is still debatable although proponents are looking for a decision in early 1996.

The remaining stories are a good read to recall the progress that was made during the last twelve months.

Infinity agreed to make a "voluntary contribution" to the U.S. government in lieu of an extended legal battle over indecency. This story also may return in 1996 especially if the Supreme Court agrees to hear a case on the FCC's rights regarding safe harbors.

Radio became one with the Internet. Eureka-147 dominated the international DAB scene. Big radio groups got bigger. The FCC finally ruled on the Emergency Alert System. The Electronic Industries Association made inroads with a Radio Data System (RDS) promotional campaign. And throughout the year, radio had plenty to talk about.

In sum, 1995 was a good year for discussion, debate and Notices of Proposed Rulemakings. Now fasten your seat belts and get ready to rock 'n' roll in 1996.

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World Radio History

# NEWSWATCH

### ABC Radio to Help Radio AAHS Operate

**DALLAS** ABC Radio Networks and Children's Broadcasting Corporation (CBC) entered a joint operations agreement last month in the development of CBC's Radio AAHS Network.

Radio AAHS, the 24-hour children's radio network, will receive support from ABC to aid in the development of operations. Such support will include affiliate sales, national advertising sales, international sales, research, marketing, promotion and technology.

"ABC Radio Networks has been captivated for some time with the idea of radio for children and we are delighted with this agreement," said Bob Callahan, president of ABC Radio Networks.

Radio AAHS is licensed to stations in 29 markets and reaches approximately 30 percent of the country.

### AM Still Popular

**NEW YORK** Forty-five percent of the population tunes into AM radio according to a radio study by Eastman Radio. The study used listening estimates produced through Arbitron Maximi$er and Scarborough for the top 50 Spring 1995 markets.

Vice President Director of Research and Marketing Charlie Sislen said, "We also found that AM listening differs greatly by age group, but all demographics can be reached on AM."

As a rule, the more highly populated metros had a larger AM penetration, according to the study. The 12+ AM penetration in Pittsburgh was 32.3 percent while in Norfolk, Va., it was down around 11.6 percent.

Eastman Radio concluded that "few advertising media are as effective as AM radio at reaching upscale adults." Scarborough showed that AM radio reaches 41 percent of households with incomes of $50,000 or more and 46 percent of all adults that have household incomes above $100,000.

### Radio Is All You Need

**WASHINGTON** January marks the second annual National Radio Month. The theme this year will be "Radio's All You Need." The National Association of Broadcasters mailed media kits in November to over 11,700 radio stations nationwide. If you did not receive a kit, contact B.J. Cohen at 202-775-3510.


When looking for a digital audio system for automation of satellite programing or live assist, there would appear to be many choices. But if you're looking for a system which is flexible enough to give you total control without sacrificing your sanity, there is only one choice. The Phantom by RDS.

You will see the difference as soon as you see the Phantom in action. The display provides you with all of the information you need to see in a clean, concise manner, without the crowed look that you'll find in other systems. If you are familiar with the most popular software on the PC, then you may already know how to use the Phantom. The Phantom's pull-down menus guide you through all of the steps involved in setup and daily operation, from creating and scheduling clocks to creating and editing logs.

The PHANTOM
Digital Audio Automation

The Phantom ends the confusion of automation by keeping everything organized. The Phantom simplifies your daily operations by keeping information such as input changes, voice changes, and clock changes in their own individual schedules rather than in the log. You can leave those liners and other voice drops out of the log because the Phantom will do them for you. The Phantom allows you to date new schedules to begin weeks, months, or even years in advance. When your satellite network informs you that there will be a voice substitution on Thursday, two weeks from today, you can prepare for it *today*.

The Phantom can retime spots to fit them cleanly into a satellite break without inserting silence, overlapping, or running late. The Phantom can create reports to keep you informed on a number of topics, from a list of expired spots to an analysis of potential mistakes in your log. The Phantom also maintains a history of system activity.

The Phantom has the features that others would want you to believe are theirs exclusively. The Phantom remains *completely* functional during recording, sensing relay closures and starting breaks as easily as it does when it is not recording. The Phantom can fill incomplete breaks with spots from a list you specify without ruining product separation.

While other systems tie your hands and limit your flexibility by only offering 3 or 4 inputs, the Phantom gives you 6 stereo inputs, using its AMX-84 solid state switcher, with the option of increasing the number of inputs to 14 or more. If your station is News/Talk, you know how important this can be.

The Phantom allows you to change the sampling rate, digital format, and stereo/mono settings at will to meet your needs for an individual spot. The Phantom offers a number of digital formats, including the new Dolby AC-2 format, as an option.

*Call us today to find out how your station can benefit from the advanced technology of the Phantom and the experience of RDS.*

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P. O. Box 980, Perry, GA 30169

REGISTER DATA SYSTEMS

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World Radio History

# Cyber Mate for the Radio

TOP stories of 1995

**by Alan Haber**

**WASHINGTON** After an explosive showing on the Internet in 1995, radio may well have found one of its most valuable and powerful promotional partners.

Radio and the Internet may not initially have seemed like kissing cousins, but that is indeed what they have become: the two have entered into the quintessential cyber-marriage, complementing each other in wedded bliss on the World Wide Web.

### Once there were 200

At the beginning of 1995, there were about 200 radio stations with Web sites, catalogued on a variety of comprehensive lists, including one that is part of the Yahoo search facility (http://www.yahoo.com/Entertainment/Radio) and another that is maintained by Ted Young, chief engineer at WMBR-FM, the Massachusetts Institute of Technology's radio station.

According to Young, there are now about 900 stations on WMBR's exhaustive list (http://www.mit.edu:8001/activities/wmbr/otherstations.html). Just under 700 are domestic; the rest are international. Young said that about 70 percent of the stations on the list are commercial. At the beginning of the year, he said, there was a much higher percentage of non-commercial stations on the list.

What has made stations look to the Web in a serious way? A year ago, said Young, a lot of commercial stations were starting to figure out that "perhaps they can help their revenue" by erecting a Web site.

"I think (stations) feel now that (a Web site) possibly has some monetary return — if not now, then maybe somewhere down the road," he said.

### Radio became aware

This is the year that radio became aware of the Internet, said John Williams, whose 440 International site (http://www.440int.com) is a veritable cornucopia of delights for radio fans. The site features popular culture tidbits that can be used by on-air personalities, a variety of broadcast-related consulting services, and an extensive catalogue of information on great DJs and stations.

**Radio may well have found one of its most valuable and powerful promotional partners**

Williams, one of the original "Boss Jocks" (as Johnny Williams) from the mighty KHJ-AM in "Boss Angeles," also views 1995 as an explosive year for people on the Internet.

"America OnLine, Compuserve, and the other on-line services have become very aware of the World Wide Web," he said.

Technology, said Williams, "is improving so rapidly with the new, upgraded (Web) browsers and Windows 95, making it so much easier to set things up and go surfin'. Hang on for direct, fiberoptic and/or satellite connections. You ain't seen nothin' yet."

Williams thinks 1996 "will be the explosive year for radio on the Net because people, in general, are so World Wide Web-conscious now." Radio stations are conscious of the benefits of being on the Web, especially the revenue-producing aspects of having a Web site.

### Focus

The focus in 1996 will be on zeroing in on the return on a station's investment in its Web site, according to Peggy Miles, president of Intervox Communications, an Internet interactive communications and database marketing company, whose clients include EZ Communications' 21 radio stations.

Miles said stations can realize a return on investment, in the form of revenue, in several ways: by including advertising on their sites, by selling sponsorships of topical information and events, by selling Web sites to advertisers, by selling links to preexisting advertiser Web sites and by selling or providing Internet access to listeners where income can be realized from access fees.

With all of the possibilities for drumming up revenue for and increasing awareness of stations, it is no wonder radio is in love with the Web. Being able to download airable news bites and scripts from a site like RadioSpace (http://www.radiospace.com/welcome.html) surely doesn't hurt. In fact, being able to reach out to current and potential listeners — who may live clear on the other side of the world but can listen to a station in real time via one of the audio technologies in use on the Web, such as Real Audio (http://www.realaudio.com) and Xing (http://www.xingtech.com), doesn't hurt, either.

RadioSpace's Steve Murphy thinks the number of radio stations with Web sites will probably jump to a couple of thousand within the next year. Looking back on the explosive growth realized by radio on the Internet in 1995, it's not out of the realm of possibility.

# *U.S. DAB on the Slow Track*

TOP stories of 1995

**WASHINGTON** The progress of digital audio broadcasting slowed considerably this year, after a couple of major setbacks to the testing process.

Public demonstrations were made for the first time of the USA Digital Radio systems in a mobile environment (both AM and FM in Las Vegas during the NAB spring convention) and the AT&T system at World Media Expo in New Orleans.

Meanwhile, the international community decided on a world digital radio standard, Eureka-147 DAB.

The AT&T system is an IBAC (in-band, adjacent channel) DAB system designed for the FM band. AT&T also had hoped to have an over-the-air demonstration of the Amati system at the World Media Expo, but that is now slated for next year.

USA Digital Radio also announced it had reached an agreement with National Semiconductor Corp., a chip manufacturer, to produce integrated circuits for consumer DAB gear utilizing USA Digital Radio's technology.

U.S. proponents are still embroiled in debates over multipath conditions set up during the lab portion of the testing (under the aegis of the Electronic Industries Association and the National Association of Broadcasters digital audio radio subcommittees) and progress on selecting a digital standard for the country has practically come to a standstill.

The field portion of the testing, set to begin in the fall, is now not scheduled until after proponents have been allowed to modify their systems — in response to a modification being allowed to the Eureka-147 system for the field portion of the testing.

The goal for a December 1995 recommendation to the Federal Communications Commission by the EIA has now been pushed back to at least third quarter, 1996.

The latest on testing and development of the U.S. proponents' DAB systems included the news about hardware modifications to help ameliorate the cost of moving from analog to digital radio. Harris Allied, for example, demonstrated that USA Digital's IBOC system is fully compatible with a Harris DX-10 digitally modulated transmitter. The transmitter had no problem handling both an analog and digital AM signal.

Modifications to the transmitter to receive and transmit the digital signal are minor, and involve about 20 minutes of work, according to company executives.

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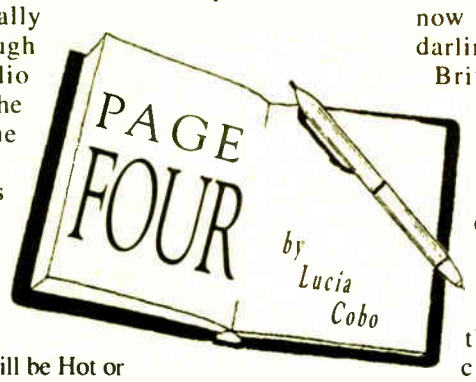
World Radio History

# The Ins and Outs, But Are They Hot or Not?

**WASHINGTON** As the year winds to a close, media watchers everywhere are compiling their annual What's Hot (In) and What's Not (Out) lists. Here at **RW**, we could not, of course, pass up the opportunity to do the same.

What is most Hot these days is merger mania. Despite Capitol Hill, this industry is going to consolidate with the blessings of the Federal Communications Commission. So for now, telecom reform is Out, and mega radio groups are In.

What that also means is that Group W Radio is In and CBS Radio is Out. (Or is it the other way around? After all, Group W actually bought CBS although the Group W Radio name is Out and the CBS Radio name remains.)




The Las Vegas Hilton, site of many of NAB's best and worst moments, is Out. In with the Sands — jury is still out on whether this will be Hot or Not.

The really big 'Vegas Out this year is the old Landmark Hotel that was finally demolished after years of sitting vacant and run down. NAB veterans will no longer gaze upon its empty shell as they stroll from the strip to the Hilton (oops, they won't be strolling to the Hilton either, never mind ...).

ISDN hit it big this year, obsoleting the old two tin cans and a string for those out there who can actually get the phone company to understand that: Yes, it does offer ISDN service in the United States.

Eureka-147 is sizzling around the globe while here in the states DAB testing has all but frozen in its tracks. Lab testing is Out. Field testing isn't happening yet, so I guess we are at a standstill.

On a glitzier and more musical note, the Fab Four are back In and we can all bid a fond adieu to the Grateful Dead, who are Out.

Crooner Tony Bennett is Out and Ol' Blue Eyes himself, Frank Sinatra, is In, still.

On a similar note, the Disco mania that swept the airwaves in 1994-1995 is Out and Talk Radio re-emerged as the In format for 1996's big election agenda. Howard Stern remains In, as evinced by the fact that Infinity Broadcasting ponied up in excess of $1.5 million dollars to the FCC to keep its bad boy on the air.

The wonderkid of the early 1990s, Modern Rock, is Out, while the more commercially viable alternative-leaning CHR is In.

Benedictine Monk music also is Out — giving way to the posthumous success of Selena, Hispanic America's version of Madonna.

The much-ballyhooed trial of the century mercifully is over — and Out, as is OJ. In now is the erstwhile darling of the Royal British family, the Princess of Wales and her torrid romances. Lady Di has eclipsed Charles in a bid for the adulation of the royals-adoring brits.

Closer to home, the three-time Super Bowl champion Washington Redskins are down and Out. In as the hot topic of conversation (Will they or won't they move to Baltimore?) are the Cleveland Browns.

The Fabulous Sports Babe took sports airwaves by surprise — she is definitely In. Out is former Nixon impresario Gordon Liddy and his award-winning talk show.

Sad but true, in markets outside the top 50, DJs seem to be Out and hard drives seem to be In.

On a nostalgic note, DXing looks to be on its way Out and RealAudio, or Internet radio stations seem to be In.

Likewise, the World Wide Web is In and the Atari 2600 is Out.

Analog still sounds great but digital is the buzz.

Paradoxically enough, thanks to the overzealous former News/Studio Sessions editor of **RW** and current editor of **Pro Audio Review**, the irreplaceable John Gatski, tubes are Out and tubes are back In for 1996.

Thanks to the current technical editor of **RW**, Alan Peterson, *From the Trenches* is Out and the *World According to ARP* is In.

In are regional trade shows targeting radio and

Howard Stern is still hot.

The Beatles are back in style.

Selena is enjoying posthumous success.

Out is the trying-to-please-no-one-but-our-bottomline World Media Expo show.

There you have it. I am sure we missed a few, but if you think of them and would like me to update the list in a future column, write or e-mail care of **RW**.

That's it for now.

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World Radio History

# 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.

### Striking a chord

Dear **RW**,

The *Guest Commentary* in the Oct. 18, issue by John Bisset hit home with me.

I couldn't have written the article better myself. I am a perfect example of the disgruntled engineer that left the radio industry for a much brighter and much more satisfying career in the cellular telephone industry. John is right, the jobs are out there, especially in cellular.

After spending 15 years in the business, I realized that there had to be a better way to make a living. Most of my last six years in the radio were spent working for a general manager/salesman that simply refused to try to understand anything about the technical side of the business. As a direct result of this attitude, several incidents occurred that are now very funny to contemplate.

The most famous incident began after a locally severe thunderstorm had taken out all four final tubes in the station's auxiliary transmitter. Granted, these tubes were not and are not cheap, even rebuilt ones. However, to insure that the station could stay on the air if the main transmitter went down it was necessary to replace all four tubes. After explaining the situation to the general manager and the need to replace the tubes, I was told that I could only purchase three tubes to replace the four bad ones.

I tried in vain to explain that the transmitter required four tubes to operate, and buying three would not solve the problem. I even tried to approach the problem from a logical standpoint that he could understand. I explained that the problem was like having four flat tires on a car. Obviously it is necessary to replace or repair all four tires or the automobile is not going to operate properly, if at all. This approach did not work.

Guess how many tubes I was allowed to purchase — yes, only three. In the end, I scrounged around and finally found an old beat-up tube at another local station that would at least allow me to turn the transmitter on without throwing the plate breaker.

I realized later that because the general manager approached every situation from a sales standpoint, he probably thought I was trying to negotiate and he therefore was willing to compromise by allowing me to purchase three instead of four replacement tubes.

The above situation was typical of many I faced during my 15 years in broadcasting. When I finally got fed up I was able to find a very good position with a nationally known cellular telephone company.

The number of hours I work per week now seldom exceeds 50 and I will make more money in my first year in the business than I did in any single year in broadcasting.

Bisset is right, the jobs are out there. The jobs are out there with much better hours, benefits and at least equal pay with a chance for advancement. The only problem I have now is explaining to my kids why daddy is always home on the weekends.

*Dennis Pharr*
*AT&T Wireless Services*
*Oklahoma City*

### Offense is best defense

Dear **RW**,

For the movie version of John Bisset's *Guest Commentary* "Radio Losing Best of Its Engineers" perhaps we could get Rick Moranis to play the part of the poor maligned, mistreated staff engineer who triumphs in the end. He'd be tirelessly toiling in the background, hoping that his efforts would be noticed and appreciated, hoping that management will "... communicate that he is on the team."

In our movie the general manager's girlfriend dumps him for our engineer, and the staff carries our guy out on its shoulders as we roll the credits. Dream on.

Fact: If you work in an environment where your co-workers and superiors possess more powerful interpersonal skills than you, regardless how technically proficient you are, you have a serious problem. The good news is that addressing it is easier than you think.

If your goal is to feel appreciated, fulfilled and a member of the "team," you need to talk the talk and walk the walk of a high-powered person. That means every interaction with another managerial staffer must be prepared in advance and must be targeted towards a specific goal.

Let's apply this theory to Bisset's example of the engineer who was required to "... work all night and then be in attendance for a 9 a.m. meeting on Monday. He should have approached the general manager sometime the previous Thursday or Friday and quickly listed the engineering items for the Monday meeting. Hand the general manager a copy of those agenda notes and ask him or her: "Could you discuss these items at the Monday meeting, or would you prefer I meet with the staff members involved myself?" Then be quiet and wait for an answer.

Let's examine that strategy. Our engineer provided his boss two specific alternatives at first: You discuss my items at the meeting or I'll do it outside the meeting — take your pick. Notice our guy didn't ask whether he had to be at the meeting. He presumed it would not be required, while simultaneously acknowledging concern for the station's needs. But, hey, maybe this general manager is a real Neanderthal and he says: "Be at the meeting or you're fired!" You'd better be ready for another round in this interaction. Our engineer responds with: "I understand. I'll check with Traffic to move my maintenance to another night besides Sunday. Do you have a preference for which night?"

This time it is an open-ended choice. At this point in round two, I believe the next person who speaks loses. Learn to ask a question and be quiet. It is a powerful skill.

When you must motivate decisions from others and you have an interest in the result, don't whine about it, prepare! I'd suggest you script out what you believe the conversation's possibilities are and your first and second choices for outcome. Do this planning to at least two levels of resistance at first. Privately rehearse the conversation in advance. Wait to ask your questions until you have his or her undivided attention. Eye contact is a good indicator.

Before you think this kind of strategy is something exotic, you should know that the salespeople (which probably includes the general manager) have all had this stuff. The good ones use it instinctively. They weren't born with it. It comes from books by authors like Og Mandingo, Zig Ziglar and Tom Hopkins.

You must cultivate these instinctive skills, which requires study, preparation and practice. It'll become easier with time for two key reasons: 1) you'll learn automatically to structure your words to steer the decision your way and, 2) your co-workers and superiors will hold you in greater esteem because you exhibit assertiveness and leadership qualities they admire. Stress in other parts of your life will be more manageable too.

I think I like that movie ending best of all.

*Frank McCoy*
*Skywave*
*Chicago*

## Managing Change

The word seemingly on everyone's lips these past few years has been "change." Recapping 1995 as we look ahead to 1996 asks the question: Whither will change lead the broadcast industry?

Technologically speaking, the evidence of change has been in place for a few years, although much of the effort seems to have come to a head in 1995. This year we witnessed the first public, mobile demonstrations of in-band, on-channel and in-band, adjacent-channel digital audio radio. This year also marked the launching pad for Eureka-147 DAB around the world, with countries as diverse as the United Kingdom, Poland and Germany (to name a few) going on-air with digital audio radio (new band).

The AM Expanded band project for AM broadcasters was set in place two years after the commission completed its overhaul of AM technical criteria — only to be yanked back for "re-calculation" — leaving only WJDM Elizabeth, N.J., to enjoy its expanded band frequency allotment.

The same industry that expedited a voluntary standard in 1993 for radio broadcast data system (RBDS) has shuffled along, adding the equipment but lagging in the full exploitation of the technology.

ISDN, has, on the other hand, made tremendous inroads into the world of radio with equipment suppliers and manufacturers fueling the growth of this versatile technology for radio. The regional Bells are all promising 100 percent availability of ISDN anywhere in the United States.

And of course, 1995 has been the year for on-line radio. The potential of the Internet is tantalizing broadcasters with the promise of a worldwide audience and a new promotional partner for its commercial efforts.

The era of regulatory change that many expected with the Clinton Administration has not really materialized. Vice President Al Gore's reputation for embracing new technologies has remained that: a reputation. The expected shift to re-regulation has instead resulted in a Congress and an FCC willing to lift and loosen many of the regulations governing the broadcast industry. Anticipated deregulatory change has in fact led to some of the biggest deals of the industry's history with entire groups swallowing broadcast legends whole.

A more capitalistic FCC, led by Chairman Reed Hundt, is looking for money from auctioning of future spectrum allocations as well as increased spectrum fees, at the same time streamlining staff and operations within the agency.

Economic indicators point to growth in advertising at a respectable pace for the remainder of the 20th century. We are well past recovery and into real growth as a business.

Technology, regulatory reform, economic growth. These words of change continue to lead the way for broadcasters — if at a somewhat slower rate than anticipated. Time will show how the industry and the country handle the changes looming on the horizon. For now, the potential continues to excite.

**-RW**

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**Next Issue of Radio World January 10, 1996**

World Radio History

# FCC to Rule on Digital Audio Radio Services

**by Angela Novak**

**WASHINGTON** The Federal Communications Commission (FCC) allocated spectrum in the 2310-2360 MHz (S) band for satellite digital audio radio services (DARS) and predictions indicate that satellite DARs will be broadcasting by 1998.

The FCC issued its Notice of Proposed Rulemaking (NPRM) in June and asked for comments to the notice to be filed by Sept. 15. The deadline for reply comments was Oct. 13.

The FCC is now working on the Report and Order, which is expected to be adopted in the first half of 1996. Once it is adopted, licenses will be issued.

Still up for consideration is the question of spectrum allocation. Four applications are currently on file at the FCC. The National Association of Broadcasters (NAB) stated in its comments that the spectrum should be opened to new license applicants.

In September, the FCC granted a waiver to Satellite CD Radio, one of four DARS applicants on file at the FCC, granting authorization to spend up to $10 million towards construction of its satellite system. The FCC stated that the waiver does not guarantee that CD Radio will be granted a license and that they will build "solely at their own risk."

Reaction to the allocation was mixed. The news was eagerly received by proponents of the service. The four system proponents with applications on file at the FCC, Satellite CD Radio, American Mobile Satellite Corp., Digital Satellite Broadcast Corp. and Cue-Prime, have waited for the FCC action for over a year.

The National Association of Broadcasters (NAB) voiced its concern over the impact DARS will have on local radio and the potential economic harm it could cause broadcasters.

The Electronic Industries Association (EIA), which represents receiver manufacturers, noted that terrestrial stations will soon have their own digital services and therefore should not see the satellite service as a threat.

The NPRM stated that opponents of DARS must prove that it is not in the public interest.

Specific issues addressed by the notice included: the number of licenses to be granted, the amount of spectrum per license, selection of licenses when mutually exclusive applications are filed, and license classification.

The commission asked for comments regarding the impact on local broadcasting, the possible change in listener patterns, forced changes in programming and the impact on advertising revenues.

During the comments period, the FCC heard from hundreds of local stations and the NAB. The most frequently mentioned concern was that DARS will harm local stations by fragmenting local audiences.

Comments also stated that DARS should be strictly subscription-based and that the FCC should wait until terrestrial digital audio radio was available before introducing satellite DARS.

Circle (18) On Reader Service Card


# HSDS Waits for DAB

**by Christopher Nicholson**

**WASHINGTON** The radio industry is still waiting for testing to begin in order to set a standard for a high speed data subcarrier. The testing is ready, but has been delayed due to digital audio broadcasting (DAB) testing at NASA Lewis Research Center in Cleveland.

According to the Electronic Industries Association (EIA), testing should be in full swing by Jan. 1, 1996, and has been allowed 60 working days to be completed.

The test categories include calibration, characterization of signal failure, reacquisition, and adjacent channel interference. In addition, the tests will look at how a High Speed Data System (HSDS) is affected by an analog program; how HSDS affects an analog program; and how HSDS affects analog subcarriers, RBDS and 57 kHz paging.

Testing will be done on three systems vying to become the voluntary industry standard. Seiko and the Federal Highway Administration are working together on Seiko's HSDS in conjunction with Delco and IBM. The prototype program is taking place in Seattle.

Mitre's Subcarrier Traffic Information Channel (STIC) is being sponsored by the FHA and will equip 200 cars for a program in Atlanta similar to that in Seattle. Scientific-Atlanta licensed the patent for STIC and is working on the project as well.

Digital DJ's FM Subcarrier Information Service (FMSS) is a modified version of NHK's Data Radio Channel (DARC) used in Japan. While not compatible with other subcarriers, FMSS is compatible with in-band, on-channel (IBOC) systems and uses a bandwidth that stretches from 60 to 90 kHz.

Included among the many possibilities of high speed data subcarrier technology are stock reports, sports, news, weather, logos and promotions. Currently, radio stations in San Diego; Seattle; Portland, Ore.; Los Angeles and the Netherlands are using HSDS commercially as a paging service with wristwatch pagers.

# Mergers Push Limits

**WASHINGTON** Radio witnessed the formation of its first "mega" group this past July when Westinghouse Electric Corp. announced it would be purchasing CBS Inc. for $5.4 billion. Just one day prior, the Walt Disney Co. announced its $19 billion deal to merge with Capital Cities/ABC Inc.

The Disney-Capital Cities/ABC merger is still pending, hinging on approval by the FCC and Justice Department as well as the shareholders of each company. Capital Cities/ABC, which will become a wholly owned subsidiary of Disney, brings (among other operations) 21 radio stations, and radio networks serving more than 3,400 radio stations into the agreement. The combined enterprise will be known as The Walt Disney Company.

When the U.S. House of Representatives passed the telecommunications bill of 1995 two days after Westinghouse's announcement, the way looked clear for Westinghouse to be allowed ownership of 39 radio stations in 13 markets. Of the 39 stations, 36 are in top 10 markets and the remaining three are in the top 15.

But the bill lifting ownership limits did not make it to the president by the time the FCC reviewed the Westinghouse deal on Nov. 22. Still the FCC granted temporary and permanent waivers that allowed the company to go over the top. When the merger officially closed on Nov. 24, Westinghouse surged closer to its goal of owning the best four facilities in the top 10 markets.

Earlier in July, Evergreen Media signed a definitive merger agreement to acquire Pyramid Communications. By adding Pyramid's 12 radio stations, Evergreen will own 34 total stations and will add duopolies in Boston and Philadelphia to its operations. The deal, which is expected to be closed in the first quarter of 1996, is worth $306.5 million plus an adjustment for net working capital.

At the beginning of August, Chancellor Broadcasting signed a definitive agreement to acquire 19 radio stations owned by Shamrock Broadcasting. The transaction, with a capital value of $395 million, is still awaiting FCC approval and is expected to be completed in early 1996. The deal will establish Chancellor as the third largest pure radio company in the United States, with 33 stations — 21 FM and 12 AM.

In a three-way deal announced in November, SFX Broadcasting entered into a definitive agreement to acquire Liberty Broadcasting for $223.25 million and simultaneously sell 11 of the Liberty stations to Multi-Market Radio (MMR) for $100.1 million. In addition to the eight Liberty stations that SFX will retain, the company owns, operates or has agreed to acquire 23 radio stations in nine markets. MMR owns and/or operates 15 stations in eight markets in addition to the 11 it will acquire through the SFX deal. The transactions are still awaiting FCC approval.

According to BIA Publications, 899, or nine percent of all radio stations have been sold or announced a proposed ownership change in the first nine months of 1995. Country stations saw the most activity with 155 sold, followed by adult contemporary stations with 125 sales. Sports stations came in third at 118.

*— Christopher Nicholson*

World Radio History

# Plug and Play ISDN

**by Lynn Meadows**

**WASHINGTON** In Europe, Integrated Services Digital Network (ISDN) is plug and play technology. In 1995, on this side of the Atlantic, ISDN was order and pray technology — pray that it worked.

But several telecommunications companies are hoping to change that impression in 1996. AT&T, Ameritech, BellSouth, NYNEX and Pacific Bell are working with Boca Research, IBM, Intel Corp., Motorola and U.S. Robotics to make ISDN easier to order.

Their goal is to develop about four standard codes that will be easily identified by customers and highlighted in documentation provided with ISDN equipment. For the participating telephone companies, the codes will represent a certain type and configuration of ISDN service. Customers will be able to request an ISDN line with a certain configuration and instantly be understood by the service provider.

Bill Smith, Executive Director, Broadband Multimedia for BellSouth, helped arrange the coalition. He admitted that some customers have "horror stories" of trying to order ISDN. Part of the problem is that customers do not always know what type of ISDN they need and often they are not able to get much help from their local company. Look for that to change in 1996.

The new codes could make life easier for engineers who use ISDN in their remotes. Likewise, stations on the Internet may enjoy more hits as consumers better understand the technology and begin using the ISDN lines to access their Web pages faster.

Mike Simpson, president of Midcom Inc. in Dallas, has worked with European broadcasters on different occasions.

"They just can't believe how screwed up U.S. ISDN is because all of Europe is identical," he said. Simpson said that ordering ISDN was easier compared to a few years ago.

Like many broadcasters, Simpson has questions about Subscriber Line Charges (SLC) that were left unanswered in 1995. Simpson set up the Midcom NFL/ISDN Co-op earlier in the year to equip all 29 football stadiums in the league with ISDN. He said the bills he receives from various phone companies have inconsistent SLCs.

At the beginning of the year, the Federal Communications Commission (FCC) ordered companies to charge an SLC for each of the derived channels in an ISDN line. The Basic Rate Interface (BRI) ISDN line that radio stations use has two voice channels and one data channel.

The Primary Rate Interface ISDN line for transmitting video, however, has 23 channels plus a data channel. The phone companies squawked at the idea of charging for these virtual channels and the FCC never enforced the rule.

The FCC issued a Notice of Proposed Rulemaking (NPRM) in May to receive comments on how the SLC should be calculated. Options include charging one SLC per ISDN line and basing the SLC on the ratio of the cost for providing an ISDN line versus the cost to provide an ordinary line.

Susan Lewis Sallet, spokesperson for the Common Carrier Bureau, said the FCC is working on resolving issues in docket 95-72.

Sallet said they got a "good response" and "lots of comments." But for now, the commissioners "have suspended enforcement of current rules."

Sallet added that the only requirement the FCC has on local phone companies is that they cannot increase their charges to the long distance companies to cover the costs they are not collecting in SLCs from ISDN users. She expected a decision in 1996.

TOP stories of 1995

# 1995 Buoys Talk Radio

**by Alan R. Peterson**

**WASHINGTON** Talk programming got a huge boost in 1995 with the OJ Simpson trial and the Oklahoma City bombing, while simultaneously receiving a lambasting from politicians.

While the murder trial and bombing provided themes for talk radio programming, talk host G. Gordon Liddy was taken to task for questionable material on his show following the Oklahoma City disaster.

In between these national events, issue-driven talk radio on local and regional topics continued to sustain listeners.

During the Winter 1995 Arbitron ratings period, stations airing gavel-to-gavel Simpson coverage increased an average of 173 percent in average quarter-hours (AQH) over a total week, compared to the Winter 1994 period.

During weekday hours, these stations experienced 371 percent growth in AQH.

According to a Focus on Radio publication from Katz Radio Group, stations that programmed nonstop Simpson trial coverage drew listeners away from other formats, including competing news/talk stations programming against court coverage. Urban and country formats also saw approximately 10 percent of audiences shift to the trial.

The bombing of the Murrah Federal Building in Oklahoma City in April provided talk shows with discussions on militia groups, law enforcement procedures and the connections to the Branch Davidian tragedy in Waco, Texas, two years prior.

At a time when emotions were high following the bombing, comments made by national talk host G. Gordon Liddy drew reaction from listeners and politicians. His remarks on defense against illegal entry by federal agents infuriated a number of groups and drew the ire of the president. Ironically, soon after the incident, Liddy was the recipient of the Freedom of Speech award from the National Association of Radio and Television Talk Show Hosts.

Whether local or national, important issues were the engines that drove talk radio in 1995. Following a serious accident near Chicago in which a train struck a school bus, WLS(AM) spent several days discussing different facets of the subject with listeners. According to operations manager Drew Hayes, "That was really when we were serving our listeners and delivering interesting, entertaining and helpful radio at its finest."


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# Caps Not Lifted, Yet

TOP stories of 1995

**by Lynn Meadows**

**WASHINGTON** During the blazing months of summer it looked like nothing could hold back telecommunications reform legislation. With less than two days of debate, H.R. 1555 passed the House just in time for the August recess.

Now, a weary Congress bruised by budget fights will have to heal its wounds over winter break and come back steeled for an almost-guaranteed presidential veto.

When Senator Larry Pressler (R-S.D.) became chairman of the Senate Committee on Commerce, Science and Transportation, he said his goal was for final reform passage to occur in July. The most important part of the reform for radio station owners is the removal of the 20 AM/20 FM station ownership limit.

Most members of the National Association of Broadcasters' Radio Board approved of lifting the caps. Radio Board Chairman Richard Ferguson, president and CEO of NewCity Communications, said passage of the bill was his first priority when he was elected this summer.

Many station owners see the upcoming venture of Satellite Digital Audio Radio Services (DARS) as a paramount reason for deregulation. Because DARS owners will be able to send around 40 digital-quality channels into every market in the country, station owners say they need to be able to position themselves to compete.

To counter the push for ownership deregulation, the Coalition for Broadcast Diversity was formed. Members include Beasley Broadcast Group, Greater Media Inc., Jersey Shore Broadcasting Corp., Meredith Broadcasting Group, and Press Broadcasting Co.

Senators received a fax from the coalition warning them that diversity could be threatened if the ownership deregulation passed.

"Proponents of the effort to remove the caps have a single purpose: To reduce the number of people participating in broadcasting ownership," the letter stated.

Eighteen group owners are either at or over the current ownership limits, according to BIA Consulting. Westinghouse was granted several temporary waivers from the FCC in November for both TV and radio holdings it acquired when it purchased CBS. Others pushing the limit include Evergreen Media and Chancellor Broadcasting.

The conference committee had been expected to hammer out differences between the Senate and House bills in September. But the Senate conferees were not even selected until mid-October. With the government shut-down, discussion of the bill simmered on the back burner despite a push by Pressler and Majority Leader Bob Dole (R-Kan.) to get it through before the holiday break.

Radio deregulation is only a small part of the telco bill. The cable and telephone industries, whose lobbyists have deep pockets, are addressed in depth. With so many vested interests at stake, many people are skeptical that the bill will be able to pass in a presidential election year.

Industry watchers are divided on whether or not the telco bill will be able to pass in 1996. What they do not debate is that the drive to consolidate will continue, with or without legislation.

# NAB Opposes Auctions

**by Angela Novak**

**WASHINGTON** Congress passed legislation that instructs the FCC to auction 100 MHz of spectrum located below 3 GHz by Sept. 30, 2002.

The provision for auctioning broadcast spectrum is part of the budget legislation that is currently being negotiated in conference.

Currently, broadcast spectrum is free to qualified applicants who are granted licenses based on the FCC's current comparative process, which takes into consideration ownership contingencies and community service proposals, among other things. Under the pending legislation, spectrum would be awarded to the highest bidder.

Lynn McReynolds, NAB spokesperson, said that the legislation does not set a good precedent. The legislation could be harmful to minority applicants, for example, who would have been granted spectrum by the FCC based on its current comparative process but possibly would not acquire the spectrum in the proposed auction process.

According to the report that accompanies the Balanced Budget Act, spectrum that would be available for auction includes any that has not been designated by the FCC for assignment by auction and has not been identified by the NTIA as "reallocable" frequencies prior to the enactment date.

The legislation directs the FCC to auction the licenses in blocks of at least 25 MHz unless the FCC determines that a combination of smaller bands proves more cost effective. According to the report, the FCC must promote the most efficient use of the spectrum and take into consideration the cost of having to reallocate current broadcasters' frequencies. The report also states the need to protect public safety users and comply with international spectrum allocation agreements.

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# Hands-Off Operation

**by Lynn Meadows**

**WASHINGTON** In a late-year present to station owners, the Federal Communications Commission (FCC) agreed to allow unattended station operation. The October decision, which became effective Dec. 1, frees stations with satellite feeds from having to hire equipment baby-sitters during overnight operation.

The only string, as expected, was monitoring of the Emergency Broadcasting System (EBS). The FCC has allowed that if stations figure out a way to comply with current EBS requirements, owners can leave the station empty at night in good conscience. Noting the quality of today's broadcast equipment, the FCC said that in many areas, automation seemed to provide "more accurate and controlled operation" than humans.

Meanwhile the switch from EBS to the new Emergency Alert System (EAS) was stalled by five petitions for reconsideration and did not rise to the top of the commissioners' packed schedules until October. In a notice resolving the petitions, the commissioners extended the EAS implementation date to Jan. 1, 1997.

The extension was helpful because manufacturers were waiting to see if resolution of the petitions would require any equipment changes. The original target date of July 1, 1996, would have required some manufacturers to work overtime to get the product volume ready in time.

EAS manufacturers had a strange year. Within days of the NAB spring show, they were told they could show their EAS product but could not sell it or give out prices because it would not be type certified until all the petitions were resolved.

Extension aside, the FCC denied petitions to describe how the Radio Broadcast Data System should be used in EAS. Nonetheless, Gerald LeBow of Sage Alerting, whose system has digital inputs for RBDS, was pleased with an addition to the rules that describes RBDS.

A study by TFT indicated that EBS costs the industry $60 million each year in terms of lost airtime, record-keeping, and staff training expenses. The company said that EAS will reduce that cost to less than one-tenth of that amount.

On July 1, engineers had to ensure their equipment could respond to an eight-second emergency tone rather than the 22-second tone. Several chapters of the Society of Broadcast Engineers (SBE) held gatherings where they modified their old EBS boxes to accept the new tone. After the change, several commented that certain songs set off the alarm.

Heating up the summer was a debate on whether there is a patent on the new EAS protocols. Quad Dimension out of Kansas City has a patent on a system called Storm Alert for Emergencies (SAFE). The system uses Frequency Shift Keying to send geographically specific alarm codes.

SAFE closely resembles the National Oceanic and Atmospheric Administration Weather Radio Specific Area Message Encoder (NWRSAME) used by the National Weather Service. When Quad Dimension alerted EAS manufacturers that they must have a license agreement to use the technology, the FCC turned the matter over to the Department of Commerce.

The DOC houses both the National Weather Service and the Patent office. A reexamination of the patent was expected, but congressional budget matters, including the threat to disband the DOC, stalled the process this fall.

The FCC began reviewing EAS equipment for certification in early December. Acting EAS Chief Frank Lucia said that unless some unusual problems arise, the equipment will be certified in time for the spring conventions.

Lucia said that although EBS could be "crudely automated," it would not work nearly as well with unattended station operation as EAS will. Once EAS becomes effective, stations that run unattended will probably soar in numbers.

Under the new unattended rule, stations will have three hours to correct interference problems once they are discovered. But, unattended or not, stations with serious interference conditions must be able to shut down within three minutes of receiving an FCC request.

World Radio History

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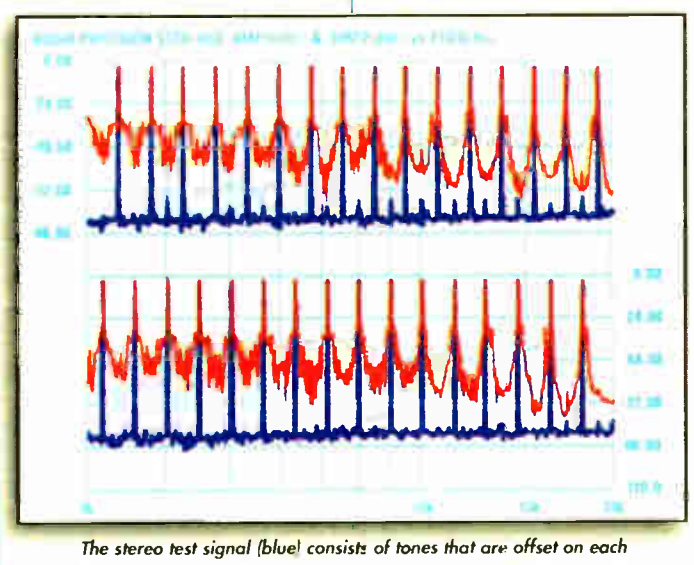

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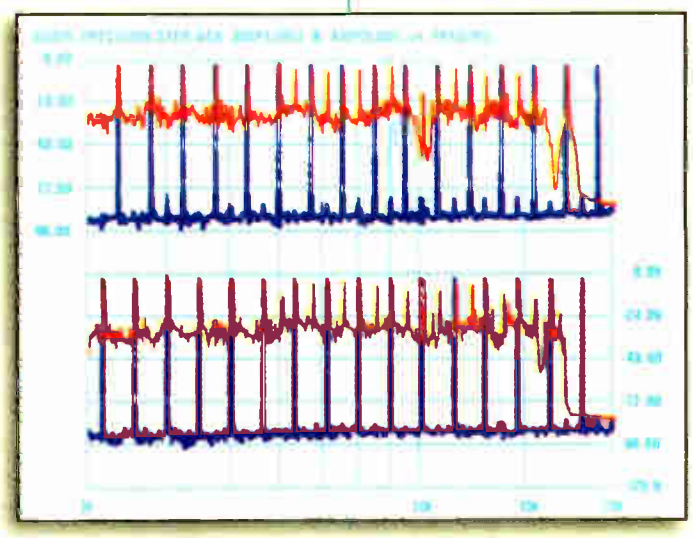

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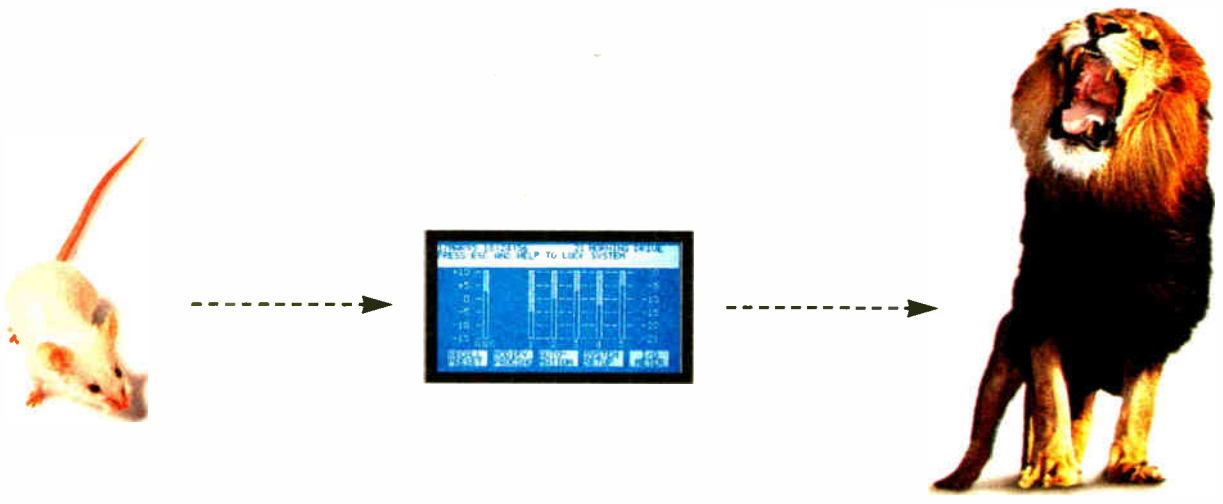

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World Radio History

# Eureka Plows Forward In Europe, World

**by T. Carter Ross**

TOP stories of 1995

**WASHINGTON** Although the future of digital broadcasting in the United States remains mired in test after trial after debate after argument, 1995 was the year that ones and zeros flooded European airwaves.

By year-end, full-scale Eureka-147 DAB pilot programs were on-air in Germany, England, Sweden and Poland. Closer to home, Canada issued the ground rules for transitional licenses for broadcasters ready to make the jump to digital.

The first official DAB pilot went on the air in Germany in August, and additional DAB trials in the German states of Bavaria and North-Rhine Westphalia followed soon after.

A few weeks later, the number of DAB-broadcasting nations grew to three. On Sept. 27, the British Broadcasting Corp. (BBC) and Sverges Radio (SR) inaugurated Eureka-147 DAB services in the United Kingdom and Sweden, respectively.

Although public broadcasters are active in the German DAB pilots, it took the intervention of NTL, the formerly state-run transmission maintenance contractor, to put private stations on the DAB airwaves in Britain.

Before year-end, the DAB presence would expand again with the introduction of a Eureka-147 pilot in Warsaw, Poland.

Of course, this flurry of activity belies the difficulties that Eureka-147 still faces in Europe and elsewhere.

Across Europe, a hodgepodge of frequencies — from space in the L-band to television channels 8 and 12 — are being used by different broadcasters. This calls into question the feasibility of developing Pan-European receivers, the possibility of transborder listening and concerns about interference in border areas. Adding to the diverse number of possibilities is the Archimedes project, which hopes to develop a satellite/terrestrial hybrid DAB system to cover the continent.

The EuroDAB group, which formed at the beginning of the year to address the nitty-gritty issues involved in implementing DAB, has delved into the issue of spectrum allocation, but no real resolutions are forthcoming.

In addition to the issue of where to put DAB, the questions of who and what to broadcast digital were also raised.

In the eyes of more than a few private broadcasters, Eureka-147 is being foisted upon Europeans and Canadians by public broadcasters and the telecoms. Private broadcasters, particularly in smaller Canadian and U.K. markets, wondered throughout the year if an in-band, on-channel (IBOC) or an in-band, adjacent-channel (IBAC) system might not better serve their interests.

Despite interest in the IBOC and IBAC systems shown at NAB and WME during the year, the predominant feeling is that Eureka is a done deal for much of the world and private broadcasters are sure to join reluctantly with national DAB efforts.

Elsewhere in Europe, Belgium announced at the March EuroDAB meeting plans to establish a bilingual DAB outlet for both Francophone and Flemish citizens. At the same time, Hungary began moving ahead with DAB plans with the backing of private commercial stations, while the Popov Research Institute in St. Petersburg, Russia, made the first Russian overtures regarding DAB.

France, too, is ready to go ahead with DAB in mid-1996. Of particular interest is the possible development of DAB-based multimedia applications.

The majority of DAB news centered in Europe and Canada during 1995, but digital radio breakthroughs occurred aground the world.

In Mexico and Australia, successful tests of fixed and mobile satellite-based Eureka systems were conducted. Australia took the additional step of announcing in mid-August plans to build experimental DAB stations in Sydney, Melbourne and Brisbane next year. All of these stations will use Eureka-147 in the L-band; however, IBOC is not being ruled out.

China began construction of a Eureka-147 test center in Beijing and a DAB pilot network in Gungdong province, which is set to begin in mid-1996.

Rumblings of interest were also heard during the year from Argentina, India, South Africa, Latvia, South Korea and Libya.

Among members of the Arab States Broadcasting Union, attitudes are mixed. Some nations, such as Jordan, Algeria and Morocco, are in favor of exploring the implementation of DAB in their regions. Others, such as Syria, are more resistant to the technology.

For many Arab States broadcasters, DAB seems beyond the needs of their nations, many of whom do not use FM to any great extent. Jordan and Algeria, however, argued that it was necessary to prepare for the eventuality of DAB.

International broadcasters also looked to DAB — particularly satellite-based implementations of Eureka-147 — as a possible successor to international shortwave radio.


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World Radio History

# AM Expansion Allotment Plan Under Revision

**by Alan Haber**

**WASHINGTON** It looks as though 1996 may finally be the year that the AM expanded band becomes tangible real estate and radio stations move in as long-term tenants.

TOP stories of 1995

The first proposed allotment plan for the expanded band, issued by the Federal Communications Commission (FCC) in October, was felled partly by problems with the database used to prepare it.

As reported in RW's Oct. 4, 1995 issue, 19 Petitions for Reconsideration, some citing database errors, were received by the FCC after it announced that about 80 AM stations would be given berths in the expanded band. The number of stations that can inhabit the expanded band is limited due to a variety of factors, including Canadian and Mexican border agreements.

A 30-day comment period initiated by the FCC concluded in mid-November of this year and resulted in only four comments being received. At press time, Jim Burtle, leader of the commission's technical facilities group, said the FCC was reviewing its response to the comments.

"We're trying to push it along as fast as we can, because we understand the urgency of it," he said.

According to Burtle, a second proposed plan will hit the streets and go through a 30-day comment period, possibly in early 1996. "Depending on what we receive," said Burtle, "or if we receive anything, that plan may or may not be the final plan."

Once the commission comes up with a final plan, stations will have 60 days to file Form 301.

Burtle said that some of the stations that made the allotment list last year might not find themselves on it this time around. WJDM-AM in Elizabeth, N.J., is still guaranteed an expanded-band dial position, thanks to a law signed six years ago by former President Bush. It is possible the dial position may not wind up being at 1660 kHz, as delineated in the Special Temporary Authority granted the station by the FCC this spring. Elizabeth is the largest city in the country without nighttime service.

Improvement factors will be recalculated, said Burtle, "which will result in a reordering of the stations. Some of them might be greatly affected and some might not be affected at all." Once the commission has the new reordering of stations, he added, "then we'll start with calculating a new allotment plan from that."

All 688 AM stations in the running for expanded-band berths last time are still in the game for this second round.

"It's just that the order of their consideration might be changed, and that will determine the order in which we calculate them, and, of course, the allotment plan will be different," said Burtle. Stations get a "slight preference" in the ranking, Burtle said, if they also upgrade to AM stereo.

The signal quality for stations in the expanded band will be "very good," according to Burtle, because the stations will be "well-spaced." Burtle said that the expanded band is going to be markedly different than the regular AM band. "If you find a station up there that you can listen to," he said, "it's going to be very good quality."

Burtle said that another window of opportunity is prescribed in the expanded-band rule making; there may be slots to fill if, for example, stations that receive allotments do not follow up with their Form 301s.

# *NPR Funding Safe For Now*

**by Angela Novak**

**WASHINGTON** Congress voted to continue funding for National Public Radio (NPR) through 1998, rejecting some members' proposals that funding be cut off for the Corporation for Public Broadcasting (CPB).

The house voted to reduce funding for the CPB from $308 million to $240 million for the next two years. At press time, the senate had not yet voted on the cuts, which are therefore subject to change.

The proposed elimination of federal funding for public broadcasting drew both criticism and praise and has forced the public broadcasting industry to re-evaluate its role and strategy within the broadcast industry as a whole.

Hearings were held in September to explore the possibility of making public broadcasting self-sufficient. Eight public radio proponents presented ideas for guaranteeing the long-term stability of public broadcasting. Ideas included creating a trust fund, exacting spectrum fees, cutting costs, using advertising, enhancing underwriting and creating a new class of license.

Delano Lewis, president and CEO of NPR, suggested developing a private corporation that would be responsible for administering a non-governmental investment portfolio. Lewis said the income interest from the portfolio would be used to provide the programming currently offered by public broadcasting.

Enhanced underwriting came up earlier this month at the NPR board meeting when members unanimously voted to use the Federal Communications Commission's more liberal underwriting guidelines. The major difference is that underwriters now will be able to use identifiable slogans like "just do it" and "don't leave home without it."

The board also struggled with a request from two distilled spirits companies to underwrite programming to the tune of half a million dollars. Lewis said he was not sure he approved of beer and wine underwriting much less hard liquor.

TOP stories of 1995

Board member Jack Mitchell of Wisconsin said his station does not mind taking money from abortion clinics or churches since the station does not profess to stand behind their products or services. For now, the board decided not to accept the underwriting, but to look for another way to pocket the cash.

NPR's programming is at the center of the arguments both for and against the proposed cuts.

Critics of the proposed cuts maintain that NPR provides programming and services otherwise unavailable to listeners. In particular, they see the cuts as a threat to rural and small stations that rely heavily on NPR programming.

Those opposed to federal funding of public broadcasting see the programming as politically biased and "liberal" and challenge the programs to survive in the commercial marketplace.

In addition to the budget questions, NPR is facing a new challenge: competition. In January, Ed Graham of American Radio Network plans to launch Public Radio Service (PRS), an NPR-like programming service, which he said will be a less expensive, full-service programming option for stations around the country.


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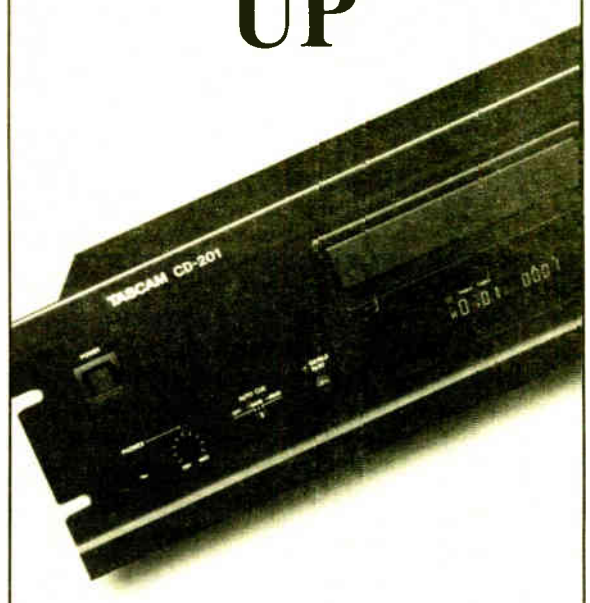


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# RBDS Gains Acceptance

**by Lynn Meadows**

**ARLINGTON, Va.** The Electronic Industries Association (EIA) hopes you have heard of the Radio Broadcast Data Service (RBDS). You know — the technology that allows broadcasters to send an inaudible stream of data to specially equipped radios.

Almost nine months have passed since the EIA started its year- long campaign to introduce the Radio Data System (RDS), as RBDS is sometimes known, to the top 25 markets in the United States. Last month, WKYS(FM) in Washington, D.C., became the 100th station to take the bait and join the program.

The bait includes a free RE America encoder, either a Denon or Delco receiver, software that lists songs and artists, technical training on the use of RDS equipment and sales training on the promotional opportunities of RDS.

The strings that are attached include guaranteeing the EIA that the encoder will work through 1997 and giving up $5,000 in advertising time or underwriting credits to increase public awareness of RDS.

Some groups are holding out on the offer. Before it was bought by Westinghouse, CBS Radio refused to let its FM stations accept the offer until an AM RDS standard is found. Likewise, local Infinity stations cannot accept the offer until it is approved through the nationwide corporate structure.

Gary Shapiro, president of the Consumer Electronics Manufacturers Association of the EIA, said stations in markets 11 through 25 will be receiving their RDS sign-up kits soon.

Stations in the Cleveland, Minneapolis/St. Paul, St. Louis, Denver, San Diego, and Seattle/Tacoma markets have already approached the EIA to get RDS before their competitors.

TOP stories of 1995

Most stations use their RDS to show call letters, preview programs, display song information and supplement spots. Many simply show the message "If you see this, call (station's phone number)."

In Europe, where RDS has been in use for nearly 10 years, stations use the technology to transmit traffic information as well as format information. With RDS, listeners can automatically find a new station when one fades out.

The EIA will have an RDS Wall of Radios at its Winter Consumer Electronics Show next month. Companies with RDS products include Pioneer, Onkyo, Denon, Delco, Panasonic, Philips, Grundig, Bosch/Blaupunkt, Becker and Audiovox.

John Casey at Denon said his company has shipped close to 100,000 receiver units so far. Denon has 20 RDS products to display in 1996, including car and home receivers. Casey supports the EIA's program.

"I think it has had a profound affect on the widespread availability of the signal," he said.

In fact, January marks the first time the Crutchfield Catalog will display RDS products. A blurb describing RDS will be included beside three Denon products.

The portable Yacht Boy from Grundig has found a niche in the RDS industry. Grundig regularly promotes the product by taking out ads in the Economist and various in-flight magazines.

The latest quarterly RBDS Roll Call from **RW** puts the total number of stations using the technology at 342 stations. That includes stations that lease their subcarrier for Global Positioning Services.


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# Tape Market Shake Up

▶ continued from page 1

those — 500 to 750 — in Minnesota. The job reductions will be concentrated in the audio and video products business and in some support functions.

On the same day as the 3M announcement (Nov. 14), Ampex Corp. announced that it had sold its magnetic tape subsidiary — known as Ampex Media Corp. (AMC) — to Quantegy Acquisition Corporation, a company made up of AMC's existing lenders. A major Quantegy shareholder is The Equitable Life Assurance Society of the United States.

"In connection with the sale of its magnetic tape subsidiary, Ampex has received only a nominal cash consideration, but the company will record a gain on the disposal of approximately $45 million in its fiscal fourth quarter, which ends on Dec. 31, 1995," the company said.

The Ampex magnetic tape subsidiary has its primary facility in Opelika, Ala., where it manufactures recording tape for audio, video and instrumentation markets. Ampex said during a transitional period in these markets, the recording tape will continue to be sold under the Ampex trademark.

Ampex made it clear that it will continue to make recording tape for some of its digital products.

"The business that is being disposed of primarily supplies recording tape for use with recording equipment that Ampex Corporation has discontinued, or for equipment not manufactured by Ampex, and it has been accounted for as a discontinued operation since May, 1993," the company said.

"Ampex Corp. will continue to produce recording tape for use with all of its current line of digital data storage, video and instrumentation tape drives and robotic libraries in order to ensure the level of quality and technical specifications required of these advanced products," Ampex said.

The digital tape production will be conducted by Ampex Digital Media, a division of Ampex that is located at the company's Redwood, Calif. headquarters.

Thomas J. Wheeler, president and CEO of Ampex Media Corp. assumes the same job title at Quantegy. He said current customers of recording media will continue to do business with Quantegy just as they had done with the Ampex subsidiary.

Wheeler said significant investments have been made into the manufacturing technology to be used by Quantegy.

"Over the last five years we have invested over $30 million in new manufacturing technologies that enable us to offer the latest metal particle products in the most advanced recording systems," Wheeler said.

Though both the 3M and Ampex announcements were couched in formal business terms, their implications were significant for the relatively short history of recorded audio.

Les Paul, the guitarist and multitrack recording pioneer, performed in 1947 with Bing Crosby on the first taped radio broadcast, Bing Crosby's Philco Radio Time. The Ampex Model 200s were not quite ready yet and the show used a German Magnetophon reconstructed and modified by Jack Mullin.

"If one of the reels on that machine broke it could have killed five people in the room ... it was going so fast," Paul said. "The tape that the Germans were using was made of paper. It was like fly paper. The Germans would just scratch some iron dust on it. Later 3M provided the first version of 'Scotch' recording tape to replace that German paper stock."

The EQ for Jack Mullin's re-designed circuitry of the 1943 Magnetophon became the basis for the NAB curve. The first pair of Ampex Model 200 tape recorders — serial numbers 1 and 2 — were delivered to Jack Mullin at the Bing Crosby show in Hollywood in April, 1948.

History repeated itself in 1956. Ampex developed the world's first professional broadcast video tape recorder. 3M developed recording tape for it.

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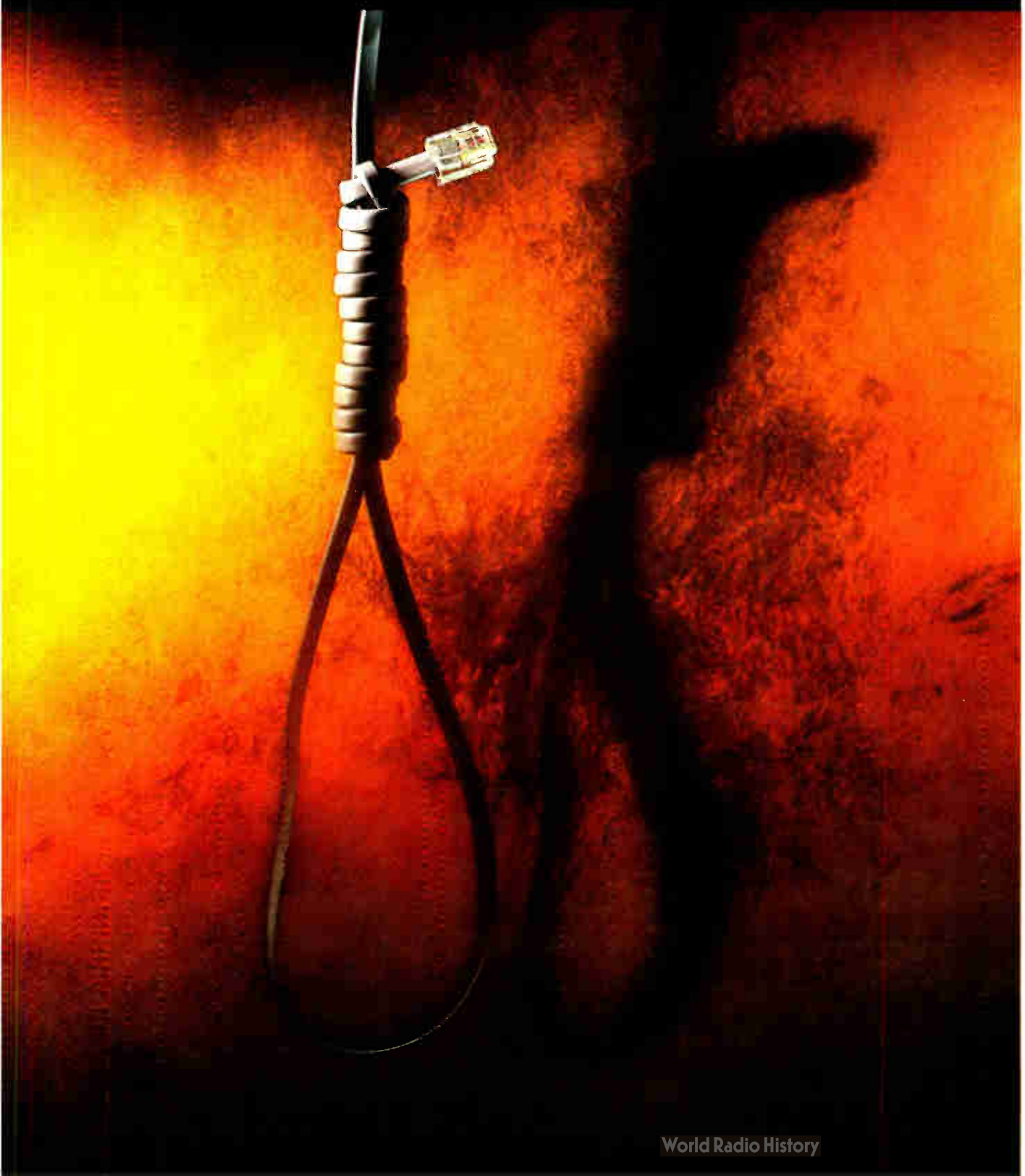

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# Beatles Strike Chord on Portland Radio

## T.V. Station Enjoys Huge Ratings Thanks to Radio Advertising Promoting Special Show

**by Bob Rusk**

**PORTLAND, Ore.** A listener called the Bob Miller morning show at adult contemporary station KEX (AM) 1190 kHz and claimed that if you play the new Beatles CD backwards, you can hear a message from John Lennon.

"Did you ever try to play a CD backwards?" Miller asked with a laugh. "Let me know how it works." Miller then recalled a story that circulated when the Beatles' Abbey Road LP was at the top of the charts in 1969. Some believed that if you rubbed Vaseline on the

The Fab Four in the early days

album cover, Paul McCartney's obituary would appear.

"There were all of these people running around my hometown with these greasy albums," Miller told his audience. "Nothing came through, except you were a fool for doing this!"

During the week of the recent three-part "Beatles Anthology" on ABC-TV, there was a lot of music and stories about the Fab Four on Portland radio — as well as on stations in every other market. What makes Portland stand out is that Part 1 of "The Beatles Anthology" scored a huge 26.4 rating and a 41 share of the audience for local ABC-TV affiliate KATU (channel 2).

They were the highest numbers in the country. For the entire three nights of the special presentation, KATU-TV grabbed an impressive 21.6 rating/36 share.

According to KATU Creative Services Director Colette Roof Rees, "We beat everybody on the three-day average. There are 32 metered markets (in the country) and we were the only one that broke a 30 share."

Roof Rees gives local radio much of the credit for her TV station's success. "We have a wonderful working relationship that we've been developing with the radio stations in Portland over the last year," said Roof Rees. "We certainly could not have done what we did with 'The Beatles Anthology' a year ago."

KATU ran ads on about a dozen Portland radio stations during the crucial November sweeps. A 30-second network spot for "The Anthology" was packaged with a 30-second local spot for KATU's 5:00 p.m. newscast.

Except for two country stations, all of Portland's other top-rated music stations are compatible with the Beatles. That is much different than in many other markets, where Hispanic, urban contemporary and rap stations would not play the Beatles. Wanting to grab as many adults 25-54 as possible, Roof Rees also bought spots on Portland's country stations. "I think country listeners are interested in the Beatles," she said.

"We spent a tremendous amount of money on radio advertising. I'm fortunate to be able to run advertising on my own air at channel 2, so I used a combination of TV and radio to make sure my reach was out there and the frequency of spots was high.

"I can't get the frequency just using my own air. We used radio to make sure our message was getting out."

KEX is one of the radio stations that wanted to do more than just run commercials for "The Beatles Anthology," so the station also played Beatles flashbacks (which were programmed on both radio and TV).

"It was a flashback promo with our main female anchor talking about her memories of the Beatles," Roof Rees said. "It worked because KATU is the number one TV station in Portland and Julie Emry is the number one female news anchor."

Classic rock station KGON-FM (92.3) got exposure on KATU when midday personality Iris Harrison was seen talking about the Lads from Liverpool in another Beatles Flashback.

KGON-FM plays Beatles music every day, but Program Director Bob Harlow added even more to the playlist during The Anthology. "We play The Beatles at least 12 times a day," he said, "but during The Anthology our listeners were even more interested in their music." In addition, KGON-FM did live cutaways from a Tower Records store on the first day "The Beatles Anthology, Volume 1" CD was for sale. A Beatles cover band, A Hard Day's Knights, provided entertainment. Roof Rees called all of this "value added" to the KATU-TV/radio cross promotion. "It contributed to what we think is a textbook example of marketing," she said.

Making the TV ratings for "The Beatles Anthology" even more impressive in Portland, the telecast was up against "Dead by Sunset," an NBC-TV movie that was based on an incident that occurred in the city. The movie was filmed in Portland and was expected to draw a large local audience. It came in second to The Beatles.

Roof Rees stressed that having excellent programming is not enough to attract viewers. Radio advertising is an essential part of the equation.

"Radio is my medium of choice, whether I have the Beatles Anthology or not. Radio works very well for us. The cost per thousand is low and radio is very creative in delivering viewers to us. We need radio in order to get the message across."

Toward the end of their run

**Having excellent programming is not enough to attract viewers. Radio advertising is an essential part of the equation.**

# Infinity Pays Up

**by Alan Peterson**

**WASHINGTON** Infinity Broadcasting and the Federal Communications Commission (FCC) put their six-year Howard Stern indecency showdown to rest Sept. 1, with a record $1.715 million settlement.

The settlement was greater than the actual fines, which totalled $1.706 million.

The fines were levelled by the commission for broadcasts of shock-jock Stern's show that aired between 1988 and 1994. Elements of the broadcasts were considered to be in violation of the commission's indecency statute — an opinion long-disputed by Stern and Infinity.

According to FCC General Counsel Bill Kennard, "The FCC found that Infinity should be liable for $1,706,000 in fines for repeated violations. The Court of Appeals for the D.C. (District of Columbia) circuit found that our indecency standard was not vague and that broadcasters had sufficient notice of what the standards are."

At the 1995 Radio Show in New Orleans, Infinity President and CEO Mel Karmazin remarked on conversations he and the FCC had been having for a few years in hopes of settling their differences.

He said, "Infinity has always believed that the material that was broadcast by Howard was definitely within the guidelines that the courts have provided on indecency."

Kennard noted, "Rather than litigate the issue any further, the parties have decided that it's in both of their interests to settle the case." Stern himself was on vacation when the settlement was announced.

Rumors flew at the Radio Show and over the Internet about the likely reasons for the settlement. Possibilities included Stern signing with SW Networks or Infinity clearing the slate for possible acquisitions of other radio stations. The only acquisitions made since September were the stations of Alliance Broadcasting, still pending.

In July 1993, stricter control systems went into place at WXRK-FM, New York, the station originating the Howard Stern show. The safeguards include a broadcast delay to dump offensive or improper language.

According to Kennard, "If there is something out there that we don't know about that involved conduct between July 1993 and the current date ... we're still going to look at those (complaints)."

Other than that, Infinity — following settlement of the fines — will be treated as though they are any other licensee.

TOP stories of 1995

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STATION SKETCHES

# Function Generators Bridge Gaps

by Tom Vernon

**HARRISBURG, Pa.** Many small-market engineers lust after some of the newer computer-based audio test centers, but find much of it priced out of their reach. Still, the requirements for high-end audio make simple sine wave testing somewhat inadequate. For many, the bridge between these two worlds is an inexpensive function generator, which will be the subject of this month's column.

The most basic function generators deliver sine, square, and triangle waveforms. More expensive units deliver pulse and sawtooth functions as well. Still more elaborate units are programmable, allowing you to make up your own waveforms and store them in memory. AM and FM modulation of the waveform is typically included, as is DC offset and sweep. Some units include both linear and logarithmic sweep functions. Digital readout of frequency and amplitude may also be included.

Unlike RC audio oscillators, the bandwidth of most function generators far exceeds the audio range. Typical response runs from .01 Hz to around 10 MHz, with more expensive units having an even greater bandwidth. This response range makes the function generator useful not only for audio, but for RF, video, and logic applications as well.

## Save time

The inexpensive function generator is not without its limitations, but the savvy engineer knows how to use it to his advantage. Because the generator has multiple waveforms or functions, it cannot deliver the same purity of waveform one would expect from a dedicated sine, square or triangle generator.

Sine wave tests with a function generator are typically done to verify flatness of amplifier response. Because the sine wave is usually derived from an amplitude-regulated triangle wave, a flat response within several millivolts across the band is normal. Compare that with the half and quarter dB bumps of an RC oscillator, plus the bounce of its lamp-derived AGC circuits.

You can see that our function generator will save you a good bit of time, as you do not have to measure the input voltage while doing frequency sweeps.

**The beauty of an inexpensive function generator is its versatility**

If your function generator has a sweep function, you can view the system response with an oscilloscope, and save even more time. The problem here is that you cannot accurately determine where the response drops 3 dB at the high and low end. This is the time to put the RC oscillator to work. Connect it to the Z input of the oscilloscope for intensity modulation. You will see a bright spot on the trace which corresponds to the oscillator frequency. Put the spot on the 3 dB point and read the frequency off the oscillator's dial. You will have to do this for both the high and low end, unless the amplifier is DC coupled, then the low response will go down to 0 Hz.

The bad news with function generator sine waves is that their distortion is much worse than even mediocre RC oscillators. Figures of around 1 percent or more are not uncommon. Frequency accuracy and stability are also lacking with these units. Testing an amplifier for distortion is best left to old faithful.

Square and triangle waveforms usually fare much better than sine waves in a function generator. The use of square waves to test amplifiers is well understood, but we will review some basics here. The biggest plus is that you can judge a system's overall performance just by glancing at your oscilloscope.

## A myth

One myth about square wave testing is that you can determine an amplifier's bandwidth simply by multiplying the input frequency by five. Thus, if a device can pass a 4 kHz square wave relatively unmangled, response should be good to 20 kHz. This is simply untrue. It is based on the premise that square waves are made up of a fundamental and higher order harmonics. What is missed is the fact that harmonic amplitude decreases with increasing frequency, invalidating any quantitative HF measurements. But don't despair. There is a quick and accurate way to check bandwidth with square waves. It requires use of the formula: Bandwidth= 0.35/rise time.

Triangle and sawtooth waveforms are not as popular for testing amplifiers as square waves, but they do have some advantages. While square waves are made up of odd-order harmonics, triangle and sawtooth waves are composed of all harmonics, and thus even-order anomalies may also be observed. Because some amplifiers attenuate even-order harmonics, their distortion would not show up with square wave testing.

Triangle waveforms are useful in spotting amplifier crossover distortion. Feed a 10 kHz wave into an amp working into a load resistor. Scope the output and look for notches in the slopes at the zero crossing point. The solution to this problem is usually to tweak the bias adjustments.

Another advantage of these waveforms is that amplifier clipping is very visible on the oscilloscope. Clipping will chop off the top and bottom of a waveform, but this is hard to see with square waves, and not so precise with sine waves.

While sine waves can be treated rather casually and still come out looking good, square and sawtooth waves must be handled with care to prevent deformity. To avoid hum, RF stray signal pickup, and possible waveform deformation, avoid using clipleads with low-level signals. The best procedure is to match the characteristic output impedance of the unit's cable [illegible] resistor network. This is not[illegible] than basic transmission line matching source to load. Inform[illegible] this procedure is usually contain[illegible] the instruction manual.

## Take time to test

Of course, all bets are off on the validity of tests if your scope's vertical amplifiers are not up to snuff or your function generator is out of calibration. Take the time to test your test equipment before diving into your console. Connect the function generator directly to the oscilloscope and check the back-to-back response of both units.

OK, so you found some overshoot or tilt on square waveforms. How do you determine whether the generator or scope is at fault? You could try another scope, or swap function generators. But what if you only have one of each? If your function generator is capable of putting out about 15 V peak to peak into its rated load, there is an alternative. It involves connecting the output of the function generator directly to the deflection plates of the oscilloscope. This procedure will bypass the vertical amplifier and any limitations that it may be imposing on linearity. Be sure to check your scope manual for specific information.

The beauty of an inexpensive function generator is its versatility. While it may not outperform dedicated sine or square wave generators, it is a universal signal source with applications in audio and RF testing throughout the station.

□□□

*Tom Vernon divides his time between school and work at the award-winning WXPN in Philadelphia. He can be reached via e-mail at TLVernon@aol.com or by calling 717-367-5595.*

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PIONEER PROFILES

# The Making of a 500 kW Superstation

**by Barry Mishkind**

**TUCSON, Ariz.** When you hear the classic call letters WLW(AM), usually the first thing that comes to mind is the history of the station as the one and only superpower station authorized to broadcast normal schedules at a whopping 500 kW.

While that operation ended in 1939 after less than five years, WLW's programming and history have captured the imagination of broadcast enthusiasts for years.

Why was Cincinnati's WLW the first and only station to operate with such super power? The story of this one-station "network" starts with a frustrated automobile manufacturer, Powel Crosley, Jr., and a request from his son.

### From wheels to wireless

Powel Crosley was a driven inventor and businessman who loved automobiles. The trouble was, he never seemed to be able to make money building them.

Over the years, Cosley designed or marketed a number of items for car owners, such as draft eliminators and flag holders that fit on radiator caps. Yet his crowning success in mass marketing came not from his auto accessory business, but from his son's request for one of those "newfangled wireless" receivers.

Considering it nothing more than a toy, Crosley, with his son, went shopping for a receiver. He was horrified at the $100 minimum cost of a radio receiver in those days.

Being a practical man, Crosley instead spent 25 cents for the book "The ABCs of Radio," then purchased parts and built his own receiver. Finally, he ordered a 20 W transmitter to send something to the receivers and 8XAA was born.

### Radios for everyone

Crosley realized many others would be interested in having receivers, but lacked the money or ability to build their own. This brought him to design and build inexpensive receivers the masses could afford. The Harko, for example, was priced at $20.

Sales of the Harko during the 1921 Christmas season were so successful that Crosley stopped building everything else and concentrated on radio receivers. Of course, in those days, to sell a receiver required something we today take for granted: programming.

Radio was new, and the number of stations was small. So Crosley applied to the government for his own station, and WLW was granted a license on Mar. 2, 1922. Like all "commercial" stations of the day, it was assigned to 833 kHz, which it shared with the other local stations.

The WLW of the early 1920s was nothing like what it would become. A little curtained studio, kept rather warm by the operating transmitter, contained the whole operation.

The microphone was essentially a huge, eight-foot, morning glory horn-shaped affair, with an opening three feet across. The announcer would literally stick his head halfway down the microphone and speak up to be heard. Records were broadcast by placing the phonograph against the mic in a horn-to-horn fashion.

Crosley seemed to enjoy playing "Song of India," which he did over and over again. He would announce the music was coming from "WLW —The Broadcasting Station for the Queen City of the West." Another logo used was "WLW, the Station with a Soul."

Today, especially around April Fool's Day, you may hear a station repeating a single record all day as a stunt to get attention and publicity. Now you know the concept is nearly 75 years old.

### Expansion

What made Powel Crosley special was his combination of enthusiasm for the medium and his business sense as a manufacturer. WLW did not suffer from lack of reach. Unlike today, 100 W would reach out quite well. A November 1922 contest garnered letters from 42 states indicating there was a large potential audience, as well as customers for Crosley's radio receivers. Yet, Crosley was far from done.

His original feeling that there was profit to be made in affordable receivers for the masses proved to be correct. Crosley continued to design cheap radios, eventually making the Harko for only $9. The key to making this plan work seemed to be in getting more and more power to the radios.

Crosley led WLW to seek an increase to 500 watts in 1923, then 1 kW in 1924. In January 1925, it was the first U.S. station to use 5 kW.

An effort to reduce competition brought unexpected benefits. In January 1923, Crosley purchased the Precision Instrument Company and its station, WMH(AM).

This was especially beneficial for three reasons. First, it gave WLW access to the airwaves five nights a week, instead of three. It provided a spare antenna when WLW's was blown over in March 1923. And, although the WMH antenna used an empty wine bottle for an insulator, it was a vertical antenna. This helped WLW provide better nondirectional coverage.

The year 1928 brought WLW to 50 kW. But Powel Crosley wanted more, leading to an experimental authorization for 500 kW in 1934.

Constructing the transmitter required a combined effort by major companies. Design was by RCA, RF sections came from General Electric and control circuitry was built by Westinghouse.

It was, obviously, serial number 1. And it was huge.

The specifications are almost impossible to believe in this day of solid state integration. The transmitter was 15 feet high by 30 feet wide. Each modulation transformer weighed 35,700 pounds, including 725 gallons of oil.

Three parallel power amplifiers used 12 PA tubes. Two 33 kV power lines came down to the transmitter building, with 2,300 VAC entering the building.

**The transmitter was 15 feet high by 30 feet wide**

A 75-foot square pond held the water used to cool the transmitter, which required roughly 10,000 gallons of cool water a minute.

WLW's 831-foot, 200-ton tower was specially built with a "fat" middle to handle the amount of RF current sent into it. The tower received 72A of carrier current via a feedline nearly 10 inches in diameter. Out of a staff of 63, it took as many as 17 operators at a time to run the huge transmission system.

It has been said when WLW went on the "big rig," the street lights in Mason, Ohio, dimmed. The amount of RF generated would actually keep light bulbs in some homes illuminated after they were turned off.

Then there was WLW's staff of 190 full- and part-time performers. WLW was the originating studio for various network programs and hosted many big-name performers such as Red Barber, Durwood Kirby and Doris Day.

WLW's reach was awesome. At night, the 0.5 mV/m contour stretched from the Atlantic Ocean to Denver and Albuquerque. It was truly "the Nation's Station." There never would be another like it.

### Winds of change

By 1939, there was political pressure to stop WLW's superpower. It could have been attributed to World War II or to political intrigue by WLW's competitors, but on March 1, 1939, WLW returned to radiating a 50 kW signal. There were some occasional special broadcasts on behalf of the U.S. government, to send messages to Germany.

During the late 1930s and 1940s, more than 15 stations filed applications with the FCC for power levels in excess of the normal 50 kW level. Another round of applications accompanied the "Clear Channel Proceeding" in the 1960s. No authorizations were granted, and today the maximum power on the AM band remains 50 kW.

Yet for almost five years, WLW sent an astonishing amount of current and talent up its tower. The cheap Harko receiver and its cousins proliferated around the country, and radio truly became a mass medium.

Why was it that WLW alone achieved the "superpower" status among radio stations? The answer lies in a special pioneer broadcaster, Powel Crosley.

□□□

*Barry Mishkind writes from the radio ranch at 2033 S. Augusta Place, Tucson, AZ, 85710. He can be reached at 520-296-3797, or barry@broadcast.net on the Internet. Any materials or help in illuminating broadcast pioneers and their stations is gratefully received.*


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# Products & Services Showcase

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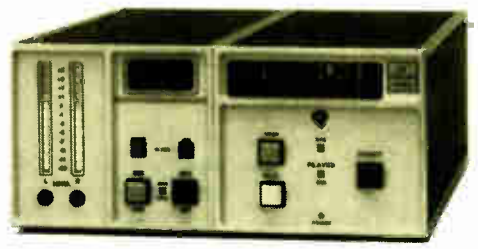

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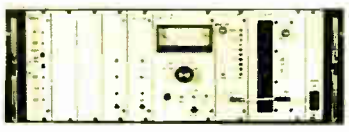

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World Radio History

FEEDLINE

# Calculate Exact Electrical Length

**by W.C. Alexander**

**DALLAS** Last month I looked at a method of evaluating transmission lines by making simple open- and short-circuit impedance measurements on the lines. We found that with the information from these easy measurements, you can determine the line's characteristic impedance, attenuation, and approximate electrical length. By comparing these findings with manufacturer's data, you can tell the condition of the transmission line.

What if we need to know the exact electrical length of a piece of transmission line? This can be very important, especially in AM directional systems where the phase delays in the system transmission lines are integral to the overall system phasing. It is also important for sample lines — not because the absolute length of the lines is important, but because they must all be the same.

Using the same impedance bridge, oscillator and detector as we used for our open- and short-circuit impedance measurements, we can determine the electrical length of a transmission line by finding the line's resonant frequency. The process is quite simple.

**Knowing that the sample lines are of equal length is essential for any array tune-up.**

First, you will need to know the approximate physical length of the line. This is usually a guess based on the distance from the transmitter building to the tower the line is feeding plus the line inside the building and in the tuning house. All we need here is a place to start. For example, if a particular line feeds a tower that is, say, 300 feet from the transmitter building and we can see that there is about 40 feet of line inside the building and five feet in the tuning house, we would make our initial estimate of the line's physical length at 345 feet, a good place to start.

### Simple process

Next, we will assume a velocity factor for our line based on the manufacturer's specifications or, again, we can guess. For the sake of this discussion, let's assume a velocity factor of 85 percent for our 345-foot piece of line. Now divide the estimated physical length of the line by the assumed velocity factor to get an estimate of the line's electrical length. In this case, 345 feet divided by 0.85 yields about 406 feet electrical.

Our next step is to find a frequency at which the line should be resonant, or an odd multiple of quarter wavelengths. To do this, multiply the assumed electrical length by four (to get the full-wave length of the line), then divide that number into 984 to find the assumed resonant frequency in MHz. In our example, 406 times four is 1,624. 984 divided by 1,624 is 0.606 MHz.

If the line to be measured is very long, it may be better to find a frequency at which the line is three-quarter wavelengths long. To do this, divide the assumed electrical length by three, then multiply by four to get the full-wave length of the line. Then divide that number into 984 to find the assumed resonant frequency.

For example, suppose the line we are measuring is 1,020 feet long. First, divide by 0.85, our assumed velocity factor (1,200). Then divide by three (400) and multiply by four (1,600), then divide into 984 to find the three-quarter wavelength resonant frequency in MHz (0.615). Had we computed the one-quarter wave resonant frequency of a 1,020 foot line, we would have found it to be 0.205 MHz, which may be below the range of many bridges, oscillators and detectors.

When measuring a really long line, you may need to find the five-quarter wavelength resonant frequency by dividing by five, multiplying by four and dividing into 984. You get the idea.

### Zero in

Now that we have a good "guesstimate" of the line's resonant frequency, set the oscillator, bridge and detector up for that frequency and connect it to one end of the line. Open the line at the other end and read the impedance. You should see some resistance, which is essentially the copper resistance of the line, and you will probably see a few ohms of reactance as well.

When you are dead on the resonant frequency, there will be a little resistance and zero reactance. If you have some reactance in your first measurement, change the frequency by 10 kHz one way or another and remeasure. If your reactance in this measurement is closer to zero, you're going the right way: press on. If the reactance was further away from zero, go 20 kHz the other way and remeasure. Continue with frequency iterations, working in 1 kHz steps as you focus in on that frequency where the reactance is zero. When you find it, you will have determined the resonant frequency of the line.

For example, let's say we found the resonant frequency to be 0.598 MHz. To get the electrical length of the line, divide 984 by the resonant frequency, divide by four and then multiply by whatever number of quarter wavelengths you are using. In this example, divide 984 by 0.598 (1645.485), divide by four (411.371) and multiply by one. The electrical length of our line has been determined to be 411.4 feet, not too far off our original guesstimate.

Sometimes, the difference can be surprising. You may discover that there is a roll of excess line buried somewhere on the site, or the trenches to the towers take a circuitous route.

### Phase delay

If you have already made open- and short-circuit impedance measurements on the line, it is interesting to compare the approximate electrical length that those calculations gave us to the electrical length determined by finding the resonant frequency of the line. Usually, the two numbers are very close, within a few feet at most. Of the two methods, the resonant length method is far more accurate for determining exact electrical length.

To find the phase delay of a transmission line on your frequency, start by finding the length of one electrical degree at your operating frequency by dividing 984 by the frequency in MHz, then divide by 360. Divide this number into the measured electrical length of the line to get the phase delay of that particular piece of transmission line.

If, in our example, the station was operating at 700 kHz, divide 984 by 0.700 (1405.71), then divide the result by 360 (3.91). One electrical degree at 700 kHz is 3.91 feet long. Now, divide 3.91 feet into the 411.4 foot electrical length we determined our line to have. The result is 105.36, revealing that our line has a 105-degree phase delay. This would be useful in determining the necessary phase shift in the ATU and phasor networks to achieve the proper driving point phase.

When constructing a new array (or reworking an old one), one of the first things I do is measure the electrical lengths of all the sample lines in the system. This tells me whether there are any phase errors in the sampling system that I need to know about. There may be other errors caused by the sample pickup transformer, loop or transformer/loop location, but you have got to have a place to start. Knowing that the sample lines are of equal length (or knowing what the errors are) is essential for any array tune-up.

In coming months, we will continue to look at the tricks of the trade that are used in AM antenna work. You might have already guessed that many of these methods can be used for FM work as well. After all, a line is a line is a line, right?

□□□

*Cris Alexander is the director of engineering at Crawford Broadcasting in Dallas. He can be reached at 214-445-1713.*

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World Radio History

# Examine Status of Backup Systems

**by John Bisset**

**SPRINGFIELD, Va.** Looking for a holiday present for your favorite program director or general manager? Bill Ashley from Bradley Broadcast Sales (800-732-7665) showed me what has got to be one of Sony's best inventions yet. The Model SRF-M32 is a shirt-pocket-sized walkman that you can find at Best Buy or a similar discount store for under $35.00. This 3-inch-square radio, that's only 3/4 of an inch deep, fits in a shirt pocket and is packed with features. The LCD usually shows time, but when the radio is on, it will display the tuned frequency. There are five presets for AM, and five for FM, and it runs off two AAA cells.

What really makes this nice for a PD, or audio-conscious engineer, is that switching between the presets is instantaneous. Remember how some radios mute the audio for a second when you switch channels? On the SRF-M32, when you push the button, the audio from that pre-selected channel is there — great for loudness wars! Bill tells me that the radio is NRSC compliant, having a decent sounding AM section. Other features include an FM sensitivity switch and a key-protect switch, which prevents accidental channel changing if you bump the buttons. This radio will fit in the palm of your hand and makes an ideal monitor to stick in your tool box. To make things even more compact, if you buy the Telex SEB-1 Single Ear Button, you now have a mono sum earplug that wraps easily around the radio when not in use. You can buy the Telex Ear Button from Bradley for $8.50.

Sporting a sexy case with rounded corners, compact size and low price this is the radio for radio people. Our thanks to Bill for sharing this find with us.

★ ★ ★

Now that the weather is turning bad, some of the outside routine maintenance can be put on hold. To occupy your next visit to the transmitter site, spend some time checking up on your backup systems. For example, does the VOM have fresh batteries? How about the flashlight? Is there a roll of solder on the bench? When was the last time you took a fuse inventory and ordered replacements from Digikey (800-344-4539)? If you pressurize your lines with nitrogen, do you have a spare tank, or are there several empties that need to be picked up? Is your tool box well supplied? It's not unusual to stick a screwdriver in your pocket when you leave and forget to return it. The problem is exacerbated when you need a specific tool - like a right angle Phillips, to get deep inside your Power Rock and remember it's back at the studio. Taking a few moments to do a tool inventory can pay back a hundredfold in saved time when the next emergency occurs.

Are all the pilot lamps in the transmitter equipment working? I worked with a fellow once who didn't believe in replacing burned-out lamps. His rationale was you could see that the transmitter was working because there were readings on the plate current and plate voltage meters. Fair enough. But when the burned-out lamps include overload indicators, repair time increases exponentially. If your stock of bulbs is low, add them to the list when you call Digikey. While on the subject of bulbs, check for spare light bulbs - especially for the trouble lamp.

If you can afford some transmitter down time, check the set screws in the chain and gear drives for the phasor as well as the transmitter tuning or loading controls. There is nothing more frustrating than to crank on a phasor, diligently recording the turns-counter numbers, only to find that the coupling is slipping and one turn actually equalled half a turn.

**Does the VOM have fresh batteries? When was the last time you took a fuse inventory and ordered replacements?**

While inside the transmitter, check the silver plated parts in the output cavity. Changes in color can be a sign of over-heating. Suspect either loose parts inside the cavity or poor air flow. Silver-plated parts can discolor due to chemicals in the atmosphere. Determining the cause of the discoloration is simple, by using a bottle of Tarnex. If, after cleaning the plate with Tarnex, the bright silver color is returned, suspect atmospheric chemical changes. If the cleaned part remains black, blue or purple, suspect over-heating. It's important to thoroughly wash off the Tarnex with clean water. Fixed plated parts can be scrubbed clean using a Scotch Brite pad. Just remember not to scrub so hard that the plating is removed!

★ ★ ★

I guess it's time to file this tip away under annoying clicks. We reported some months back about clicking in an FM's demodulated audio being traced back to failed capacitors in an Optimod Stereo Generator. As I remember, the folks at AKG replaced defective caps at no charge to Optimod owners who had this problem occur.

Well, the clicking is back. This time on a TFT Model 724 Stereo Modulation Monitor. After trying all kinds of combinations, what cured the problem was replacing the filter caps on the A-3 Audio Meter Amp Board.

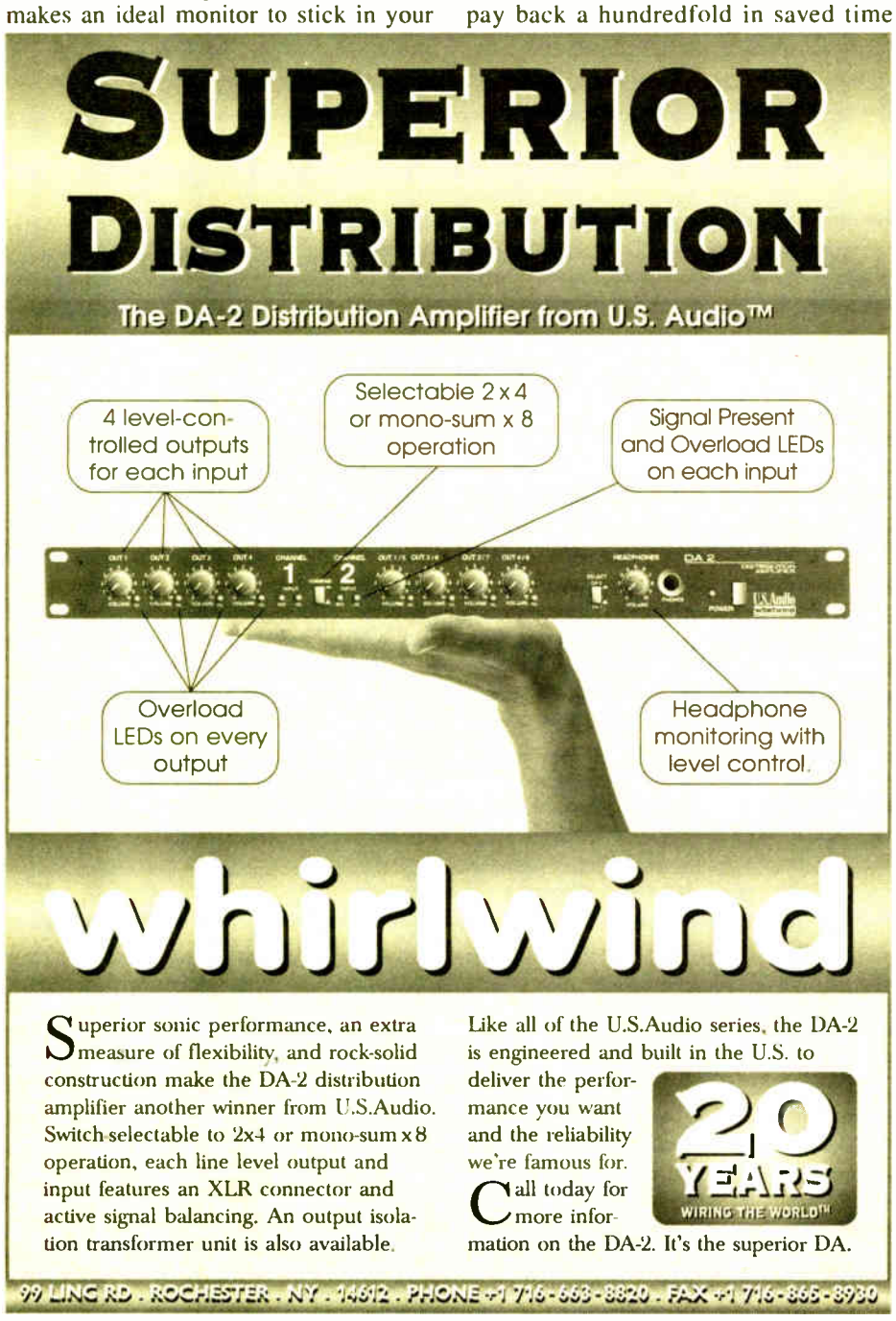
Replacing C-16 (5mfd), C-17 and C-25 (both 15mfd) corrected the problem. To prevent the need for recalibration, make sure the components being replaced are identical to those removed. Thanks to Ellis Terry, director of engineering at Douglas Broadcasting, for sharing this tip.

★ ★ ★

We'll wrap-up this month with a tip from an audiophile friend. I haven't tried it out, but I must admit, it sounds reasonable. He has salvaged scratched CDs by drawing over the scratch using a black Sharpie marker. It appears that the marker ink keeps the scratch from scattering the laser's beam. Sounds rational, but the problem is I don't have any CDs that I want to potentially ruin to try it out. If you have first-hand experience, drop us a line on AOL.

□ □ □

*John Bisset is a principal with Multiphase, a contract engineering firm based in Washington, DC. He can be reached at 703-323-7180. Fax submissions for the Workbench column to 703-764-0751, or through America On Line at wrwbench@aol.com. Printed submissions qualify for SBE Certification credit.*

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# MARKETPLACE

Recently Introduced Products for the Radio Broadcast Professional

### Prime Focus Adapter

Avcom's new PFA-12 prime focus adapter modifies existing offset Ku-band DBS LNBs to work efficiently with prime focus antennas with F/D ratios between 0.3 and 0.4. The PFA-12 allows low cost DBS LNBs to be quickly modified for use with larger prime focus dishes for reception of DBS signals in Alaska, Hawaii and other remote areas.

*For more information from Avcom, contact the company in Virginia at 804-794-2500; or circle* ***Reader Service 35.***

### RF Amplifiers

Broadcast Technologies has introduced its B-350 and B-600 RF amplifiers designed specifically as drop-in replacements for FM transmitter IPAs. The amplifiers cover between 150 W and 600 W and allow the user to update a high power transmitter with solid state broadband technology.

Both RF amplifiers feature power control, vswr and current foldback, high efficiency and complete surge protection. In addition, the two amplifiers come standard with full remote control and a detailed manual.

*For more information from Broadcast Technology, contact the company in Colorado at 719-336-3902; fax: 719-336-3961; or circle* ***Reader Service 10.***

### Extra-tall LEDs

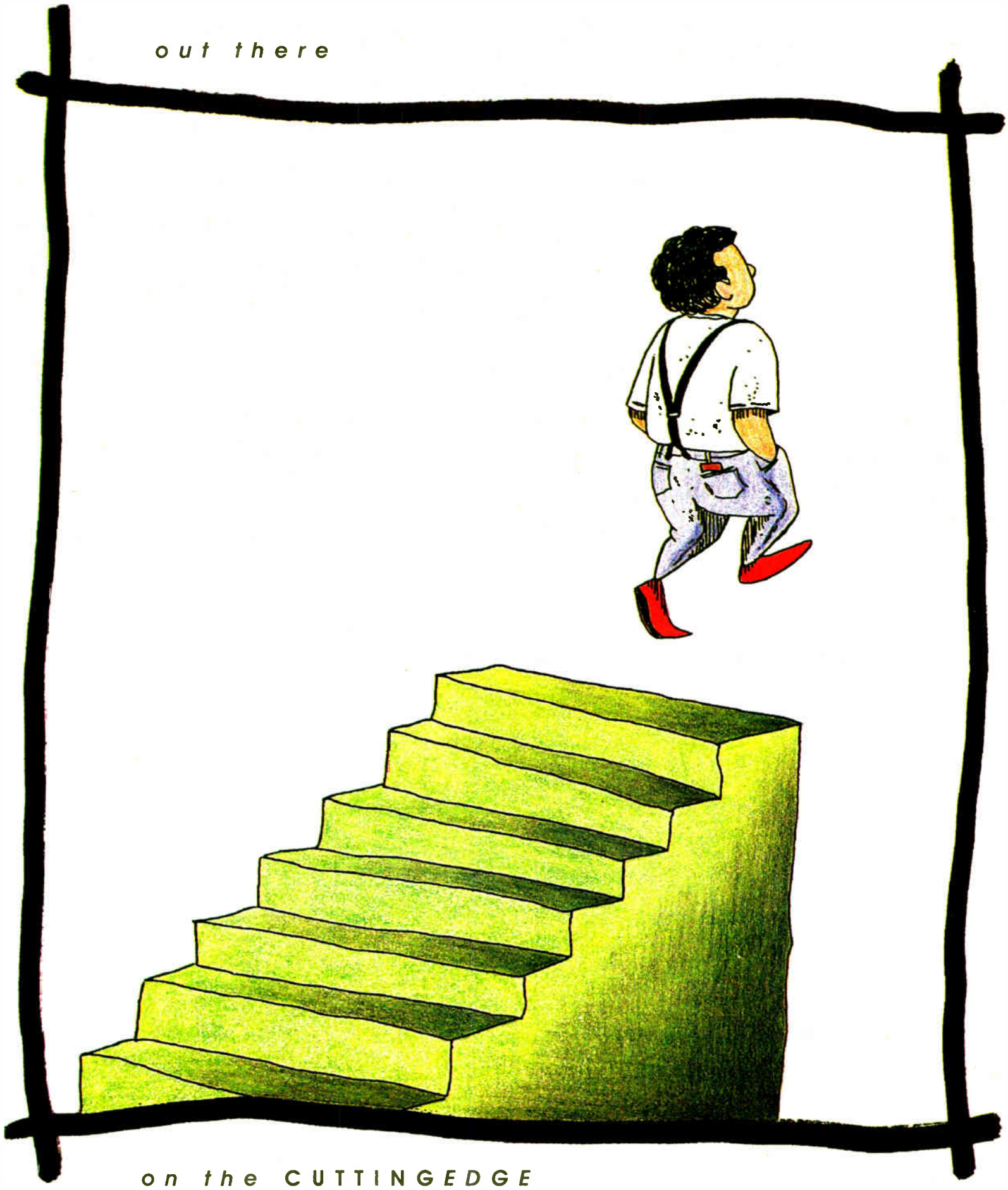
Extra-tall LEDs that position light sources one-half or five-eighths of an inch above PC boards have been introduced by Lumex Opto/Components. The LEDs are used for applications where extra height can eliminate the need for add-on spacers on boards that require separation from front panels to allow for better cooling.

Available in red, super red, green or yellow, the LEDs are available in two sizes: 12.5 mm high and 16.5 mm high. Depending on the viewing angle, light intensities range from 10 to 80 mCD.

*For more information from Lumex Opto/Components, contact the company in Illinois at 708-359-2790; or circle* ***Reader Service 93.***

World Radio History

*out there*



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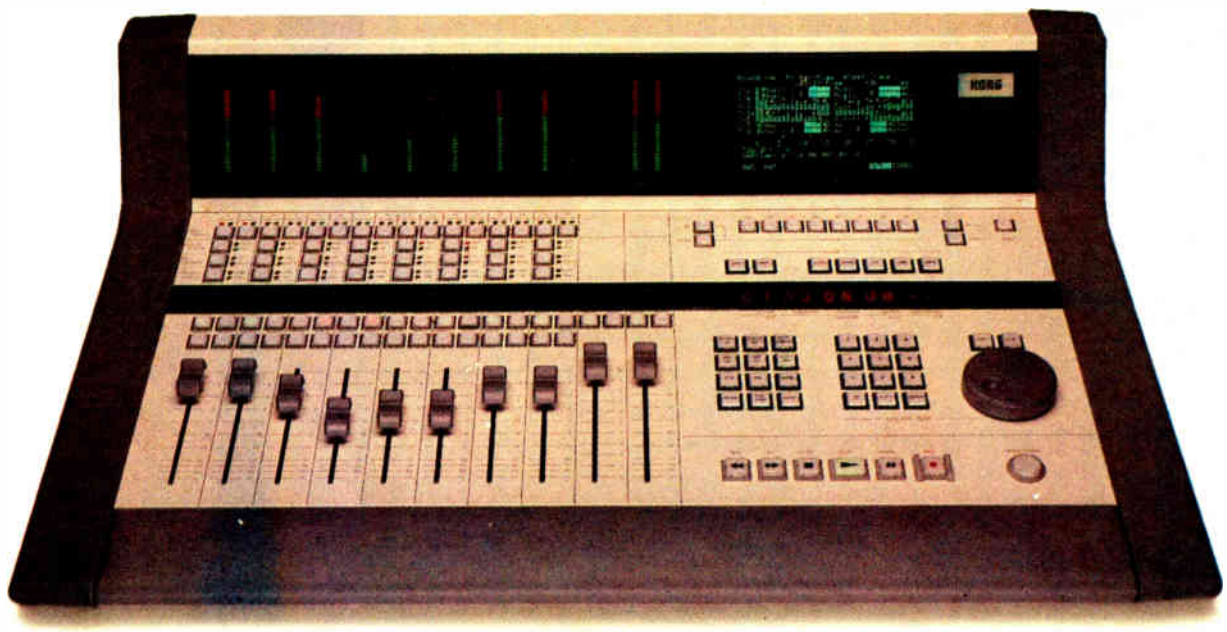

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World Radio History

**VoxPro** is for More than Phone Calls
**See page 39**

PRODUCT EVALUATION

# *Multitrack Software from Voyetra*

**by Alan R. Peterson**

**WASHINGTON** Get ready for digital multitrack recording for under $160. Voyetra Technologies of Yonkers, N.Y., has released Digital Orchestrator Plus, a music and recording software package.

This inexpensive program was designed primarily for MIDI music users, but may find homes in broadcast production studios, personal studios and small-to-mid-sized agencies for in-house commercial production.

Digital Orchestrator Plus turns a 486 or higher PC into a multitrack recorder that records and plays up to eight independent digital audio tracks along with MIDI data.

There are a number of audio and MIDI programs that do this, but for $159.95 list, this is quite an accomplishment.

### MIDI roots

Digital Orchestrator Plus is based around Voyetra Technologies' successful MIDI Orchestrator Plus sequencing software, and borrows audio technology from a sister program, AudioView. Indeed, the original objective was to create a MIDI and audio recording system for the PC platform to accommodate inexpensively the needs of musicians and composers — more so than radio production.

Radio people have little immediate need for MIDI, because in-station music production is not in high demand. When the MIDI part of Digital Orchestrator Plus is overlooked, what remains is an intriguing and inexpensive digital multitrack recording system.

Still, one can never have enough power, which is why the MIDI part of the equation will be discussed further inside this article.

### Hardware

Digital Orchestrator Plus requires a 486-DX or higher PC, 8MB RAM, Windows 3.1 or 95, a large-capacity hard drive, a quality sound card and a MIDI interface. If the PC is a 486-SX or less, a math coprocessor is required to perform audio calculations within a reasonable amount of time.

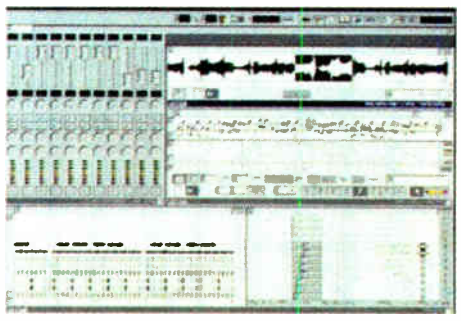
Should MIDI sequencing be a consideration, an external keyboard is required to enter MIDI tracks. A microphone or mixer is necessary for inputting digital audio tracks.

Capacity for digital audio tracks is limited only by a user's hardware. According to Voyetra, a 90 MHz Pentium computer can handle approximately eight 22 kHz mono tracks synched to MIDI.

There are reasons the software weighs in at such a low price. While Digital Orchestrator Plus puts no limits on the number of tracks that can be recorded, playback is what imposes the heavy demands.

Three factors affect track playback: CPU speed, available RAM and the access time of the hard drive. Obviously, the more powerful the machine, the better the performance. As stated above, a coprocessor is a necessity if running on a 486-SX or a 386 computer.

The ability to play back eight tracks of



Digital Orchestrator Plus screen

digital audio is a considerable advantage, but this requires lots of computational power and those eight tracks are, after all, only 22 kHz.

Audio quality might squeak by for speech, but lacks the sparkle of that top octave for any music recorded to hard drive. Digital Orchestrator Plus can do four 44 kHz tracks with a Pentium.

To Voyetra's credit, the merge feature allows unlimited track bouncing, opening up space for more audio. The bounce is noiseless and hiss-free.

### Recording

By default, Digital Orchestrator Plus writes audio data to your Windows Temp directory until saved or when exiting the program. It is possible to change this to a dedicated drive or directory of your own choosing, but a sensible amount of drive space is necessary to hold data. The Voyetra manual suggests 20MB of uncompressed disk space as a reasonable minimum (compression schemes slow down data throughput).

Recording an audio track first requires the Track/View window to be displayed. The tracks displayed by Digital Orchestrator Plus can accommodate digital audio or MIDI data.

An empty track is chosen, the mouse pointer is positioned in that track's Type column and clicked until the Digital Audio icon comes up. Another column called the "R" column is comparable to the "record ready" status of a conventional multitrack recorder. A letter R will appear here, showing the track is ready for recording.

The on-screen Record button is clicked, a metronome ticks off four beats and recording begins. When complete, the Stop button is clicked and the program draws the waveform.

Digital Orchestrator Plus takes full advantage of standard Windows Cut, Copy and Paste edit commands. If you have used other Windows sound editors before, you already know how to zoom in on desired regions and mouse-drag them to new locations within a project. Voyetra has kept this part simple and familiar.

An interval of silence is left in place of the range that has been moved, cut away or deleted. Holding down the Ctrl key while dragging leaves behind a copy of the selected data. This is useful for looping and extending music or drum patterns, or repeat playback of a sound effect.

The Windows Clipboard feature can be used for pasting audio. Standard Cut and Copy commands move selected data into the Clipboard. When a new range has been selected, the Paste command replaces existing wave information with the Clipboard contents.

To merge contents with existing material, do not select an entire range for removal, but click the mouse at the point where you want the data to begin.

### Transformation

Digital Orchestrator Plus has several transform features you would not expect in such an inexpensive program.

A handy compressor/limiter tames the dynamics of a specified range of audio. The feature is selectable between a compressor, limiter or noise gate and allows variable control over attack, release and threshold of compression activity.

Many audio programs come with delay (echo) effects, but Digital Orchestrator affords fine control over the delay process. Selectable delay time, intensity and regeneration are available, as is delay modulation to allow flanging and vibrato effects.

Tacked onto the delay transform is a phase-switcher that selectively inverts the delay's output before feedback for added dimension. A frequency rolloff feature cuts highs from successive delays to simulate actual echoes.

I have to question the use of the word "reverb" to define an effect in most audio programs. What you get is actually a series of tight individual echoes rather than the diffuse reflective effect we associate with reverberant physical space. Effective digital reverb requires a considerable amount of computation.

Two features I do like are Audition and

continued on page 38 ▶

Product Capsule:
**Voyetra Technologies Digital Orchestrator Plus**

**Thumbs Up**
- ✓ powerful MIDI features
- ✓ mouse editing
- ✓ remarkably low price
- ✓ digital transforms

**Thumbs Down**
- ✓ requires high-power computer
- ✓ lacks channel EQ

For more information, contact Voyetra Technologies at 914-966-1102; or circle **Reader Service 187**.

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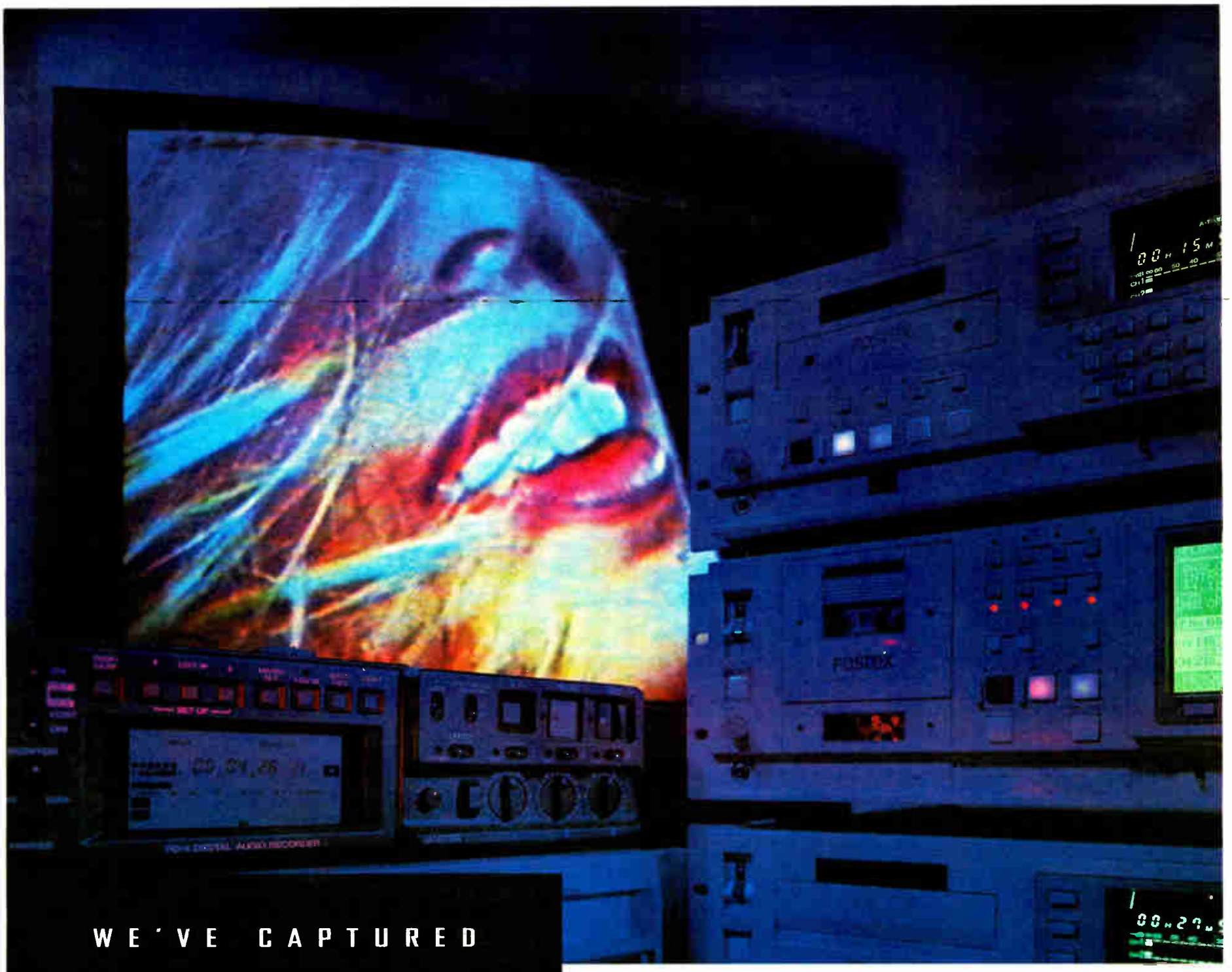


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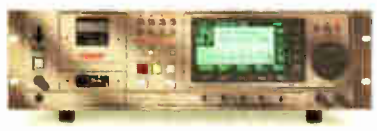

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DIGITAL DOMAIN

# Manipulating Audio with Movie Program

**by Mel Lambert**

**LOS ANGELES** Often, the availability of a new or refined production tool lets us achieve a creative function we never thought possible.

When preparing jingles, commercials, PSAs and related tracks, how often have we liked the read on a particular take, but preferred the pacing and general energy of another? Or maybe the timing could be tightened, but not at the expense of intelligibility?

What about the ability to take a regular music track and form a version that utilized a palette of electronic and related effects?

A new piece of software that I have been using recently enables all of these functions and much more.

### The envelope please

VocALign, a new piece of Mac-based software from Synchro Arts Limited, allows the envelope of one track to be used to modulate the content of another.

VocALign was designed for use with Digidesign's ProTools (version 3.0 or higher) and related products like the lower-cost Audio Media system. It can also be used as a standalone program.

VocALign is extremely easy to use. It is designed to run on any reasonably high-powered Macintosh, including early II Series, 040-based Quadras and the newer 601/604-derived PowerPCs.

### How it works

Select a guide track directly from within ProTools or by opening a Sound Designer II-compatible file. The program analyzes the track's content and builds an amplitude profile.

Now you are free to select another track over which you would like to place the modulation envelope. The VocALign software will automatically provide the best fit of the new material to the previous envelope via a number of matching criteria.

If the master track was extracted from a ProTools session, it can be dropped back onto a user-determined track in the same project. It is then ready to be edited and/or blended with other material.

Used-defined macros can be set up to streamline the operation, which occurs in real time on a Power PC. Elegance personified.

### Movie roots

VocALign was originally designed for the motion picture industry. It is used in automatic dialogue replacement/voice-overs (ADR/VO) to match replacement lines with original production or location dialogue. VocALign also has uses in lip-synching voice-over lines, foreign dialogue replacement and tightening up double-tracking.

In music applications, VocALign adjusts backing vocals or other instruments for music beds, modifies the relative timing of one music track to another and so on.

### Features

Six or more factory presets are used to control VocALign's time alignment flexibility.

The Low Flexibility preset, for example, restricts the amount of time-stretching and compressing, whereas High Flexibility allows a considerable amount of adjustment.

As well as I can determine, VocALign first analyzes the original waveforms via a series of filter banks. It performs a time alignment of the spectra, then generates a time modification path that achieves the best match of the modulations of the new signal to those of the guide.

Lastly, the program automatically edits the new signal according to this path and writes a new audio signal to hard disk.

For fully-integrated operation via ProTools, a VocALign macro player (an Apple control panel in reality) is provided. The program can also be used in manual mode to process previously-stored SDII sound files. Digital sound file formats such as AIFF, .Wav and .Snd types can also be accommodated using standard Mac-compatible translation utilities.

In addition, once a Guide or Dub track has been captured from Pro Tools, the user can recapture one of the signals without affecting the other.

I understand versions of VocALign for the Windows environment are also under development. More details as they become available.

Information on VocALign is available from Synchro Arts Limited, 13 Links Road, Epsom, Surrey KT17 3PP, United Kingdom.

Phone or fax +44 1372-811934 or contact the company on the Internet at 100420.1632@compuserve.com. Most

continued on page 29 ▶

# Ultimate in Satellite Control for NPR Shows

**by Rich Rarey**

**WASHINGTON** It was already dark outside at 5:15 p.m.

It was the day before Thanksgiving, and the phones at public radio's satellite Technical Support Office were ringing steadily.

Technical specialists Vince Destajo and Scott Bridgewater were double-teaming the phones. As one hung up, the other would snatch up the instrument, catching it on the second ring.

"You're not receiving anything on your new demods?" Bridgewater asked his caller. "Hold on ... let me authorize them." He turned to a desktop computer and searched a form for the caller's station call letters.

PUBLIC DOMAIN

He tapped quickly at the keys. "There, now you should be in business ... yeah, sure ... you're welcome."

It is in this small room, crowded with equipment, that the digital transmission age of public radio is helped along at the most personal level.

### Tech support

Over 500 public radio station engineers can call the technical support office for clarification of installation manuals, problems with their new digital downlink equipment and questions about their peripheral equipment.

What is the most frequently asked question of satellite technical support? Vince Destajo immediately recited the answer in a nursery-rhyme litany: "Pin 1 to pin 2, pin 2 to pin 1, 3 to 3, 4 to 4, 5 to 8."

Scott explained, "Most of the questions are about the data cable that goes between the Downlink services channel data output on a Comstream ABR700 demodulator and the ARTIC (A Real-Time Interface-Coprocessor). That is a 64-kilobit data stream that carries the Direct Access Communications System (DACS) and scheduling."

Scott said, "The manual page was confusing at best. It is probably the single most important cable in the system."

Without a properly wired cable, a station cannot receive the on-line schedule and the DACS: the system that allows public radio stations to send text and data messages to NPR and to each other.

### New questions

"The quantity and the style of questions are changing," Vince said. "We're getting away from some of the installation questions, as more and more installations are completed."

When the demods first rolled out, stations would ask Vince how they authorize them. When the computers rolled out everyone needed to know how to hook up all of the cables.

Scott said, "Lastly, we're now getting some people asking the 'how do you drive the software' type of questions. If you were to categorize these software questions, it would be how to define resources, how to make a tape machine a resource in a computer and how to get a deck to do a particular function."

### Cue information

A big difference between the old public radio satellite system and the new satellite system is the shift in responsibility for cuing. Previously, in the old system, the satellite System Technical Center issued instructions that would trigger a station's tape machine to record.

The new satellite system provides a data

continued on page 29 ▶


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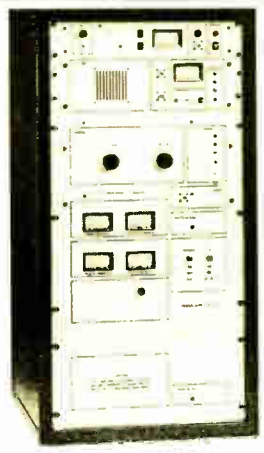

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World Radio History

# Digital Uplink System Streamlines NPR Satellite

▶ continued from page 27

stream describing all program material scheduled on the transponder, and the public station staff need only use their provided computer to view the schedule and click on material they want to broadcast or tape-delay.

Because the new satellite system transmits exact time-of-day data, the station's downlink equipment and computer form a very focused automation system. The machine interface consists of programmable relay closures, making it a system that each station can integrate to its present equipment and style of operation.

If the station's chief engineer finds that the new equipment does not quite do what is needed, a call to technical support can help straighten things out.

"We're going to be dealing with people with software issues," Vince said. "The station engineers will be asking more specific programming questions."

Typical questions include: "How do I get the scheduling computer to capture Fresh Air, insert my own local news, turn on the channel on a board, and shut that off at the right time?" All of that is certainly possible.

### Simple automation

Vince described one such operation. "One station engineer was reportedly using four contact closures to make a four-bit number for inputting to an automation sequencer. He can program the scheduling computer to close and open whatever combination of contacts he needs to make numbers from zero to 15, whenever he needs them."

Because the complement of equipment provides each station with 20 user-definable relay contacts and user-definable status inputs, a lightweight automation system can be constructed. Such technology might be useful to stations for developing their unattended overnight station operations.

There exists the need for handy tips and vital software dissemination. This is why a support dial-in bulletin board (BBS) has been commissioned, with an eye toward starting an FTP site and Web page to enhance support.

What lies ahead in January? If the current schedule holds, the public radio satellite system will cease its analog transmissions on Jan. 3, leaving the uplink remote control software roll-out and field debugging for the uplink stations.

"We only have 23 uplinks to worry about," Vince said. "But the sophistication and complexity of the automation at the uplinks is twice that of a downlink. So we're going to be spending a lot of time to make sure that complement of equipment is running and in order."

### Uplink remote

Until the uplink remote control system is in place in mid-1996, each uplink will be operated by what Scott Bridgewater describes as a "graphical-user-interface manual control of the uplink."

This manual-control software includes a scripting function to help the user with modulator tuning and transponder selection.

Is the new equipment cool? Yes, very. Is there technical support ready to assist each and every downlink equipped station? Fortunately for the public radio system, the happy answer is a loud yes.

There will be something of a new sound for NPR news programs next month. When the public radio digital satellite system is fully commissioned, the news magazines will be able to take full advantage of the 265 kilobits channel bandwidth to transmit the programs in stereo.

NPR member stations have the option to air the programs in stereo or sum the channels to mono, whichever works best for their RF coverage needs.

"We're delighted with this transition, and we're excited to be able to offer news programming to our stations in stereo," said Bill Buzenberg, vice president for news at NPR.

Major Armstrong and John Bose would be proud.

Happy holidays to you, and until next month, I remain,

Your obd'n't eng'r.

□□□

*Rich Rarey is technical director of NPR's All Things Considered. He can be reached at rrarey@npr.org*

# New Software and Storage

▶ continued from page 27

Digidesign dealers around the world should also be able to provide additional information.

### Media formats

I had hoped in this issue to provide information about Iomega's remarkable Jaz high-capacity drives. Unfortunately, a test sample was not available at deadline, preventing my waxing lyrical about them. Maybe sometime in the near future.

If I may, I would like to offer one or two observations about the impact that such technology — 1GB removable hard media for a remarkably low price — will offer the radio-production community.

Already, a number of leading workstation manufacturers are considering the use of such drives as standard media for inload and archiving. E-mu and Roland are two such companies.

Like many computer users, I have adopted and then obsoleted various file-storage formats over the years. The amount of data produced by Macs and PCs has increased dramatically from 400K to 1.4MB floppies.

We have been witness to Syquest, Bernoulli, magneto-optical (MO) and removable hard-drive technologies. We have always expected enhanced storage capacity and reduced prices from manufacturers and that is precisely what they have delivered.

As I gaze perplexed at several dozen 44MB Syquests and 120MB MO cartridges that are now obsolete, I am tempted to wonder where it will all end.

Progress is one thing, but having to transfer archived material from one transitory format to this week's favorite is quite another. When transferring large amounts of sound files from media to media, big certainly is beautiful.

But must we retain systems that can replay any and all of these transitory formats? What about the off-chance we might need to recover a track recorded a couple of years ago, or an audio file that comes to us on what we might now consider an outmoded format?

Sadly, we have to answer "yes" to all of these questions.

□□□

*Mel Lambert has been intimately involved with the production and broadcast industries on both sides of the Atlantic for almost 20 years. Now principal of Media&Marketing, a West Coast-based consulting service for the professional audio industry, he can be reached via mediapr@aol.com or 818-753-9510.*

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LINE-OUT

# The Right Byte: Which System for You?

**by Bruce Bartlett**
**with Jenny Bartlett**

**ELKHART, Ind.** The number of digital recording formats is growing.

At first, all we had was digital audio tape (DAT). Now there are two-track digital audio workstations (DAWs), multitrack DAWs, samplers, digital cart machines, hard disk recorders, and hard disk recorder-mixers. Any of these formats is useful for radio station production needs. Many stations utilize more than one format.

All digital recording devices employ the same basic A/D and D/A conversion process, but use different storage media.

A DAT machine records to tape, a hard disk (HD) drive records on a magnetic hard disk, a magneto-optical drive records on an MO disc and a sampler records into memory. All of these devices can sound excellent — much like a CD.

Here, we will describe each format and suggest the pros and cons of each.

### DAT

Currently, two-track open-reel digital recorders are quite expensive. The low-cost alternative is DAT. Costing $700 and up, a DAT machine records audio digitally on a small cassette of magnetic tape. It is a convenient format which has become the standard for mastering and audio backup. Tape cost is about $10 for two hours of recording.

Some units are small and portable, making them ideal for field work. DAT is the best choice for remote two-track recording, and for playing finished stereo productions on the air. To edit a DAT tape, however, you need a two-track DAW (described later).

A sampler converts analog audio to digital, and stores the digital data in memory. Because its memory is limited, a sampler is used to record only short sound events, such as sound effects or single notes of an instrument. You can use the sampler to edit each sample and trigger its playback; either manually, by a MIDI controller, or by a MIDI sequencer.

**DAT is the best choice for playing finished stereo productions on the air.**

Typical samplers include the Roland MS-1 and S-760, the E-mu Emulator and e64 and the Akai S2000.

Digital "cart machines" can record several spots on a Minidisc, magneto-optical disk or hard disk. Some examples are the Akai DD1000 and the 360 Systems DigiCart.

### Two-track DAW

A two-track DAW includes a sound card you plug into a computer, and two-track editing software. To use it, copy your unedited DAT tape onto hard disk. Then use your mouse and computer monitor to edit the selections. Finally, record a new edited DAT tape off the hard disk.

While editing, you can remove noises, delete misread sentences, or take out entire songs. You can even do crossfades and fadeouts.

With a two-track DAW, you can edit a concert recording for airplay. You can create simple spots by sound-on-sound. You might record a music bed first, edit the voiceover, mix the voice with the music, and mix in sound effects.

A two-track DAW may be more cumbersome to use than a multitrack DAW, but the two-track system is cheaper. A good sound card and editing software cost about $600 and up.

As for the hard drive, you need about 11MB per minute of stereo program, plus more for temporary audio files and regular programs. A 1.2GB hard drive is big enough to record a full-length CD program.

Some examples are Turtle Beach Wave, Sonic Solutions, Sound Forge, Digital Audio Labs' Fast Eddie and Editor Plus.

### Multitrack DAW

A multitrack DAW is similar to a two-track DAW but records four to 50 tracks. You can do sophisticated mixes by setting up tracks on the computer screen, controlling on-screen faders and so on.

You mix the tracks in your computer rather than on an external mixer. Some DAWs let you do an automated mix.

Multitrack software costs less than a multitrack tape recorder, and hard disk has fewer errors than tape.

Some examples are Spectral Prisma, MicroSound, Turtle Beach Quad, Samplitude, SAW and SAW Plus, Sadie, Digidesign Session 8 and ProTools III.

*(Editor's note: see the review of the Voyetra Digital Orchestrator Plus software on page 25 of this issue.)*

### Modular multitrack

A modular digital multitrack (MDM) records eight digital tracks on a videocassette, using a rotating drum like a DAT recorder. Two popular models are the Alesis ADAT-XL, which records on S-VHS tape, and the Tascam DA-88, which records on Hi-8mm tape.

ADAT records up to 40 minutes on a single tape, while the DA-88 records up to one hour 48 minutes.

With both types you can sync together several eight-track units via a cable and add more tracks. Unlike SMPTE time code, MDM sync does not use up any tracks.

MDM options include remote controls, remote editors, and circuit boards that allow sync to SMPTE and MIDI.

MDMs are the most popular multitrack recorders. Why? They sound good and their tape is cheap — about $15 for nearly two hours of eight tracks. You can edit their recordings by dumping them to a multitrack DAW. In fact, punching-in may be all the editing you need to do.

Because they resemble an analog tape deck, MDMs are simple to use. They need no computer to operate and are portable. MDMs are ideal for multitrack concert recording. You can add units as your track needs increase.

### Hard disk recorder

The hard disk recorder is a multitrack recorder using a hard disk instead of tape. The disk can be built in, added on or both.

Unlike tape, hard disks offer random access. This lets you quickly locate any point in a recording, edit each track and slide tracks in time. Disks have fewer errors than tape.

Some units edit destructively, rewriting data on the disk rather than just pointing to the data you want to hear. Others have playlist editing, which is fast and non-destructive.

Compared to multitrack DAWs, hard disk recorders are more portable and less expensive, but harder to edit with. Compared to MDMs, HD recorders have fewer errors but shorter recording time.

Some examples are the Akai DR-4d and DR-8d, the E-mu Darwin, the Vestax HDR-6 and HDR-8 and Otari RADAR.

### Recorder and mixer

Another name for a recorder and mixer is a standalone workstation. It includes a hardware mixer and dedicated software.

That is, the mixer uses actual faders instead of virtual faders on a monitor screen. The software has only one function: digital recording/editing. Standalone units can be expensive but are very reliable, fast and easy to use.

Some examples are the Fostex Foundation, Fostex portable HD recorder-mixer, Doremi Labs DAWN, Fairlight mfx3 MINI, Korg Soundlink, Lexicon Opus, AKG DSE 7000, and Roland's DM-80 and DM-800 systems.

### Application guide

In order to decide what format is appropriate for the needs of your own station or studio, refer to the following criteria:

- Low-cost media: Tape (DAT or MDM).
- Low-cost system: DAT, MDM or DAW (using an existing computer). Two-track DAW is especially cheap.
- Long recording time: DAT, MDM or two-track DAW.
- Easy to learn and use because of hardware mixer: MDM and mixer, HD recorder-mixer.
- Complex productions: Multitrack DAW or HD recorder-mixer.
- Record several tracks at once: MDM, HD recorder or HD recorder-mixer.
- Does not tie up a studio mixer: DAW or HD recorder-mixer.
- Portable: DAT, MDM, HD recorder or portable HD recorder-mixer.
- Record sound effects or spots for use in production: Sampler, digital cart machine.
- Random access for fast edits and time-shifting tracks: DAW, HD recorder, HD recorder-mixer.
- Removable media: DAT, MDM or removable hard drive.
- On-location recording: DAT or MDM.
- Play long programs on the air: DAT.

□□□

*Watch for a special Buyer's Guide on Digital Audio Editing and Production in the Feb. 7* ***RW****.*

*Bruce Bartlett is a mic engineer, writer and recording engineer, and the author of Practical Recording Techniques published by Howard Sams. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.*


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World Radio History

PRODUCT EVALUATION

# Phonic Monitors Have A 'Real World' Sound

**by Bruce Bartlett**
**with Jenny Bartlett**

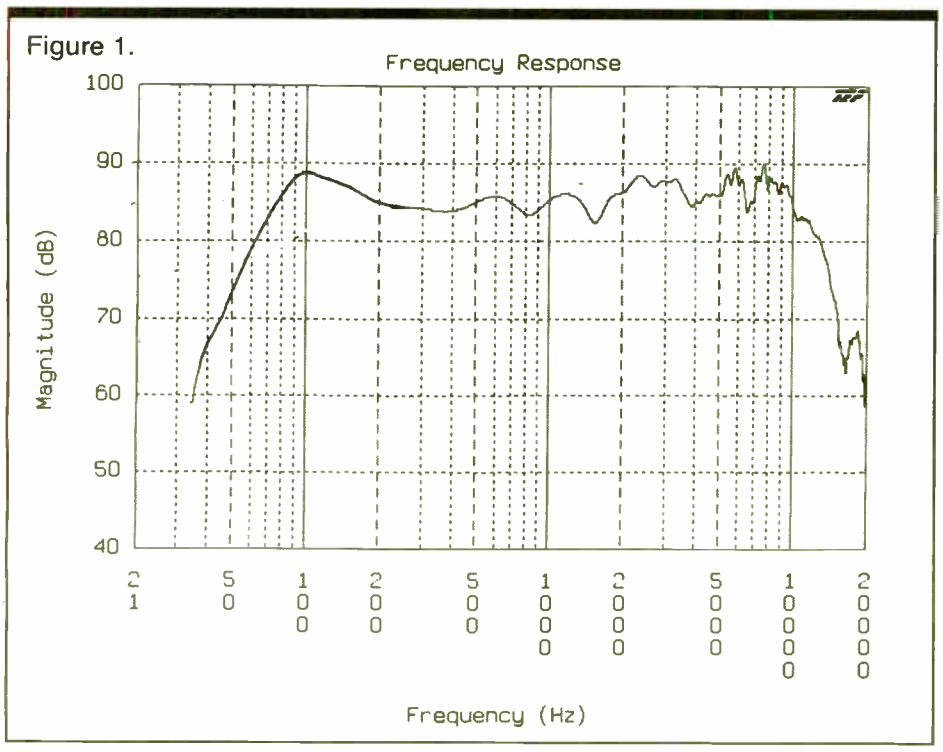
**ELKHART, Ind.** "How will my mix translate to the home listeners' speakers?" That is the question we always ask while mixing a radio production.

One answer is the Phonic SE-207 speaker.

It is not meant to be an accurate monitor with deep bass, but rather a reference to the real world — like the speakers most people own.

According to Phonic, the SE-207 speakers "provide a very wide frequency response in a real-world-size cabinet, so that sound engineers can be sure that the music mix will translate well from the studio to home and car stereos."

Figure 1.




Normally you monitor your mix on a flat, full-range system. But you can switch occasionally to the Phonic speakers to see how most of your listeners will hear the mix.

Phonic lists more uses for the SE-Series monitors:

- Used in multiples as public-address speakers in commercial installations
- Used on stage as 'spot' monitors
- As additional remote home speakers in the bedroom or the kitchen
- As excellent car stereo speakers for the rear deck.

The SE-207 is a compact 2-way system with a ribbed plastic enclosure. Mounted in the black cabinet are a 6.5-inch polypropylene woofer and a 1-inch soft dome tweeter.

The woofer employs a 13.3-ounce magnet structure and a 1-inch, four-layer "krypton" voice coil (I think they meant a kapton former). Ferrofluid is used to cool the tweeter's voice coil.

On the cabinet's front face is a convex perf-metal grille which protects the speaker drivers. On the back, a pair of press-insert connectors accept bare wires.

Included with the speakers is a pair of metal mounting brackets, which let you attach each speaker to the wall or ceiling. An optional RK-15 omni-mount bracket gives you more freedom in aiming the speaker.

According to Phonic, the frequency response is 70 Hz to 20 kHz with no tolerance given. Impedance is rated at 8 ohms and sensitivity at 90 dB SPL/W/m. Crossover frequency is 3000 Hz. Maximum power handling is claimed to be 100 watts. The SE-270 is available for $219 a pair.

### On the bench

I measured the SE-207 with a Techron TEF-20 analyzer. The mic was one meter away, halfway between the woofer and tweeter. The measurement was taken from 300 Hz up to exclude room reflections. Below 300 Hz, the measurement was done with the mic very close to the woofer. This yields the response in half-space, such as near a mixing console or against a wall.

As Figure 1 shows, the anechoic response on-axis is 65 Hz to 12 kHz, ±3 dB, which is very good for an inexpensive speaker. There are some small high-frequency bumps and a rapid rolloff above 12 kHz, which can lend a slightly harsh sound to percussion, cymbals, and sibilant "s" sounds.

Figure 2 is the Energy Time Curve, which relates to the transient response. It

continued on page 33 ▶

### Product Capsule: Phonic SE-207 Speakers

**Thumbs Up**

- ✓ good response, THD
- ✓ reasonable price
- ✓ accurate real-world speaker

**Thumbs Down**

- ✓ slight harshness

For more information, contact Phonic at 714-253-4000; or circle **Reader Service 55**.

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World Radio History

# Phonic: Sonic Truth

▶ continued from page 31

is reasonably good. The woofer signal kicks in shortly after the tweeter signal. Cabinet vibrations are 7 dB below the woofer's direct-sound level.

Figure 2.

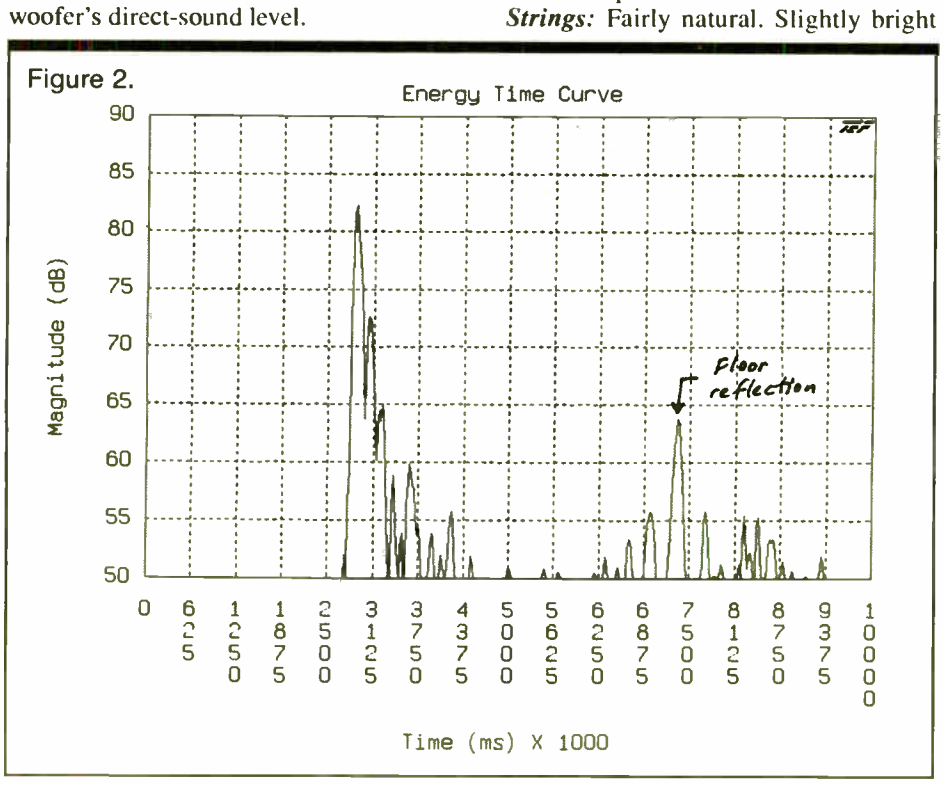



Figure 3 shows the Total Harmonic Distortion (THD) vs. frequency at 90 dB SPL at one meter. The results are good for a small speaker. Distortion is below audibility (less than 3 percent) at most frequencies. You would not want to play the Phonics really loud, but you would not need to for multimedia productions.

## Listening tests

I put the Phonics three feet apart and three feet from me, on stands just behind my mixer. They sounded good for the price.

Let me add a note here. I am judging the Phonics speakers for fidelity, not how well they represent the majority of listeners' stereos.

Having said that, these are my impressions of several instruments:

***Cymbals:*** Slightly bright and harsh.
***Bass:*** No deep bass. Some doubling. Fairly tight considering the lightweight cabinet.
***Vocals:*** Pretty natural, not puffy or thin. Sibilants are a little harsh.
***Electric guitar:*** Good edge or bite.
***Snare:*** Good impact.
***Kick:*** Deep lows are absent.
***Strings:*** Fairly natural. Slightly bright or steely on some recordings.
***Acoustic guitar:*** Clear and detailed.
***Percussion:*** A little edgy rather than sweet.

## Conclusions

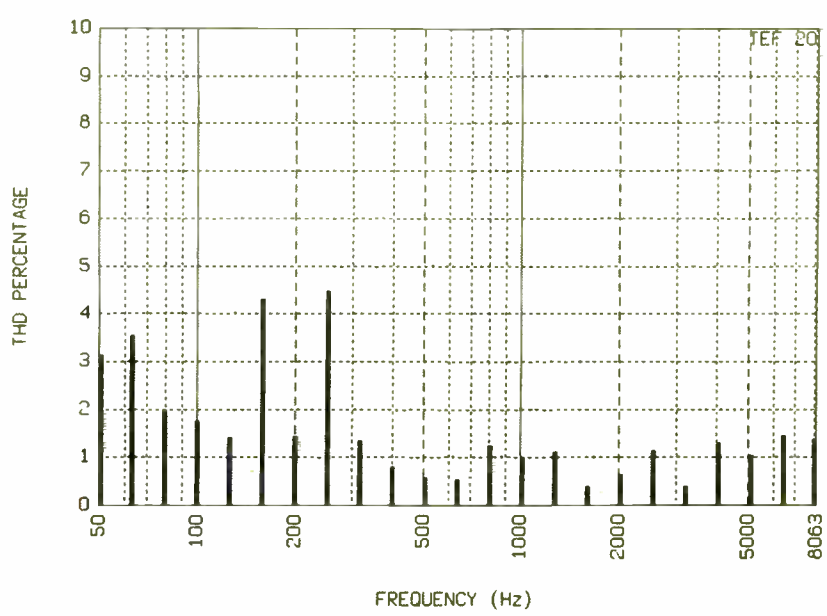
Overall, the Phonic SE-207 sounds clear and articulate. It provides better than average sound for its price. The tonal balance is a bit weak on the lows and bright on the highs, but that is compared to much more expensive speakers.

The SE-207 is not intended to be your primary monitor, but a real-world reference to examine your sound as it would be heard on home and automotive stereos. In that function it works quite well, and can be a valuable tool for your mixdowns.

□□□

*Bruce Bartlett is a microphone engineer and technical writer, 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.*

Figure 3.

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World Radio History

# WILD, WAKY, KRZY Call Letter Combos

**by Alan R. Peterson**

**WASHINGTON** Quick, name the only U.S. radio stations whose call letters are exactly the same as their cities of license.

Some come real close, like KADA in Ada, Okla., or KAPE(AM) for Cape Girardeau, Mo.

WOYL(AM), Oil City, Pa., is especially creative, and Tye, Texas could possibly grab KTYE.

KELY and KELY-FM, Ely, Nevada? Close, but no cactus.

No, the only true ones are WACO-AM-FM in Waco, Texas, and WARE(AM) in Ware, Mass. I am not yet aware of any others, but it would not be the first time I blew a trivia question.

Call letters are the ultimate Scrabble game. Four little letters get rolled together into an artistic statement, legal identifier and marketing device all in one.

People spend hours coming up with creative vanity license plates and boat names. Call letter combinations can be equally challenging and entertaining for broadcasters.

### New calls

Stations change calls all the time, underscoring the importance of an effective and ear-catching combination. If a station is perceived as unsuccessful, or cultural evolution creates an image problem for once-classic calls, new calls often become part of a grand makeover.

I once programmed a station that, owing to the call letter combination, was phonetically derided by critics as "the wimp." In spite of efforts to tweak the calls into something a little more macho, the best that could be mustered was "the Hump" (complete with camel mascot). The concept fizzled during discussion.

At the time of this writing, all combinations included here are considered accurate and in use, unless otherwise specified.

Lifting the first few letters of the city of license is a popular pastime. WOCO in Oconto, Wis., works quite well, as does WPRO in Providence, R.I.

WORC Worcester, Mass., is especially tasty, but I would not recommend this practice for a station in Hornell, N.Y. Try it and see why.

I believe KYOY and WYOY are both available and would be great calls for nostalgia/big band stations. Hum the classic song "Over the Rainbow" and listen for the line "...why, oh why, can't I?" A quick call to the copyright owners, a little splicing and a new image package is born.

### Cow-a-bunga

God bless the state of Wisconsin for snapping up "cow" call letters. WCOW is in Sparta, and there is a CP on file for WKAU in Kaukauna. They missed the hat trick with WMOO, which ended up in Derby Center, Vt.

An improbable FCC waiver to allow a set of "K" calls might have netted KCOW or KKOW, but they ended up in Alliance, Neb. and Pittsburgh, Kan., respectively.

Good news, though: last I looked, WUDR ("The Udder") may still be available.

Duck lovers in Arkansas have KWAK and KWAK-FM, Stuttgart. Fans of Neil Sedaka would enjoy KAMA in El Paso, Texas; Sing the intro to "Breaking Up is Hard to Do" and you will know why.

Is there a new baby in the family? WAAA in Winston-Salem, N.C., or WAAH in Houghton, Mich., may be for you.

When pronounced phonetically, radio station KAMU (College Station, Texas) could well become a favorite of literature and existentialism students.

And you have to love KICY, in icy Nome, Alaska.

Several celebrities own radio stations, right? Star Trek's resident Klingon, Michael Dorn, should treat himself to a directional daytimer and call it WORF. The calls may be available.

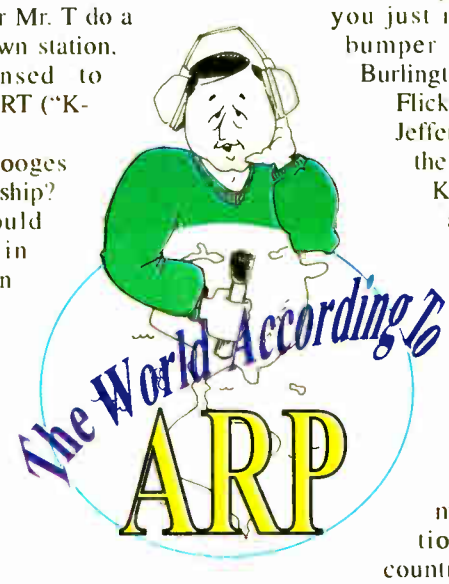
If not, he can always make an offer to buy KLNG in Council Bluffs, Iowa, or KLGN in Logan, Utah. Who would say no to a Klingon?

### Mr. T for two

It would be fun to hear Mr. T do a morning show on his own station, but WMRT is licensed to Marietta, Ohio, and KMRT ("K-Mart"?) is in Dallas.

What if the Three Stooges were into station ownership? I am certain they would have owned WUWU in Cordele, Ga., WOWO in Ft. Wayne, Ind., WNYK in Nyack, N.Y., WPIE in Trumansburg, N.Y. or maybe even KMOE in Butler, Mo.

Heck, they could have filed a CP to put KRLY on the air.




### Elmer Fudd, DJ?

The Warner Brothers cartoon division should begin buying stations to create its own radio network. Naturally, they should begin out east with WHAK, WBOP, WHAM, WHAP, WHOP, WOMP, WPOP, WIZZ and WOOF.

Later acquisitions in the west would include KRAK, KRSH, KICK, KLOD, KOOC, KORK, KPOW and perhaps KUKU.

Imagine what their network-wide station ID would sound like. You would wait by the radio all day just to hear it.

What if the Muppets started a broadcast empire? For sure, their first acquisitions would include KERM in Torrington, Wyo., KPIG in Freedom, Calif., WFRG in Utica, N.Y. and still be able to submit CPs for KRMT and WMUP.

If Clark Kent were the reporter he claims to be, he would have worked at WHO in Des Moines, Iowa, WHEN in Syracuse N.Y., WHER in Hattiesburg, Miss. and WHAT and WHYY in Philadelphia before joining the Daily Planet.

Flutter your index finger up and down over your lips to make that sound we all did in first grade. Record it and you just might have a new bumper ID for WBBB, Burlington, N.C.

Flick your Bic lighter in Jefferson City, Mo., and the good folks over at KLIK might sit up and take notice.

Does your car shimmy when driving through Oberlin, Ohio? Check your car radio to see if WOBL is tuned in.

Remember in the mid-80s when stations all across the country played "We Are the World" simultaneously? Specific stations in Shamokan, Pa., Cambridge, Ohio, Bangor, Maine and Barre, Vt., should all agree to simultaneously play that great Disney classic WISL WILE WYOU WORK.

### Check the map

Engineering articles always pose hypothetical situations on antenna arrays, spurious emissions or duopolies multiplexing through one tower. Nearly all of these stories contain something about "station *WAAA* sharing tower space with stations *WXXX* and *WZZZ*." Regardless of the topic, it is always those very calls that fill in the blanks of these stories.

Apparently, the only hypothetical situation here is geography. You already know WAAA is in North Carolina, but you should know WXXX is licensed to South Burlington, Vt. and WZZZ is in Fulton, N.Y., near Lake Ontario.

If these three stations truly shared one stick, imagine the rates that could be charged for spots and rent on the tower space.

### A little math

Will we run out of call letter combinations anytime soon? Happily, no. Bang out (26 x 2) and you will see over 35,000 "W" and "K" call letter combinations are possible. Much more than the number of radio stations now on the air here.

There are still lots of creative station call letters to be had, barring the questionable combinations. Some actually got by the commission at one time or another, but that is another story.

If your station is planning a grand makeover, start collecting call letter ideas now before someone else grabs the set you want.

I have to KLOS (*Los Angeles*) here, because my editor, Luci KOBO (*Yuba City, Calif.*) is going to give me a WACK (*Newark, N.J.*) in the head if I don't KUT (*Austin, Texas*) the KRAP (*unavailable*) right now.

WEBE (*Bridgeport, Conn.*) seein' you next time.

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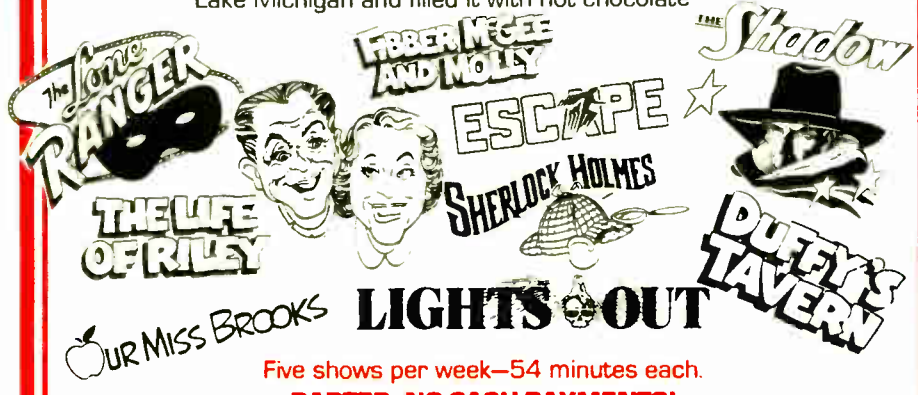


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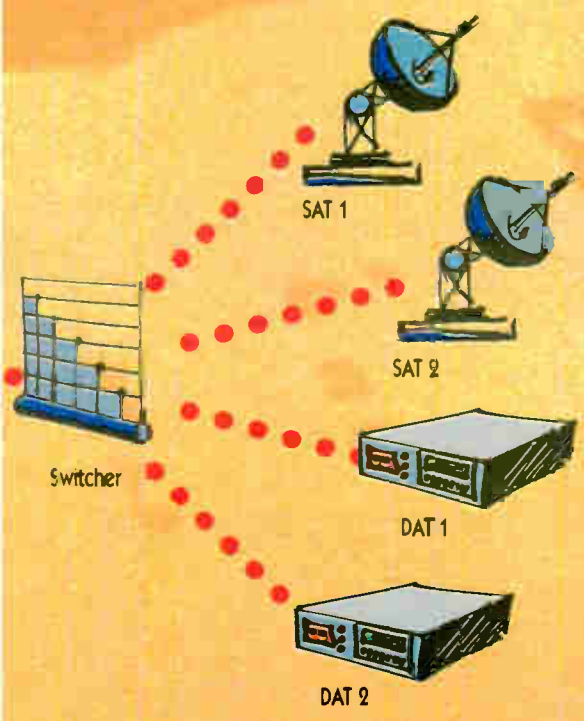


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# Budget PC Multitrack

▶ continued from page 25

Suggest. The first allows you to hear a small amount of effect before committing the entire soundfile to a transform. This allows you to tweak effect parameters and keeps you from having to sit through a bad transform, a long Undo and the retrieval of the original file.

The Suggest feature is used in amplitude scaling and DC offset. When used for scaling, it helps balance the volume between different files when cutting and pasting.

Some sound cards do not align sound to digital "zero" when recording, which results in audible popping at the beginning and end of recording. This is DC offset. When the Suggest feature is used here, it analyzes the selected range and enters a DC value that vertically centers audio data.

Note the absence of adjustable EQ. The virtual software control panel of most sound cards can shape overall EQ, but the Digital Orchestrator Plus screen mixer lacks the ability to selectively apply EQ to each digital audio track. This would require even more computational horsepower and much more than a garden-variety sound card (not to mention more expensive software). Growl about it now, but understand this is what keeps prices down.

You will not be able to save your project as a standard Windows .WAV file. Voyetra saves MIDI data and digital audio as a proprietary .ORC file. To transfer an audio file to another platform, you may have to go D-to-A and send as analog audio.

### MIDI

Having suggested earlier to overlook the MIDI features, I now rescind that statement and invite you to take a healthy look at the MIDI capabilities of Digital Orchestrator Plus.

Many mid- and high-end sound cards come with built-in wavetable synthesizers and MIDI interfaces. Desktop music production has been a reality for several years and there is no reason radio production studios should not take advantage of it. All that is needed beyond the software and the PC is a music keyboard with a MIDI Out jack and a modicum of musical ability.

Digital Orchestrator Plus is a full-featured MIDI sequencer and editor, able to record performance, make changes in tempo and key and perform Cut/Paste functions on any portion of a composition.

A mixer window resembling a 16-channel console gives complete real-time control over MIDI and digital audio mixdown. A notation window allows you to see a performance as music notation, and will direct a printer to create a score.

Two handy features to have are Quantize and Humanize. The first is used to correct timing mistakes, like a note played too late or too early. Quantizing a track makes sure everything happens on the beat or close to it, but can impart a mechanical feel to the music if overused. Thank heaven for Undo.

Humanize makes random adjustments to a performance to sound more natural and relaxed. At face value, it seems as if both features would be at odds against each other. Both are legitimate, useful tools for the MIDI producer.

To give a sequenced piece a jazzy feel, the Swing feature is engaged. This moves data on every other beat to an earlier or later position from normal, resulting in a bouncy feel.

Even if production people have no keyboard skills and must "peck" to find notes, these features give sequenced music a sense of human performance.

The argument could be made that the cost is really much higher, that the purchase of a computer should be factored into the decision. The assumption must be made that a user already owns a PC with a decent sound card; to coin an analogy, one does not buy wiper blades for a car one does not own.

True, Voyetra recommends a costly Pentium 90 as the standard machine to run Digital Orchestrator Plus. On the PC evolutionary curve it must be assumed that this type of machine is becoming a standard to gauge performance on, much like the 386-40 was only a handful of years ago.

A high-speed 486 with a coprocessor and adequate RAM will deliver reasonable performance, but for 386 users, this is a wake-up call. Audio products are only going to get more sophisticated. Upgrade now.

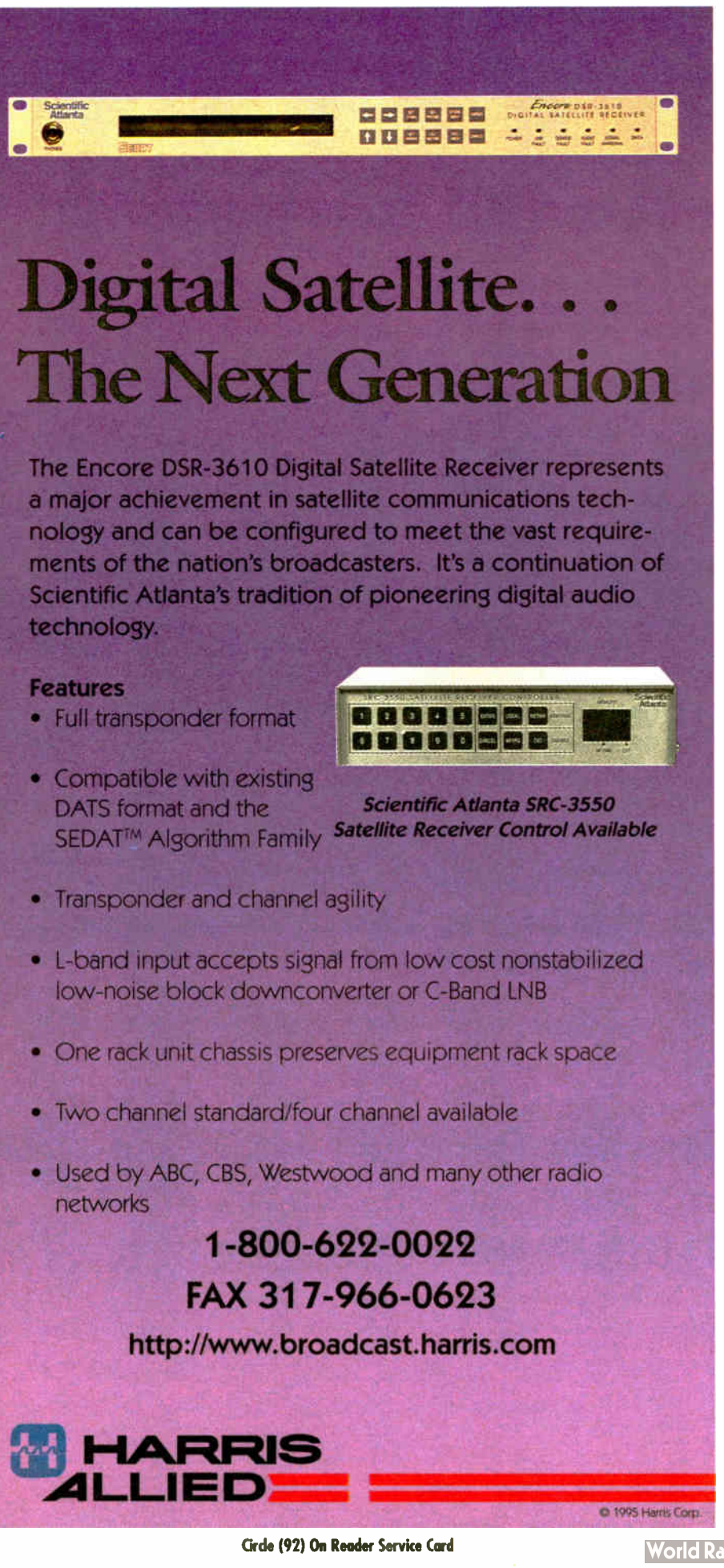
Regarding sound cards, practically all popular ones are single input types. Inexpensive PC-based multitracks such as Digital Orchestrator Plus (or any single sound card product) will not accommodate multiple inputs on one pass the way an analog multitrack deck will. Someday they will, but at present, elements of a production must still be inputted one at a time.

### Conclusions

The street price for Digital Orchestrator Plus will probably be around $110. Frankly, there are few things I would rather spend a C-note on than this program. It is pretty slick.

Digital Orchestrator Plus may not be a frontrunner for your main "money room" production system or to mix your first movie soundtrack on. But expect to be pleased by its performance as an audio recorder/editor and by its exceptional capabilities as a MIDI sequencer for most music projects.

Voyetra Technologies put a lot of thought and work into Digital Orchestrator Plus. If you want to work with MIDI and digital audio together on one machine, this is a fine place to begin and get good without paying a pile.

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PRODUCER'S FILE

# VoxPro: Much More than Jock Phone Bits

**by Ty Ford**

**BALTIMORE** When I heard about the Audion Labs VoxPro a year or so ago, I had mixed emotions.

The "radio guy" part of me was skeptical about using a Mac in a broadcast application, especially because the analog I/Os are unbalanced -10 dB.

The Mac user in me knew that Mac reliability was up to the task, and, with the right software, dedicated control panel and protection against EMI and RF, the VoxPro could easily replace a lot of reel-to-reel machines in studios and newsrooms.

For that matter, you could use the VoxPro to assemble and play back an entire newscast. You could even use the

VoxPro: goes anywhere tape can.

VoxPro to replace on-air cart machines. Of course, to do this, you would have to make an edit for each break by selecting each spot in the right order.

Come to think of it, that probably would be easier, quicker and less expensive than trying to find four carts and shoving them into four playback cart decks. But now I am getting ahead of myself.

### Mac power

VoxPro is designed to make mono or stereo digital recording and simple editing easy. The Mac I was supplied with was a 6115 Power Mac running System 7.5 with 8MB of RAM and a factory-installed audio card.

The manual mentions that Audion Labs has a list of approved hard drives recommended for expanding the storage of the system. VoxPro will work with up to a 2GB hard drive. That is 360 mono minutes. If you want more storage time, they recommend partitioning a 4GB disk into two 2GB partitions, or use multiple smaller hard disks.

VoxPro uses a special analog I/O card to handle the audio. A/D conversion is 16-bit, 64X oversampling, 44.1 kHz.

The signal-to-noise ratio is quoted as greater than 86 dB ("A" weighted), frequency response is 20 Hz to 20 kHz, THD is .01 percent at 1 kHz. Headroom is internally adjustable to 6, 12 or 18 dB. Output is internally adjustable from 0 to -36 dB.

Commands are entered by mouse, the Mac keyboard or the dedicated VoxPro control panel. VoxPro uses the mini stereo analog I/Os on the back of the Mac CPU. Harris Allied is presently shipping the new Matchbox II (a higher-gain version of the original Henry Matchbox) as part of the VoxPro package.

The Apple Color Plus 14-inch display monitor, while better shielded than my older beast, was still putting out enough EMI to get into my dynamic mics when positioned near the monitor. My experience with computer monitors is that they radiate a vertical ring of interference parallel to the plane of the face of the monitor.

Then there is the noise created by the fan and hard drive in the Apple CPU. If you want studio quality recordings, consider mounting the CPU in a ventilated enclosure.

This gets you past another problem: VoxPro and all of the peripherals take up more counter space than an Otari 5050. With the CPU somewhere out of the way and using a wall-mount for the monitor, this leaves only the ASCII keyboard, the mouse and the 13-inch by 8-inch remote panel near the operator.

Straight from the box, all you have to do is plug in the parts and audio cables and start the Mac. A VoxPro Alias file in the startup folder starts the application automatically.

### Self-checking

There is an automatic level-sensing check that requires that no audio level be sent to the Mac's inputs at startup, so you may want to precede the inputs with some way of keeping audio off the line for a few seconds during that procedure.

When shipped from the factory, the VoxPro software is custom-installed on the Mac with a very lean system. What the user sees is a simplified file list. Separate folders can be assigned to each user, by daypart or by any other category.

Per the manual, "The morning show staff may wish to have a folder dedicated to morning show materials. Within the morning show folder, there can also be several owners/producer, weather/traffic

continued on page 40 ▶

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# Upgrades for VoxPro

▶ continued from page 39

and morning show host. A maximum of 20 owners can be created. Each folder may contain a total of 40 edits and 40 Masters. Keeping individual user files is a good way to prevent accidental deletions."

That brings us to the concept of how VoxPro creates and stores files: Each recording creates two kinds of files, an Edit and a Master. Edits appear in one window, Masters in another. You can cut, copy, paste and insert changes to the Edit, but you cannot edit a Master.

This approach to non-destructive editing allows you to create Edits (versions) of material copied and pasted from any of the Masters without altering the Masters. If you were a bit lax about getting in or out of Record mode and wanted to clean up your Master, you would make your changes to the Edit and then save it as a new Master. Then you could delete the old Master and any old Edits.

### Software based

VoxPro includes a software-based automatic gain control (AGC) application placed after the A/D converters. If you overdrive the audio going into the system, the AGC will not help, but after you get the file safely in, you can apply the AGC to smooth out some wrinkles in the levels.

Phone Link Mode is particularly useful when recording announce mic on one channel and phone line on the other. In Phone Link mode, the AGC keeps the background noise on the phone line from being grabbed and raised by the compressor.

VoxPro has an Auto-Record feature that lets you set day and time for the system to go automatically into record. The Record Start Mode lets you set the record threshold from -36 dB to 0 dB. Any audio that passes the threshold starts the recording process. The Remote Start Mode is accessed via an eight-pin DIN socket on the side of the dedicated remote panel.

Almost any VoxPro action can be assigned to one of the four remote keys this interface provides. You can also do an insert recording into any edit. The new material is inserted at the current cue position.

A variation of this mode, Serial Recording, allows several different sessions to be recorded into a Master and original Edit file. This keeps the number of different files from one session from becoming unmanageable. Silence can also be inserted at any point in an Edit.

In the stereo mode, the Time Slip feature allows you to choose from "left-follows-right" or "right-follows-left." Time Slip works only on Edit files and is available only in stereo mode and only when an piece of a edit is selected.

Setting edit markers is very easy. There are two dedicated keys for left and right. A "zoom" key allows for finer adjustments. If you want to move to a different part of a track, there are slow, realtime and fast keys in either direction. The mouse can also be used to drag the waveform in either direction.

Once a piece of audio has been selected, it can be cut, copied and pasted elsewhere. VoxPro also provides a crossfade feature to "smooth over" glitches that may occur when combining audio segments from different masters or edits. This feature was not powerful enough to eliminate the occasional glitches heard as a Master or Edit is put into play. The glitch is random and sporadic, but never hugely apparent. Glitches also occur occasionally when stopping play.

In addition to Masters and Edits, each operator can have 10 "Carts." Carts can be instantly played by hitting one of the ten Cart buttons on the dedicated remote panel. Any Edit can be converted to a Cart and assigned a number.

### Upgrades

There are several features in the new Version 2.0 software that make VoxPro an even easier and more powerful system.

The networking feature uses AppleTalk or EtherNet to "put" or "get" files between VoxPro units to another hard drive partition or another hard drive within an existing VoxPro system.

You simply select a Master file and select "Put Master" from the File Menu, and designate the destination. Background transfers are not supported yet. A dialogue box opens that allows you to place the file using the "Get Master" and "Put Master."

A "ballistic wind" feature has been implemented in the fast forward and rewind modes, so the longer those keys are held down on the remote pad, the faster the "tape" on the screen moves. The audio is muted at the highest speed.

The new Scrub feature brings the VoxPro up to date with scrubbing features on most of the better workstations. All you have to do is click the mouse on the audio waveform and move the mouse left or right. If you need to scrub an area before or after the visible waveform on the screen, release the clicker, move the mouse to the appropriate end of the waveform, click again and continue to scrub.

Another very handy feature allows an audio file to be played from the beginning while the file is still being recorded. Use it for recording last-minute traffic reports that need to air immediately, or for time-delayed playback of network or any other remote audio.

Product Capsule: **VoxPro Version 2.0**

**Thumbs Up**

- ✓ easy to set up and use
- ✓ nice price

**Thumbs Down**

- ✓ another monitor in the studio

For more information, contact Harris Allied at 317-962-8596; or circle **Reader Service 114**.

### For engineers

A passworded diagnostics section allows the engineer to do some simple checks and make a few adjustments. Thermal Calibration allows the engineer to enter the number of seconds between reads. This feature is only necessary with old hard drives that require CPU time for recalibration. Systems purchased from Harris Allied do not require this precaution.

A compatibility test for disk drivers is also included that determines which drivers are used and whether they are synchronous and asynchronous.

The VoxPro system is double-buffered, which allows the new 100MB removable Zip drives to be used, even though the Zip drive's access times are slower. This allows each operator to have his or her own "reel."

On some workstation displays, the audio flows from left to right. On others, it flows from the right side of the screen to the left. Vox Pro 2.0 allows you to choose the direction of the audio display to either left to right or right to left.

Unfortunately, there is a bit of code needed to make the right-to-left work with the "go to end" and "go to beginning" buttons on the VoxPro remote control pad and the Home/End keys on the Apple keyboard.

The Page Up, Page Down and Play Beg keys on the Apple keyboard do change with the mode change.

The VoxPro has plenty of power and speed. Enough to assemble, edit and play back newscasts and most two-track production. There is a lot more going on here than a system for editing telephone calls.

Version 2.0 makes VoxPro a very affordable, feature-rich system for the studio or newsroom. VoxPro is available in three sizes: 100 track-minutes for $5,295, 140 track-minutes for $5,695 and 360 track-minutes for $7,295.

Spend the extra $1,000 for the dedicated remote control; it is worth it. The fact that the system presently has only analog I/Os is inconsequential. Its ease of operation, editing and networking abilities create another signpost on the evolutionary trail of recording that lead to the end of the reel-to-reel era.

□□□

*Ty Ford can be reached at Tford1010@aol.com or 410-889-6201.*

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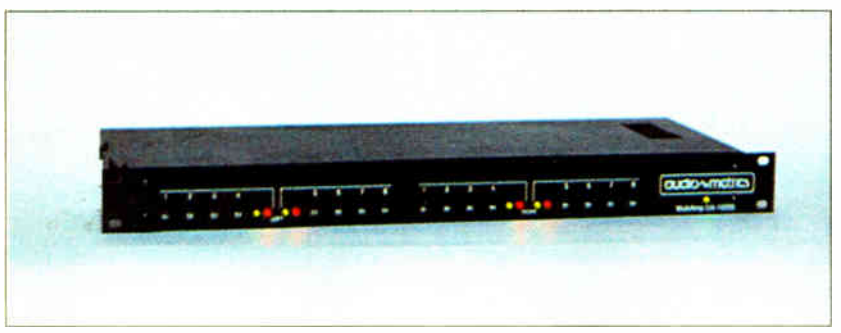

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# Many Uses for Microcontrollers

**Part III of III**

**by Jim Somich**

**BROADVIEW HEIGHTS, Ohio** Over the past few months, we have been examining the fascinating, low-cost Blue Earth Micro-440E microcontroller.

A microcontroller is a stripped-down, miniaturized computer designed to do a specific task, or a range of specific tasks. Microcontrollers have many potential applications in the broadcast plant as we shall soon see.

There are literally hundreds of microcontrollers on the market, ranging from the simple Basic Stamp to controllers with enough functions and memory to rival a well-equipped PC. I chose the Micro-440 for this series of articles because it is simple, low-cost (under $200), easy to program in BASIC and readily available. Also, Blue Earth Research provides excellent support.

## Blue Earth radio

The first article in this series gave a general overview of microcontrollers and the Blue Earth Micro 440E in particular. The second in the series described the memory-mapping and resident software in the 440E.

This month, in the third and final installment in this series on microcontrollers, we will explore some practical applications of the 440E in the broadcast plant.

Applications around the broadcast plant are many, including transmitter monitoring and control, simple automation switchers and machine control systems, to name a few.

Blue Earth maintains a computer BBS that can be accessed by purchasers of their products. You can download dozens of applications and simply load the code into your Micro for immediate gratification.

## Getting started

It is now time to finally break free of theory and get some hands-on, real-world experience with microcontrollers.

The initial startup of the Blue Earth Micro is designed to be a simple procedure. The minimum hardware configuration necessary for the operation of the controller involves supplying power to the unit and connecting it to the serial port of a host PC or terminal. Once connected, the terminal or PC can be used to program the controller.

Figure 1 illustrates the system wiring diagram for the Micro-440E.

First, connect the Micro, application module (or ST-I/O Module) and the interface cable to your PC's serial port as shown. Connect the power supply and verify that the controller's red "POWER" LED is illuminated. The ST-I/O module is a convenient way to connect power and I/O lines to the micro.

While it is possible to delve into the Micro directly through its own DB-25 I/O connector, it is considerably simpler to use the ST-I/O, which provides screw terminals for all I/O lines and a convenient power jack. A common wall wart can supply the 12VDC required by the Micro.

Figure 2 illustrates the use of the micro without an interface module.

## Command line

Invoke the MonScope-51 program (resident) by typing "MS51." Immediately after the MonScope sign-on, the READY prompt should appear, followed by a "Communication Interrupted" error message. This is normal.

Then enter the MonScope-51 command "TERM" to enter the serial communications mode. This command splits your monitor into two windows and puts your PC into a terminal emulation mode (upper window). The Micro will now accept BASIC commands from your PC.

If the above steps were followed and you are in the serial window of the MonScope-51 program with no controller response, it can usually be brought to life with a hardware reset and entering a space character. Do this by disconnecting and then reconnecting the power supply, then pressing the space bar on your keyboard.

A hardware reset may also be required if power was applied to the controller after the serial communications program was invoked and before the TERM command was entered.

Verify serial communication by monitoring the port status LEDs located on the front of the controller next to the Power LED. The green Transmit LED will become brighter while the Micro is transmitting data to the host PC or terminal.

The yellow Receive LED becomes brighter when serial data from the host PC or terminal is being received by the Micro.

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BOTTOMLINE BROADCASTER

# Understand, Maintain Directional Arrays

**by James Murphy**

**MORGANTOWN, W. Va.** Whether we like it or not, directional antenna systems are as much a part of the landscape as barns, satellite dishes and wrecked cars.

Multitower arrays once ruled the radio empire. Now, in most instances, they have taken a back seat to FM. Some folks have even forgotten what they do.

I recently asked a young technician about his station's antenna system. My intent was to find out the line of towers, what the pattern looked like, and what the antenna parameters were.

Instead he said, "One of them holds up the FM bays, the middle one supports the STL dish, and that one over there, well, some of our two-way stuff is on it."

### What can go wrong

No matter your expertise or understanding of directional arrays, one fact is certain: Sooner or later something will go wrong, and you will need to fix it.

Pattern problems and parameter variations are usually handled by consulting engineers. Hopefully, these are only rare unfortunate instances. Realistically, the failures will be in the control circuits.

Take your pick: Frozen contactor mechanisms, wires chewed apart by rodents, maybe corroded terminals. There are many more malfunctions that will prevent pattern switching, monitor switching or any other actions for changing transmitters, systems and power levels to accommodate the license parameters.

If you have been tossed into the middle of a directional system, some fundamental information might help you out of a tight spot as well as help you understand basic switching methods.

### The big switch

Figure 1 shows an RF contactor and commonly-used circuit to activate it. We will not concern ourselves with the RF portion, but will assume we are connecting RF energy from A to D in position 2, and from B to C in position 1.

Microswitches MS-1 through MS-4 change state when the contactor arm comes to rest at a new position. The four microswitches are shown in the position they assume when the contactor is connecting A to D, or in position 2.

See how MS-2 provides a closed circuit from the power rail (R/C+) through K1's coil to the Raise contact on the remote control. Conversely, MS-3 is now open, interrupting the flow through K2. This prevents the burnout of solenoid Coil 2, which would be caused by a constant pulse from the remote control.

The microswitches do not change state until the contact arm finishes its travel. If full motion of the contact arm is obstructed, the energized coil continues to get voltage as long as the remote control is activated.

A heavy-handed announcer could conceivably hold the raise button down for a few minutes and destroy one of the main solenoid coils. If that happens, count on lots of trips to the transmitter site to

continued on page 47 ▶

Figure 1.

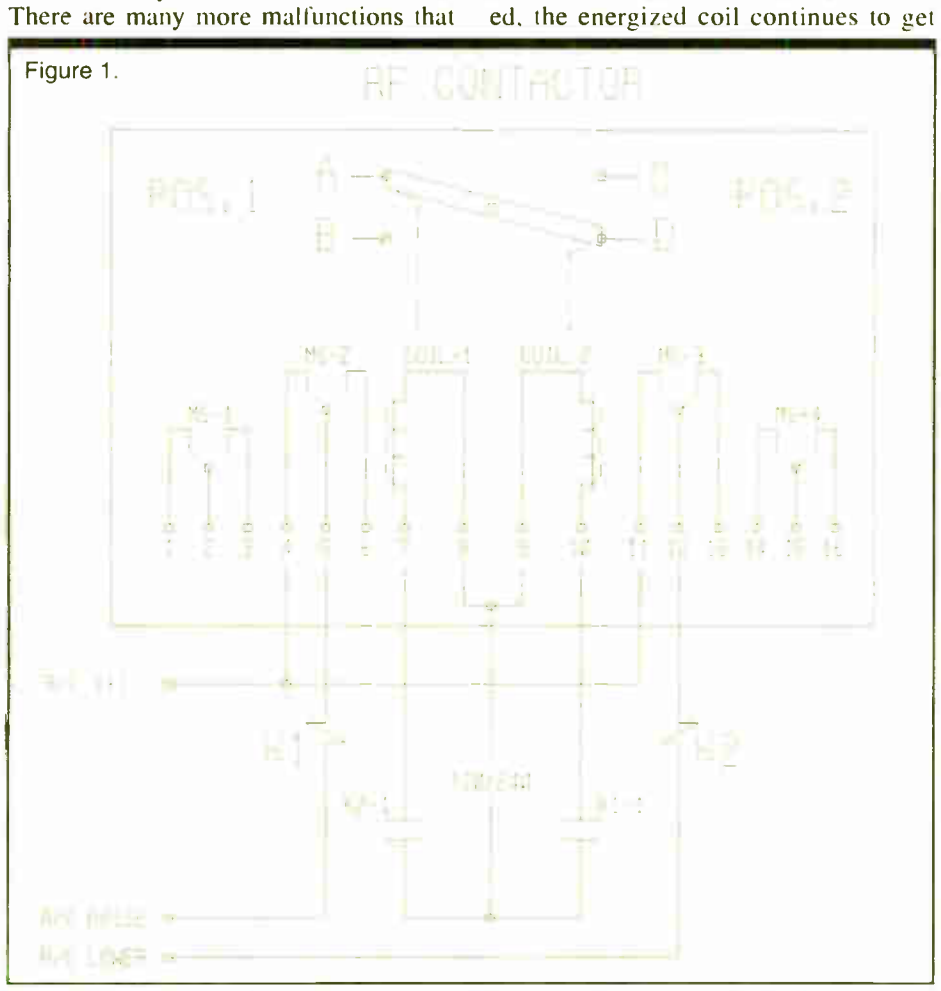



Figure 2.

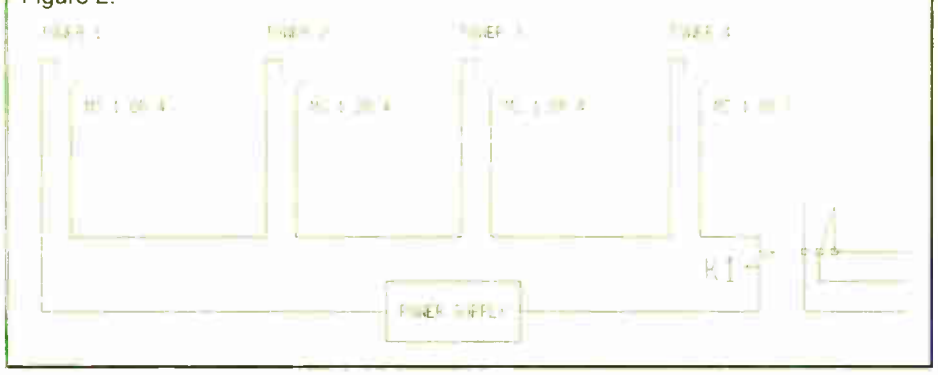
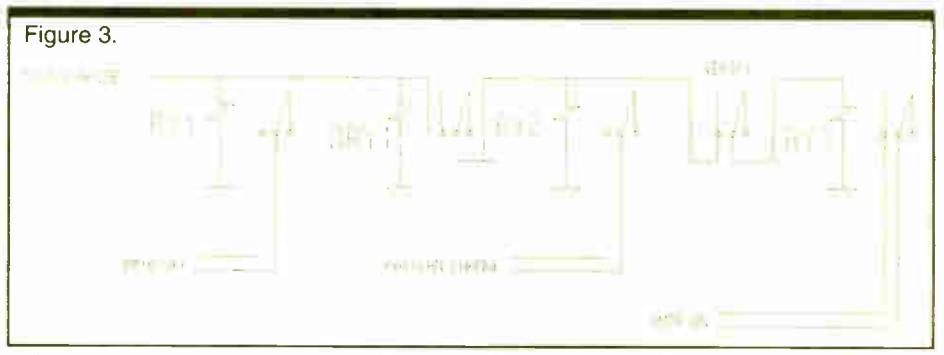



Figure 3.



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# Old Hams Blaze Trails

**by Al Parker**

**HICKSVILLE, N.Y.** Some time back, I categorized the amateur radio world into rather broad categories.

These included Old Buzzards, 60s Types, Frustrated DJs, Politicos and a host of others.

Individual human beings defy such pigeon-holing, but the human psyche insists on generalizing as a means of putting the world into perspective.

Disclaimers out of the way, I admit that the group of hams I admire most are the Old Buzzards. Certainly not every ham over 60 is a paragon of virtue, but as a group, they are a precious resource.

I suppose the wellspring of their prowess is America's most challenging era: the Depression through the Korean War. My own dad was one of these men.

### Learned elders

Maybe setting up field radios under fire, writing manuals understandable to the average Joe and creating entirely new technologies to stay ahead of the enemy had something to do with the qualities of our learned elders of radio.

Morse code (our first "digital" communications mode) was a requirement for all wartime radio operators. This capability made returning veterans natural candidates for ham radio. War-surplus radio gear could be readily modified for operation on the newly-reopened ham bands that were closed for the duration of the war.

Note that amateurs were given frequencies thought to be worthless. As the hams proved the commercial interests wrong, they were squeezed into more worthless parts of the spectrum. But like all trailblazers, early hams were undaunted. The war generation was crafting better ham rigs, making lemons into lemonade, building better mousetraps and participating in America's post-war economic and baby booms.

They were busy guys, living family values rather than just paying them lip-service.

I mention family values here because I sense in these older hams a contentment absent from their younger counterparts. They know they did what the nation expected of them. The pact between the society and its citizens was honored on both sides. They fought and won "good" wars and participated in the ascendancy of their country.

### Cutting edge

When they sit down in front of their microphones, they have earned the right to "play." To be boys again. You cannot really enjoy your second boyhood without having first been a man. They were men.

One advantage I enjoy as a freelance type is to listen to and communicate with Old Buzzards, who operate during the day for the most part. This may account for the high levels of civility on the bands during the day, 14.313 MHz notwithstanding.

Most of my Old Buzzard contacts have been on AM, many via rigs constructed by the user and in continuous use for 50 years or more.

This is not to say these men are relics stuck in the past with old technology. I have noticed many older hams embracing and mastering digital modes, computers and amateur television (ATV). In fact, the only amateurs in my neck of the woods regularly transmitting ATV are Old Buzzards.

Many do not seem as romantically attached to hollow-state technology (tubes) as younger operators. This is not surprising, as they have always been on the cutting edge, using the most efficient components available at the time to do the job. If that meant an IC chip in a speech processor to improve the sound of an ancient 1938 transmitter, so be it.

One of my favorite Old Buzzards is "Ashtabula Bill," operating out of Ohio. Bill is one of those big signals on 40 meters, and transmits an amateur signal you might mistake for a broadcast station until you listen closely.

This is no lanolin-voiced young punk or putrid government propagandist, but an amateur whose voice combines elements of General George Patton with a touch of Gabby Hayes. Authoritative, without a speck of unfriendliness.

Having a big signal is a double-edged sword. People can hear you, but it is not often reciprocal. Many poor souls trying to contact Bill have not been able to. Fortunately, Bill has done his homework.

Unlike younger mad-dog operators that bash and ridicule weaker stations, Ashtabula Bill makes every effort to pull pipsqueak signals in out of the noise. He has antenna arrays that favor different directions to make the most of what is thrown his way.

In my earlier 17 W days, Bill used every trick in the book to sift my signal out of the static. That effort made me feel welcome. For any vulnerable, neophyte amateur, those first few contacts are important, and good folks like Ashtabula Bill make the effort to endure weaknesses while gently imparting advice on improving one's signal.

Certainly Bill is a gentle soul, but feisty when conditions demand it. Some power-crazed sideband operators frequently violate the sanctity of the 40 meter AM window (7.290 to 7.295 MHz), and purposely open up on top of ongoing AM communications.

Many have crept away under the crushing weight of Bill's signal and full modulation carrying the battle-cry, "Take that, you gol-darn slop-buckets!"; the term being a less-than-affectionate AM community nickname for single sideband. Indomitable Ashtabula Bill makes every watt count.

### Restored radio

One amazing demonstration of his experience and command of theory came when I tried out a new transmitter on 40 meters; a restored classic Johnson Ranger pumping out all of 50 plate-modulated watts.

I had been getting snide comments about a warbling in the audio and was at my wits' end trying to diagnose the problem. I followed one bad suggestion after another and checked every component I could see. The Ranger was well known for superb stock audio and it was frustrating not to get it to live up to its reputation.

Bill was calling CQ (the amateur invitation to communicate) and I was eager to respond, confident he would give me the straight dope. Bill responded right away, which meant he heard me. At least that was a good sign.

We chatted for a few minutes about the usual pleasantries. Apparently nothing about my signal was bad enough for Bill to comment about, so I broached the subject.

"Bill, I'm trying out a new-old rig today. How does this Ranger sound?" I girded myself for the worst, but his response instantly set me at ease.

"Sounds great," he said. "Good audio, nice balance of lows and highs, but I did notice one thing." My heart sank.

"You've got a little frequency instability on voice peaks. Change that carbon dropping resistor in the VFO... R3, I think... to a wirewound and mount it outside the VFO box. You'll also get better overall warmup stability without that extra heat."

I wanted to challenge him, having already checked R3 with my VOM. Instead, I left the air dejected and ready to give up on the Ranger. But then I remembered, he was "Ashtabula Bill."

### Good advice

Later that night I decided to follow my elder's suggestion, and when I unsoldered that resistor, it all but crumbled in my fingers. Apparently its internal structural failure did not become evident until it reached operating temperature.

Once the new resistor was in place, the Ranger lived up to its sterling reputation and more. It has been the most reliable "fun radio" in my arsenal and someday I will use it to drive something bigger.

I have future dreams of acres of antennas and running legal limits on 40 meters. Maybe I will give those bully-boy foreign broadcasters and slop-buckets a run for their money.

If I am lucky, by that time I will be an Old Buzzard too.

World Radio History

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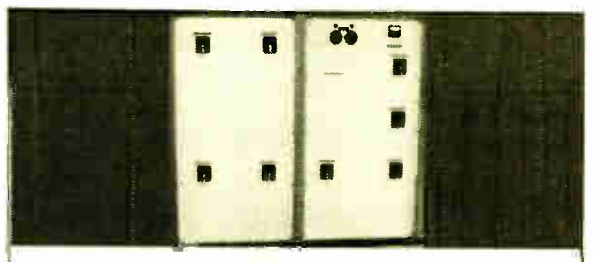

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# Microcontrollers at Work

▶ continued from page 42

After you have the Micro up and running, it is time to upload your program to it.

The MonScope-51 shell acts like a simple communications program allowing uploads to the Micro. Actually, it is possible to use any telcom program to accomplish uploading.

We will start with a very simple application. We want to sample all eight analog inputs to the micro (0-5VDC) and continuously display the results on a single line on our PC.

The program requires 943 bytes and the code, written in BASIC, is shown in Table 1.

Once you see how simple the Micro-440 is to program, it is time to try something more challenging.

Figure 1.

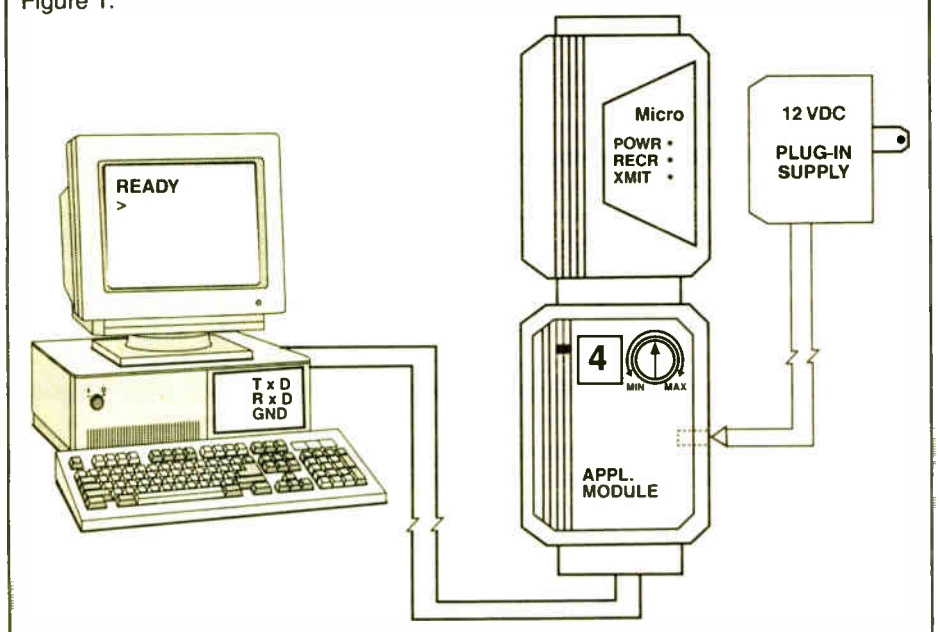


Table 2 shows a 3,643 byte datalogger program that samples all eight analog lines and logs the data into the Micro-440's memory. Channels are sampled four times per hour and averaged so that one data point per hour is stored for each channel.

Table 1.

**This simple program can be used to monitor eight analog lines at your transmitter site and display the results on your PC at home.**

```
6    REM ALL CHANNEL ADC PROGRAM
10   ADC=0FF00H
REM  CONVERT EACH CHANNEL ONCE EACH LOOP
20   FOR C=8 TO 0FH
REM  INVOKE THE CONVERSION
30   XBY(ADC)=C
REM  READ THE RESULT AND CONVERT TO A VALUE BETWEEN 0-5 VOLTS
35   B=5*XBY(ADC)/255
REM  PRINT THE RESULT ON THE SCREEN
40   PRINT USING(#.##),B,
50   NEXT C
REM  RESTORE THE CURSOR TO THE BEGINNING OF THE LINE AND LOOP
60   PRINT  CR,
70   GOTO 20
```

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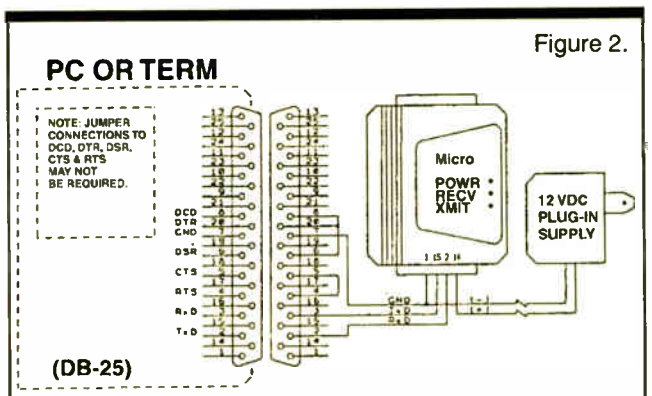
Figure 2.




Refer to Table 2 for the following. Data is stored in a contiguous block between 5000H-5FFFH. This allows for 4,095 memory locations (data points) providing 511 hours, or about 21 days of data storage.

A time stamp is placed in memory locations 40E0H-40ECH when the system begins to collect data. The memory address of the beginning data point is stored in memory locations 40EEH and 40EFH. The memory address of the current data point location is stored in memory locations 40F0H and 40F1H.

The number of times that the program stored the beginning data information is stored in memory location 40F2H. This can be used to determine if there are any data gaps due to a power loss.

Once you have experimented with data acquisition, you can program "if-then" statements into your applications.

For example, you can write a program that would signal the operator that a parameter is out of tolerance, or you could write your BASIC program so that the microcontroller would dial your pager.

The use of modern microcontrollers, such as the Blue Earth Micro-440E, can simplify your projects considerably and give you much more flexibility at the same time..

For more information and a catalog, contact Blue Earth at 507-387-4001, or circle **Reader Service 121**.

□□□

*Jim Somich is a radio broadcast engineering consultant and president of MicroCon Systems Ltd., a manufacturer of broadcast equipment. He can be reached at 216-546-0967.*

Table 2.

**8 Channel Datalogger program**

*Written by Thomas Bachmann 07/22/92 Copyright (c) 1992 Blue Earth Research*

**This program samples eight analog input channels and logs the data into the Micro-440's memory. Channels are sampled four times per hour and averaged so that one data point per hour is stored for each channel.**

```
1    REM HOURLY DATALOGGER
REM  ALLOW FOR A SERIAL CHARACTER TO TERMINATE THE PROGRAM ON
     POWER-UP.
5    X=0 : G=GET : DO : G=GET : X=X+1 : IF G THEN X=1001
6    WHILE X<1000 : IF G THEN END
REM  INITIALIZE SYSTEM VARIABLES AND PARAMETERS.
10   DIM R(10) : GOTO 200
REM  SUBROUTINE TO INCREMENT THE POINTER, VALIDATE IT AND SAVE IT.
12   A=A+CH : IF A<S2 THEN 14 ELSE A=S1
14   XBY(DP)=INT(A/V) : XBY(DP+1)=A.AND.U : RETURN
REM  SUBROUTINE TO GET THE DATA ADDRESS POINTER.
20   A=V*XBY(DP)+XBY(DP+1) : RETURN
REM
REM  MAIN PROGRAM LOOP
REM
30   MIN=0 : HOUR=0 : ONEX1 60
REM  PUT IN LOW POWER "WAIT FOREVER" MODE
40   IDLE : GOTO 40
REM  FIRST EXTERNAL INTERRUPT, DO TIME STAMP AND SAVE POINTER
60   FOR X=0 TO 12 : XBY(TS+X)=W.AND.XBY(16*X+RTC) : NEXT X
70   XBY(D1)=INT(A/V) : XBY(D1+1)=A.AND.U
REM  CHECK IF 15 MINUTES HAVE GONE BY
80   MIN=MIN+1 : IF MIN<15 THEN ONEX1 80 : RETI
REM  READ THE DATA AND STORE IT
90   MIN=0 : FOR X=0 TO CH-1
REM  INVOKE THE CONVERSION AND READ THE RESULTS
100  XBY(ADC)=X+9 : R(X)=R(X)+XBY(ADC) : NEXT X
REM  SET UP FOR NEXT INTERRUPT AND LOOP IF NOT TIME.
110  HOUR=HOUR+1 : IF HOUR<4 THEN ONEX1 80 : RETI
REM  AVERAGE THE RESULTS AND SAVE TO MEMORY.
120  HOUR=0 : GOSUB 20 : FOR X=0 TO 6
130  XBY(A+X)=INT(0.5+R(X)/4) : R(X)=0 : NEXT X
REM  SET UP FOR NEXT INTERRUPT AND LOOP.
140  GOSUB 12 : ONEX1 80 : RETI
REM  DEFINE VARIABLES FOR EXTERNAL MEMORY ADDRESSES.
REM  TS  POINTS TO THE TIME STAMP
REM  DP  POINTS TO THE NEXT MEMORY LOCATION TO STORE DATA IN
REM  RTC POINTS TO THE REAL TIME CLOCK/CALENDAR
REM  ADC POINTS TO THE ANALOG TO DIGITAL CONVERTER
REM  CH  IS THE NUMBER OF CHANNELS TO CONVERT AND STORE
REM  SN  MARK THE BOUNDARIES OF MEMORY FOR STORED DATA.
200  TS=40E0H : DP=40F0H : D1=40EEH : RTC=0FE00H : IR=0FEE0H
210  ADC=0FF00H : CH=8 : S1=5000H : S2=6000H-CH
REM  OTHER TEMPORARY VARIABLES:
REM  A   USED TO HOLD DATA ADDRESS
220  U=255 : V=256 : W=0FH
REM  INCREMENT POWER LOSS COUNTER LOCATION
230  XBY(DP+2)=1+XBY(DP+2)
REM  LOAD UP AND VALIDATE THE ADDRESS POINTER
250  GOSUB 20 : IF A<S1 THEN 270
260  IF A<S2 THEN 280
270  A=S1 : GOSUB 14
REM  SET UP THE RTC FOR ONE-MINUTE PERIOD INTERRUPTS
280  XBY(IR)=8 : GOTO 30
```

World Radio History

# Developing a Station's Audio Chain

**by Jon Banks**

**Part III of III**

**ROCKVILLE, Md.** This is the third of a three-part series on audio dynamic range. In this issue, we will apply methods from our two previous outings to set up a typical radio station's audio chain.

Let us begin with the station. For the sake of illustration, we will call our radio station "Scuzzy 92 FM."

Scuzzy 92 plays most of its music directly from CD, using consumer-type players. The console is fairly new, with balanced inputs and outputs.

**Let us begin with the station. For the sake of illustration, we will call our radio station "Scuzzy 92 FM."**

### From the top

The console feeds a processing chain with a split-band compressor and combination processor/stereo generator. There is a composite microwave studio-transmitter link (STL), with the receiver directly feeding the exciter. Refer to Figure 1 to follow our station's audio chain and levels at each point.

To avoid losing dynamic range, we want to interface our equipment so that every piece hits clipping level simultaneously. If we do that, the overall signal-to-noise (S/N) ratio will be only a little worse than the weakest piece of equipment in the chain.

First will be the CD player. Using track three of the NAB test CD, we will play 1000 Hz at maximum level (called 0 dB on the disc) and measure the output of the CD player. This is +4 dBm.

Next we play track 12 (silence) and measure the unweighted, band-limited noise level. This comes out to -84 dB. Not bad for a consumer player.

We also know nominal level on a CD is about 15 dB below peak level, or -11 dBm on this machine.

### The console

The board inputs are designed to accept a nominal level of +4 dBm. The input stage would clip if fed anything above +21. If we connect the CD player directly, we will waste a lot of the console's input headroom and pay for it with a compromised S/N ratio.

We need to use a matchbox-type IHF-to-Pro interface to boost the level of the CD player from +4 peak to +21 peak, or 17 dB. The performance of the interface amp we select must be better than that of the CD player.

The console has a nominal +8 dBm output level, and its output stage is actually capable of an undistorted +28 output. Yes, we measured it. We never believe anybody's written specs.

While the CD player needs only 15 dB of headroom between nominal and peak levels, sources such as the announcer's mic will require 20 dB. The operators will use the VU meters to ride gain, matching the nominal levels.

Even though the CD will peak the console output at only +23 dB, we want to make sure the full +28 can be sent to the first audio processor. This 5 dB cushion is not really wasted because it makes the gain riding less critical for the operators and lets mic peaks pass without distortion.

The console's +28 dBm output capability will be a problem for the first proces-

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# *Maintaining Directional Antennas Systems*

▶ continued from page 43

change power manually until parts arrive.

This scenario can be prevented with a timing circuit on K1 and K2. Incidentally, slave relays are used because it is not possible to switch such a heavy load with only the remote control.

Usually the slave relays are paralleled, with some solenoids operating for position 1 and others for position 2. In this manner, some towers are energized while others are floating or detuned.

Normally, there are pattern changes for day and night operation. Systems designed for critical hour operation and pre-sunrise authority are more elaborate. Otherwise, the basic functions remain the same.

### Timing is everything

As a general rule, a malfunction in the control circuits will show up at pattern change time. A series of timed sequential operations handles the transmitters and control circuits for the solenoid contactors.

It is this area that usually gives the newcomer the most trouble, so we will have a closer look at the system in general.

Figure 2 shows a pattern verification circuit. This makes use of microswitches MS-1 and MS-4 on the contactor decks. A series loop is established and closes when all the contactors are in their proper positions for a given mode. This loop then energizes relay K1 to provide a status report.

Figure 3 illustrates the simplest form of handling this status. The verify relay contacts are used to supply power to the downstream relay to place a transmitter on the air.

RY1 is connected to a raise or lower function on the remote control and is used to kill the plate voltage on the existing on-air transmitter.

DRY1 is a time-delay relay which allows a set period for field collapse, then changes pattern via RY2. The verify relay then provides power to RY3 to turn on the transmitter.

Most circuits of this type have additional circuitry to monitor RF energy before pattern change, and to feed the status and alarm indicators. The system gets a bit more involved if we also need to add an auxiliary transmission system to the mix.

Understanding the basic system and having someone press the buttons for you can expedite the troubleshooting process. At some future point you may wish to rebuild the entire system to bring it up to date.

### More to come

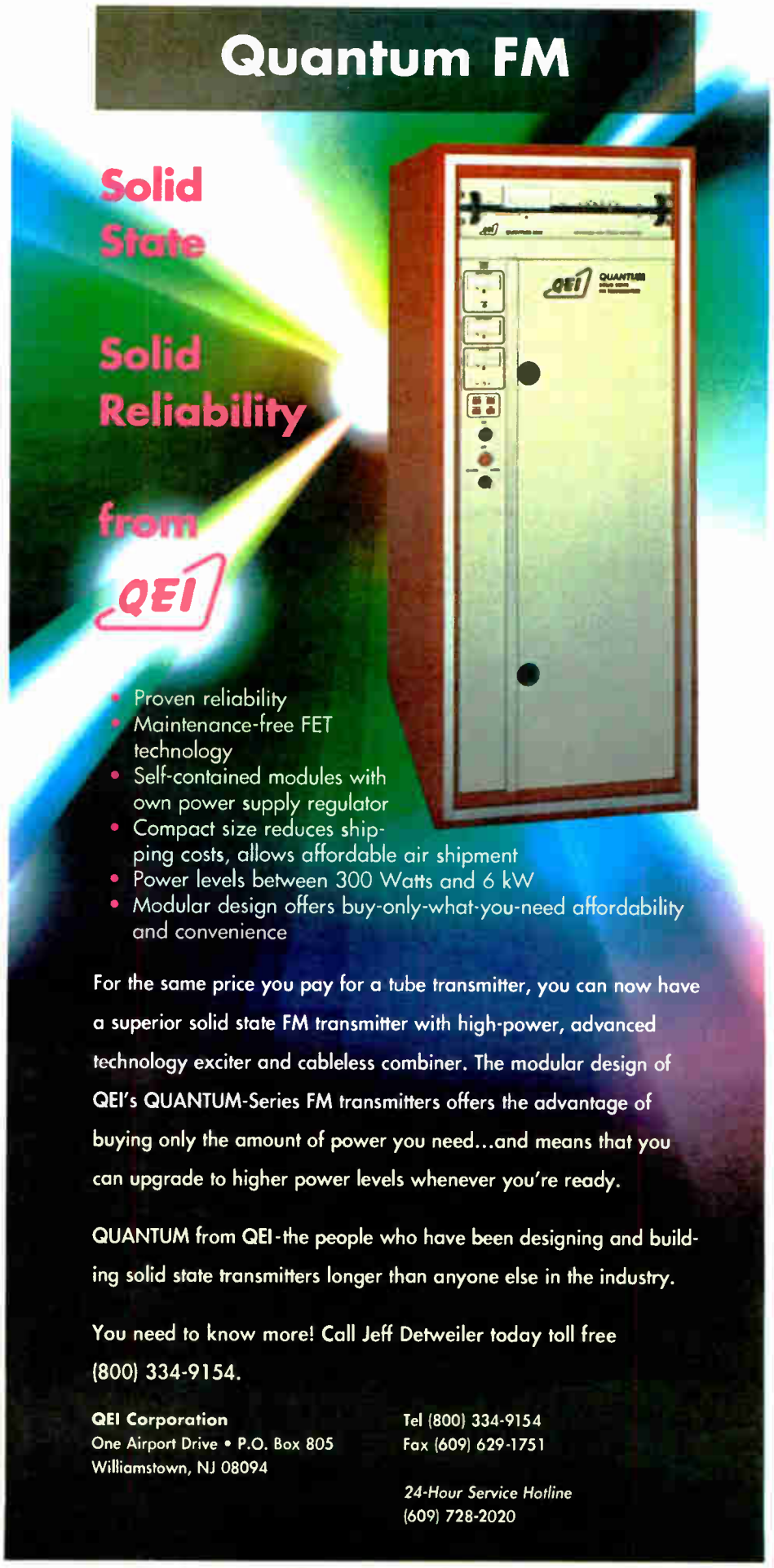
In a future issue we will talk about setting the process down in a ladder diagram, then writing the process into a programmable logic controller (PLC) to perform the tasks. It is an interesting project and might come in handy

I doubt you will find parts for this one in your junkbox, but it might be interesting to work with newer technology for a change.

Meanwhile, the information about RF switching might come in handy.

■ ■ ■

*James Murphy is director of engineering at the West Virginia Radio Corp. Reach him at 304-296-0029.*

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World Radio History

# Pieces of Audio Chain

▶ continued from page 48

sor. It has a passive attenuator ahead of a high gain stage (20 dB). This means the signal is unnecessarily knocked down, then boosted 20 dB in the first amp. This introduces an undesirable degree of noise.

### Processing

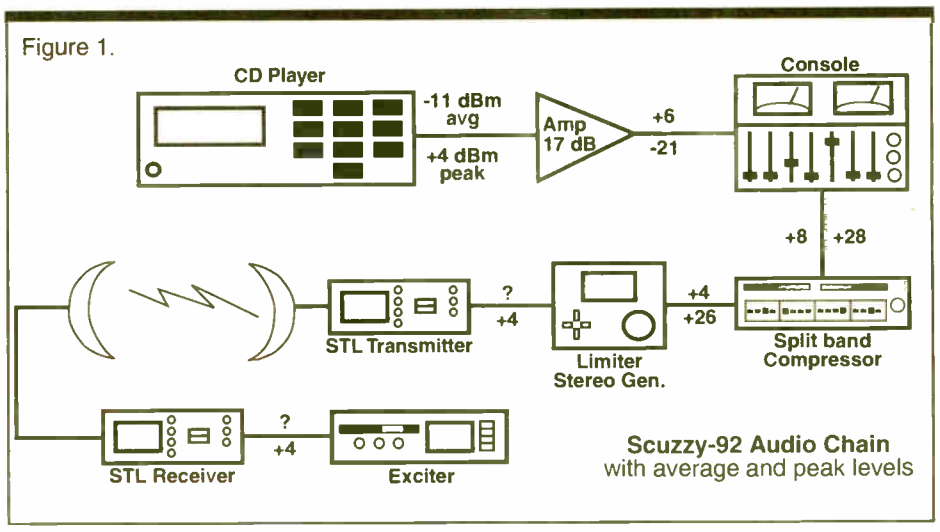
A call to the manufacturer reveals a factory-recommended modification. If we change two resistors, the first stage has unity gain. Now the attenuator does not have to reduce as much of the signal. The gain stage will overload at +20 dBm, but we can set the attenuator for only 8 dB of loss.

*Note: We cannot readjust the input attenuator later. This must remain as the correct setting.*

Our first processor is a split-band leveller, not a limiter. This means the peak-to-average ratio of our signal has not really changed. We still want to maintain our 20 dB of headroom. Fortunately, the output of the first processor and the input of the second are compatible. Each has +26 dBm peak capability, so we can directly connect them. The nominal level at this point will be about +4 dBm.

The second processor has a composite baseband output. The signal is limited at this point to exactly 100 percent modulation at 3.5 volts peak to peak. This is the same as a +4 dBm sine wave.

Figure 1.




Scuzzy-92 Audio Chain
with average and peak levels

Because the signal is precisely limited to avoid overmodulation, we do not need any headroom at all. We will, however, reserve a few dB so incidental overshoots will not cause clipping.

From here on, we can use all of our dynamic range to maximize the S/N performance.

The output of the STL receiver is also +4 dBm, matching the exciter's input. The two units are directly connected.

### Dry run

Before we call it a day, we have to check our work.

Back in the Scuzzy 92 studio, we will play a test CD at nominal level (what the NAB CD calls -15 dB) and check levels between each piece of equipment.

We should see -11 dBm at the CD player output, +6 at the console input after the interface amp, +8 at the console output with the fader at its normal position and +4 dBm at the output of the first processor.

**Before we call it a day, we have to check our work.**

All of this assumes the processor is locked at its normal, active gain.

We cannot easily defeat the processing functions built into the stereo generator, so predicting its output level is not possible. When its output is at +4 dBm, the STL receiver should output the same level.

Now we will play the test CD again at the maximum 0 dB level to be sure we are not clipping anywhere in the audio chain right up to the compressors.

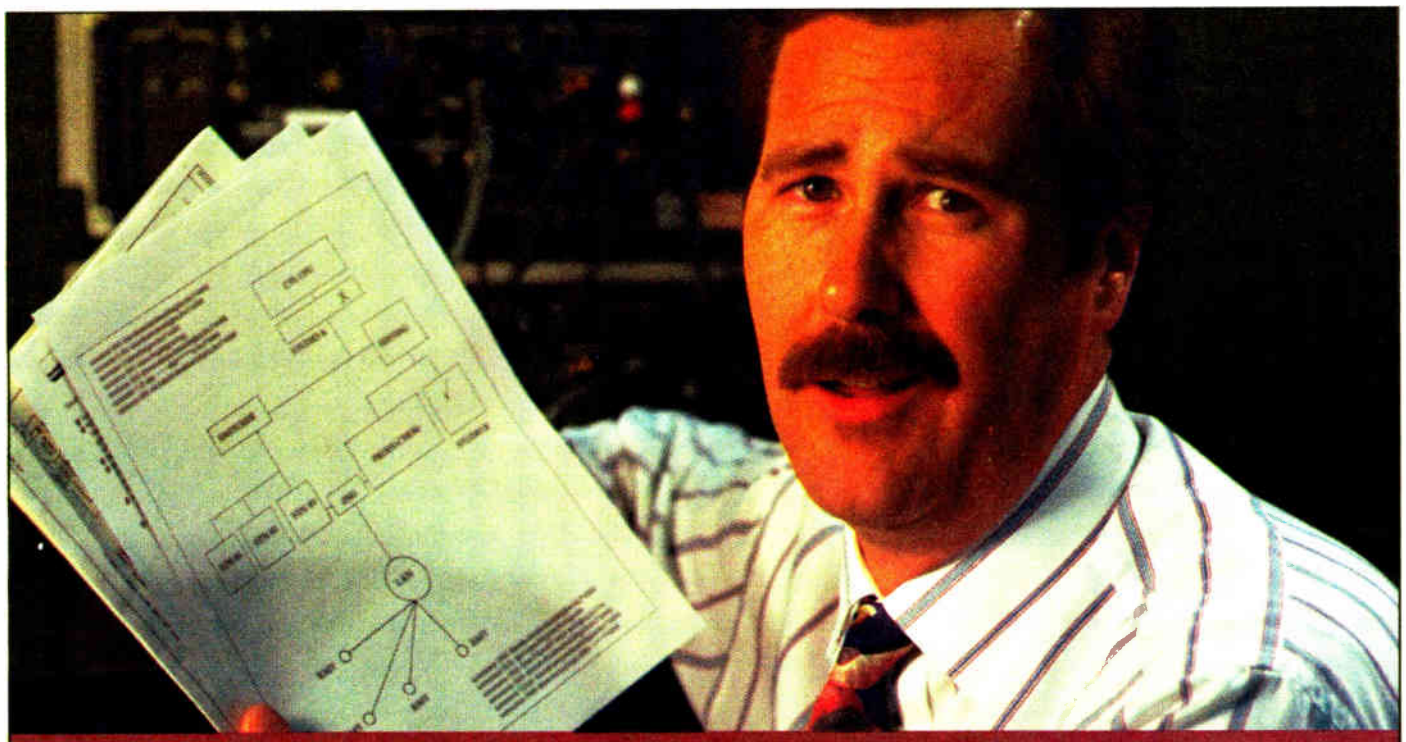
If we were doing a proof, we would put the compressors into test mode and adjust the level of the stereo generator input for exactly 100 percent modulation. We want to make our distortion measurements at this high peak level. While this may seem harsh, pushing for low THD right up to clipping level is a realistic test.

For noise measurements, we need to go back to the nominal -15 level tone. First we will set the stereo generator for 100 percent modulation, kill the tone, and read the residual noise.

Your numbers will not be impressive because you are paying a sonic penalty for every bit of gain reduction you do with your processing. But if you can measure better than 65 dB of signal-to-noise with 15-20 dB of headroom, consider it a job well done.

□□□

*Jon Banks is chief engineer of WARW-FM in Washington.*



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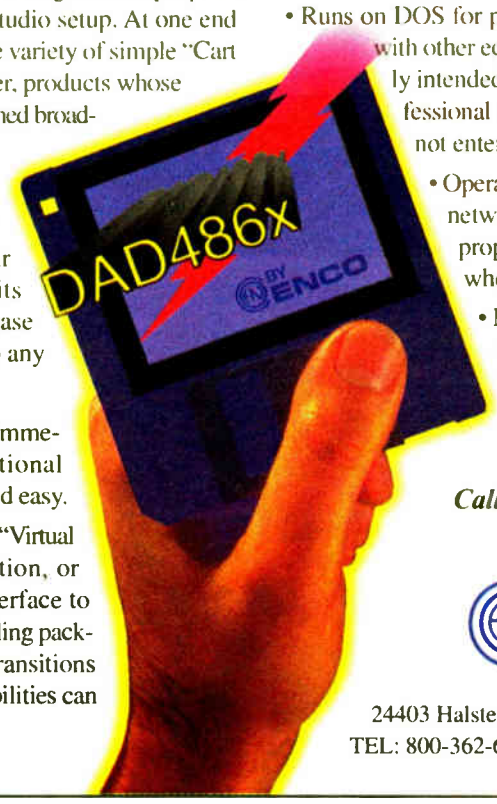


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USER REPORT

# Digilink Solves Dilemma in Seattle

**by Dick Harris**
**Chief Engineer**
**KLFE(AM)/KGNW(AM)**

**SEATTLE** In early 1994, Inspiration Media Inc. in Seattle (operating since 1984 as KGNW(AM) at 820 kHz) was informed that its owners were considering a second AM acquisition in the same market. We thought, "Oh boy! A duopoly operation!" But we soon found out that there would be a minimal budget available to activate a second AM station in Seattle. We learned early which station it would be and immediately went about making plans to set up an economically efficient operation.

### Eye-opening possibilities

In the spring of 1994 I visited the **Arrakis** plant in Fort Collins, Colo., to make a day-long study of the Digilink system under the tutorial guidance of Jon Young, the vice president in charge of that project. I was no stranger to Arrakis, since as far back as 1989 our company, Salem Communications, had been using Arrakis studio furniture. Our feeling was, if Arrakis furniture is quality, why wouldn't the Digilink also have quality and be practical?

My day with Jon opened my eyes to the possibility of operating our new duopoly station in an efficient manner. Just one staff member would have to be added to oversee the Digilink operation while other station personnel helped support the operation.

The one feature that really impressed me about the Digilink system was the ability to start recording news, for example, from a specific source: e.g., UPI Satellite, ABC Satellite, etc., and while still recording the news, begin playback on the air. The advantage is that if you are in a CD format such as we are, the CD playing into the top of the hour will run past the hour and end, then the Digilink will switch to the ID and pick up the news at the start while the record function runs in the background.

The only caveat here is that the overlap at the top of the hour must be at least 30 to 60 seconds — but that is easily planned. Some of our delayed newscasts are set to play back about six to seven minutes past the hour, so that is no problem at all.

### Time shift of programs

Another feature we make use of is Digilink's time shift of programs. The programs are captured from several different satellite sources and released from the hard drive on schedule. One of these is a one-hour program from Atlanta we record Sunday mornings at 8 a.m. and play back at 10 a.m. Meanwhile, a local church service is running live in the foreground.

The Digilink streamlined Inspiration Media's duopoly operation.

We also use Digilink for live satellite talk shows from 11 a.m. to 5 p.m. Monday through Friday and for an hour on Saturday morning. The Digilink is set up to switch to one of four of these sources on schedule. The satellite sources we use provide the current standard 25 and 35 Hz subaudible tones to provide cutaways for local spot inserts. These tones are captured with a Mueller T25-35SA decoder. Relay closures are connected to the satellite logic connector on the Digilink that will, on command, switch away from the satellite source.

There are many other features that we have not even tried yet, but I am certain that when the challenge comes we will find a way to make the Digilink perform on command. Another fact that speaks well of the Digilink is that the system was in R&D as long as 15 or 16 years ago. In the past eight to 10 years Arrakis has put in excess of 1,100 or 1,200 of systems into use around the world.

### Ready to listen

As with every system, there are some negatives with the Digilink. There are none that we have found insurmountable, though. Among these might be the ability to time-shift programs with control tones that will provide for local cutaways. Alan Harrison, the Digilink software engineer, has been very patient with me and shows keen interest in challenges like this. He suggests that Arrakis is always ready to listen to customers with ideas that will improve the product and make it more useful for more people.

Another time we talked about the disparity of computer internal clocks that either gained or lost too much on a daily basis. In our case, it was imperative that our Digilink clock be accurate so as not to upcut a top-of-the-hour feature or newscast. This was corrected months ago with a clock correction feature added to the software.

Because we utilize the Salem Radio Network Satellite system for many of our programs, we capture a dual 23/35 Hz tone closure at :59:50 of every hour that tells Digilink to reset its internal clock. This prevents what used to be embarrassing upcuts and loss of too many seconds resulting in sloppy programming.

### Another great feature

Any other negative I have found is primarily a lack of sufficient information in the operating manual for dummies like me. But that is where another great feature of the Digilink comes into play: the support service. A few minutes on the telephone will clear up any problem or misunderstanding before you know it. If there could be any improvement here, I would suggest that Arrakis consider putting in an 800 number for this support.

There is a lot more I could say about the Digilink system, but I will not be so naive as to claim it is the perfect system for everyone. Competition is one of the great things about American enterprise. As long as Arrakis is open to constructive criticism from its many users in the field and keeps trying to improve its product as time goes by, I believe the Digilink system will find a lot more users with a limited budget and a desire to match the performance of the other guys with unlimited budgets.

□□□

*For more information from Arrakis, call Bob Groome in Colorado at 303-224-2248; or circle* ***Reader Service 5.***

USER REPORT

# *Capitol Networks Goes To IDC Digital System*

**by Rob Deakin**
**General Manager**
**Capitol Networks Satellite Services**

**RALEIGH, N.C.** Capitol Radio Networks (CRN) is a regional satellite-delivered broadcasting network that services radio stations primarily throughout the Southeast via the SATCOM C5 satellite. We own and operate the North Carolina News Network, N.C. State and Duke University Sports Networks, Carolina Panthers Radio Network, Winston Cup Today, Drivetime: The Golf Radio Show and the Tobacco Radio Network. We also provide satellite distribution services for the Washington Redskins, Charlotte Hornets, Washington Bullets, University of North Carolina at Chapel Hill, East Carolina University, Washington Capitals, Benchmark Communications and other program syndicators.

### Outdated system

Since 1981, CRN has been delivering its audio services using an analog single channel per carrier (SCPC) satellite. As with most analog audio systems, our analog satellite system has become outdated and inferior. Because of the limitations of our existing analog technology, we have had to refuse music syndication business and other satellite distribution possibilities.

These factors, along with others, prompted us to take the digital plunge. We have awarded the satellite equipment contract to **International DataCasting** (IDC) of Ottawa, Ont., for purchase of its SR260 FlexRoute system.

Our search for the right equipment spanned a two and one-half year period. There are many factors that go into making the decision: technology, customer support, quality, features, flexibility, company solidity and of course, price. We looked at all of the key suppliers and quickly narrowed our choices to three.

Over the course of our two and one-half years, we performed real-world satellite tests with the equipment, visited two of the suppliers' manufacturing facilities and several other state radio networks that had already converted to digital.

### Which modulation scheme?

In addition to the choice of equipment supplier, we also had to decide what modulation scheme to implement. Our research indicated that, given our current business plan and growth outlook, quadrature phase shift keying (QPSK) modulation was the way to go. Because QPSK does not require as much power or bandwidth as binary phase shift keying (BPSK), the satellite space segment cost is less expensive. For the same reason, though, some of the hardware at the downlink site becomes

continued on page 54 ▶

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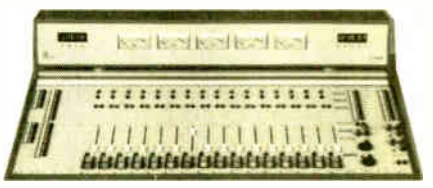

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USER REPORT

# CDS Simplifies Analyzing LMA Conflicts

*Communications Data Services On-Line Databases Assist in Calculating Possible Licensing Problems*

**by Vicki Russell**
**Principal**
**Media Properties Associates Inc.**

**KNOXVILLE, Tenn.** Most broadcast consultants seem to have clients who need mainly information or calculations on very short notice. The pressures of time make the work stressful, tending to increase the chance of errors. While everyone uses computers and broadcast databases, some calculations still call for extensive judgement and are fraught with opportunities to introduce mistakes.

Our services range from simple information regarding a particular station to population studies within a given contour and preparing and completing FCC applications. Most of the services we offer utilize the advantages of on-line databases and computational services. One of the best services we have found is offered by **Communications Data Services** (CDS) of Falls Church, Va.

Particularly difficult to calculate on short notice are potential licensing problems created by FCC restrictions on multiple-station ownership in a single market. Clients often need to know quickly whether a station in a given market can be acquired under the FCC's multiple ownership rules before they enter serious negotiations. Another corollary problem arises when a station operator in a given market wants to add a second or third station under a new license.

We solve the allowability problem by tapping into CDS' on-line services. The CDS local marketing agreement (LMA)/duopoly routine simply lets us enter the call letters of the AM and/or FM station or stations the client already owns, together with the call letters of the station being considered for acquisition. The CDS routines next allow us to select from among multiple sites, if they exist, and then analyze the market.

The CDS duopoly routine first displays the contours for the stations chosen. The routine then lists the AM stations in the market and finally, the FM stations. Each AM and FM station is designated as outside, inside or overlap with respect to the station already owned and the one being considered for acquisition. An overlap indicates a shared market and FCC rules allow for a limited number of stations sharing a market.

Various licensing details, such as city and state of license, field strength, operations class, day/night power and latitude and longitude are an integral part of the station listing information. If the client wishes simply to add a new station to the market, the station lists provide indications of potential overlap.

An upcoming addition to the LMA/duopoly study that will be very useful due to our large number of clients seeking stations in the infant stage is a routine that will permit entering a proposed station's geographical coordinates and power levels at various directional radials when call letters are not yet available. This will help calculate hypothetical duopoly conflicts for clients who need to know in the early stages if ownership is even feasible.

On-line services such as these make the life of a broadcast consultant less stressful. What most of us need now is a computer service that would tell us where to get more clients.

□□□

*For more information from Communication Data Services, contact Roger Skinner in Virginia at 703-534-0034; or circle* ***Reader Service 200.***

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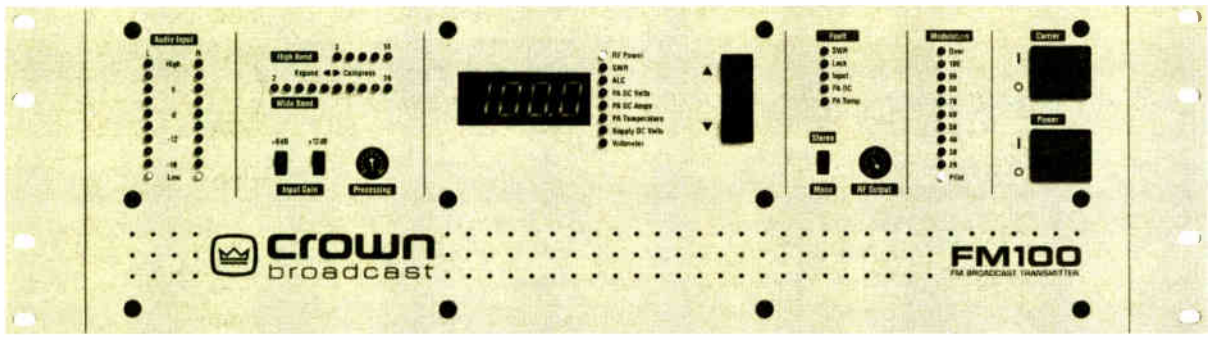


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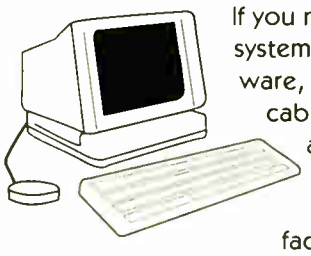

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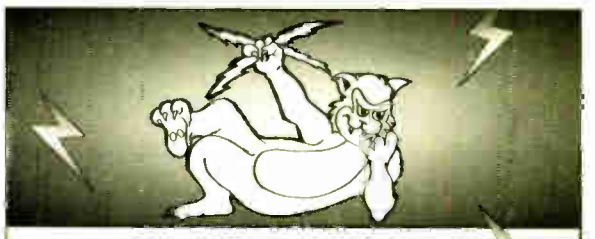

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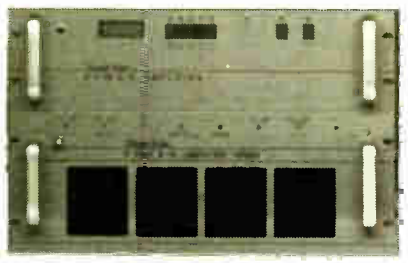

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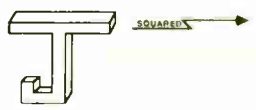


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USER REPORT

# Going Digital with IDC

▶ continued from page 51

more expensive. We decided that with QPSK we could purchase additional satellite channels, allowing us to generate more revenue, thus outweighing our higher capital costs.

All three of our finalists offered QPSK receivers. We found IDC to be very aggressive in its pricing strategy for the FlexRoute SR260 system. Virginia Lee Williams, of IDC's Atlanta office, has proven to be very knowledgeable of both radio networks and satellite technology. Using this knowledge, she successfully created a package that helps us achieve our operational and technical goals at a competitive price.

One of the reasons we chose the FlexRoute system was its ability to uplink and downlink either at a 128 or 256 kbps carrier. Using 256 kbps, QPSK offers a number of audio combinations. We can operate a 20 kHz stereo channel and two 15 kHz mono channels, two stereo channels or four mono channels.

### Low-speed data channels

The FlexRoute system provides two low-speed data channels. One data channel and network auxiliary data are available in data rates of 300 to 2400 baud. The other, MPEG ancillary data, is available at rates of 300 to 9600 baud.

IDC's FlexRoute receiver helps Capitol Networks achieve its goals.

The FlexRoute system also allows us to transmit high-speed data up to 256 kbps, providing us with additional distribution possibilities: a stereo and mono audio channel and a high-speed data channel; two mono audio and two high-speed data, etc. The receivers are all addressable so we can change the combinations on the fly. The audio sampling rate is also addressable, allowing us to switch between 7.5, 13 and 20 kHz frequency response. This is truly a flexible system.

We began implementation of a single 128 kbps carrier in July for distribution of a stereo music program for Benchmark Communications. We receive Benchmark's stereo audio at our technical operations center (TOC) via a Telos Zephyr on an ISDN circuit. We then route the audio into an IDC encoder and ship the data over a T-1 to our uplink that resides about 12 miles away. From the uplink the data is input to the modulator and then upconverted and transmitted to the satellite. By utilizing the encoders and T-1 in this fashion, we minimize the loss of audio caused by multiple compression schemes.

**IDC quickly found a solution and we have not had any problems since.**

### Simple changes

In October we added another 128 kbps carrier in order to distribute the Charlotte Hornets and various short-form programming. Because of IDC's flexibility, all we had to do was add one encoder and multiplex the two 128 kbps channels into a single 256 kbps carrier. A simple command from the IDC network control processor (NCP) changes the receiver configuration from 128 to 256 kbps.

The NCP allows us to address radio stations individually, by groups or globally so we can easily change their receiving channels. The affiliate only needs to know which audio output the broadcast will be on, rather than what frequency. This helps us in attracting more network affiliates because automated stations no longer have to worry about having a board operator on hand to change the receiver channels. The FlexRoute system's addressability allows us to manage our network traffic more efficiently, thus allowing more capacity for program distribution.

The ability to receive multiple channels, as the SR260 does, is very important to us. Many of our affiliates are AM/FM combos or LMA situations where the stations carry several of our programs simultaneously. In our old analog system and with many other digital satellite systems, a radio station would have to have multiple cards or receivers to achieve multichannel reception.

### Problem virtually eliminated

With the FlexRoute SR260, this problem is virtually eliminated because when operating at 256 kbps, the receiver can choose from four channels. In the cases where two receivers are necessary, IDC makes an inexpensive radio that utilizes a data output from the SR260 and provides additional audio and data channels.

Another benefit of the IDC FlexRoute system is the contact closures. The NCP can accept a command from the keyboard or an external source to fire a specific relay on a receiver or group of receivers. This allows our affiliates total walk-away situations. First we tune their receiver to the appropriate channel for them and then we fire their commercials.

On the customer service front, IDC has definitely passed the test. Our chief engineer left our company right after we completed phase one of our conversion. The departure left our part-time assistant engineer, Craig Wilkins — who was not very involved in the installation — in charge. Upon installation, we had a few problems with chirps and mutes occurring. IDC bent over backwards to assist Craig in solving these problems.

### Quick solution

IDC sent an engineer from Canada to our facility and found that we were losing our digital clock. The problem was actually a result of improper T-1 hardware. IDC quickly found a solution and we have not had any clocking problems since.

Clocking has been the only major problem that we have experienced. It was determined early that the receiver signal strength needs to be hot, but we have found that a good-quality phase-lock loop low noise block(LNB) has performed reliably. As for the audio quality, the SR260 meets all expectations.

As a result of our partial conversion, we have noticed an increase in syndicators inquiring about our services and are excited about the new revenue possibilities that are now available to us. Our transformation is scheduled for completion in the spring of 1996.

□ □ □

*For more information from International DataCasting, contact Virginia Lee Williams in Georgia at 770-446-9684; or circle* ***Reader Service 123.***

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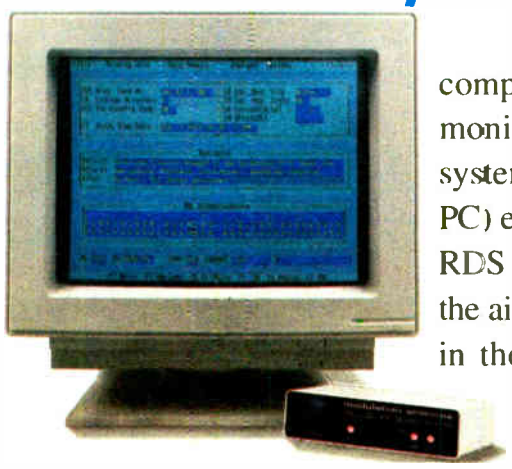
The RDS-1 is a PC expansion card supplied with software to turn any PC ('286 or better) into a powerful cost effective RDS encoder/subcarrier generator. Store up to 255 radiotext messages of unlimited length, and run full RDS automation locally or by remote control. Buy the PC card and software, or buy the broadcast quality rack mounted PC system preloaded with your messages to go on the air. The RDS-1 is the only fully software definable RDS generator available.

### RDS-MA & PRD-3000 Monitor-Analyzer Test System



The RDS-MA is a complete RDS receiver, monitor and analyzer test system (with or without the PC) enabling you to test your RDS system performance off the air, off your transmitter or in the studio; and to check out your competition! Or choose the PRD-3000 Monitor/ Analyzer unit only, supplied with the software to turn your laptop PC into an RDS subcarrier test facility (using the serial port). The only fully software definable RDS test equipment available.

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The only professional user configurable RDS data receiver available. Unlimited addressability, full auto tuning, with antenna diversity for reliable mobile operation. Use it for EAS, GPS, signs, billboards. You name it, we can control it. RS-232 and five switched control outputs. Fully boxed and powered. Assembled and tested PC board available in OEM quantities.

### SCA-186 SIDEKICK® SCA Audio Generator

The worldwide standard for professional and reliable performance. Quartz controlled stability. Built-in modulation monitor. Integrated audio processor provides best possible audio quality. Built-in noise generator and incidental noise meter for optimum transmitter adjustment and lowest possible cross-talk. Composite loop-through to simplify installation.

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World Radio History

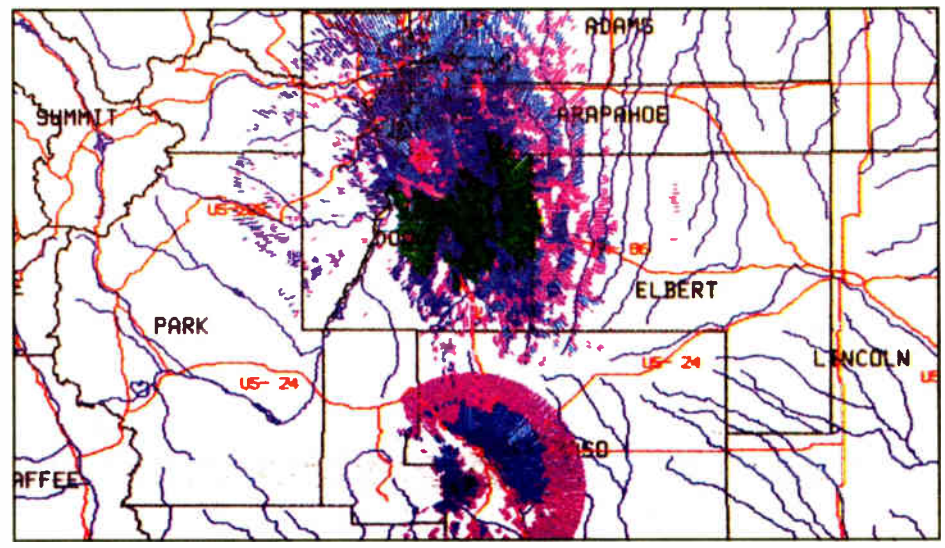
SPECIAL REPORT

# TAPping the Potential of Softwright's Package

**AURORA, Colo.** Have you ever needed to create a graphical signal map of your FM, remote pickup or studio transmitter link signal coverage? Do you need accurate data for submission to the FCC for application filing exhibits? Have you ever had to determine a site's suitability for covering your market? If you are answering with even a tentative yes, then you might want to check out the Terrain Analysis Program (TAP) written by **SoftWright** out of Aurora, Colo.

Born out of their telecommunications consulting business, Larry Ellis, P.E. and Mike Weibe, P.E. created a software package that enables telecommunication engineers to overcome some of the basic hurdles of coverage analysis.

The program is multi-faceted. If you need accurate data for submission to the FCC, the program contains modules for those required by pesky conventional coverage calculations — very handy for quickly figuring height above average terrain (HAAT) distance to contours. If you want to do a detailed terrain-impacted signal analysis, that too is within TAP's modules. Distance and bearing calculations, shadow studies and mapping are also available.




Softwright's sample field strength threshold plot for two sites with county boundaries, roads and rivers.

Conventional HAAT radial calculations seldom demonstrate real world coverage. The reason? The FCC method examines only three km to 16 km portions of the terrain surrounding your tower. This can be a serious problem if a significant terrain obstruction (like a really big mountain) lies just beyond that 16 km radius from your site — not something you want to overlook.

Modeling modules offered within TAP will immediately demonstrate that your coverage is being impacted by mother Nature. Along with foliage losses, manmade urban clutter can be added to the various models to improve calculation accuracy.

TAP offers three levels of terrain accuracy from the Defense Mapping Agency's digitized terrain elevation database: the relatively coarse 30-second database with data points spaced about every 600 m across the surface of the United States; the general-utility three-second database providing elevation data points about every 60 m; and the 30 m database, equivalent to a conventional seven and one-half minute U.S.G.S. topographic map.

Please note that the higher-accuracy databases come at a premium. Not only are they more expensive, they require much more computer disk space. The 30-second database requires about 38MB for the entire lower 48 states. The same area of the United States is divided onto five CD-ROMs in the three-second database. To make it more manageable, the 30 m data is provided in smaller data blocks.

Again, while these databases have been generated by the U.S. government, caution must be exercised when depending on the accuracy of spot elevations extracted from the data.

A few of the other modules available provide access to different kinds of databases, including FAA-listed obstructions (towers, power lines, tall buildings, etc.), FAA-listed airports and U.S. cities listed by geographic coordinates. These modules are especially important for facility planning.

If all of this sounds like something you have to use to appreciate, you are right. While it is easy to maneuver through the program, TAP is complicated. The tradeoff is the level of accuracy that makes it worthwhile to learn the program.

□□□

*For more information from SoftWright, contact Nancy Brewer in Colorado at 303-344-5486, or circle* ***Reader Service 144.***

Look No Further!

WHEN Moseley introduced the DSP 6000 in 1992 it was immediately acclaimed by the broadcast industry as THE digital STL solution. Here's why. The DSP 6000 virtually eliminates the problems associated with conventional analog transmission such as noise due to signal fades, birdies from intermod interference, and lack of spectrum for multiple audio feeds to LMA and Duopoly transmitter sites. Almost three years later, the DSP 6000 is the de-facto industry standard for sonic clarity and reliability with sales approaching 2,000 installations worldwide. But you probably already knew all of that stuff, right?

What you may not have known, is that the DSP 6000 also works in conjunction with your existing Moseley analog composite STLs! If you've invested in a Moseley PCL 505/C, 600, 606, 606/C or 6000, a few simple modifications convert your entire system to digital! And it won't cost a pot of gold (just under $6,000). Call us for modification instructions, or better yet, ship us your STL and for a mere hundred bucks, we'll make the modifications and do the setup for you.

Isn't it time you stopped chasing rainbows and started enjoying the sonic clarity of digital? "Digitally clear. Clearly digital. Just the way we planned it." ▼

Moseley

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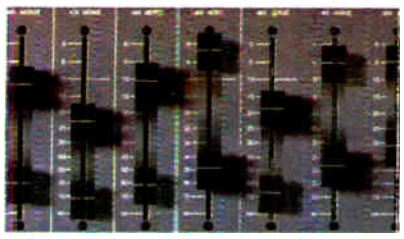

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YOU BOTH DECIDE ON AN ADX. THE ADX WORKSTATION WAS SPECIFICALLY DESIGNED FOR POWERHOUSE ARTISTS WHO CAN'T AFFORD TO WASTE VALUABLE PRODUCTION TIME WITH CREATIVITY-LIMITING TOOLS.

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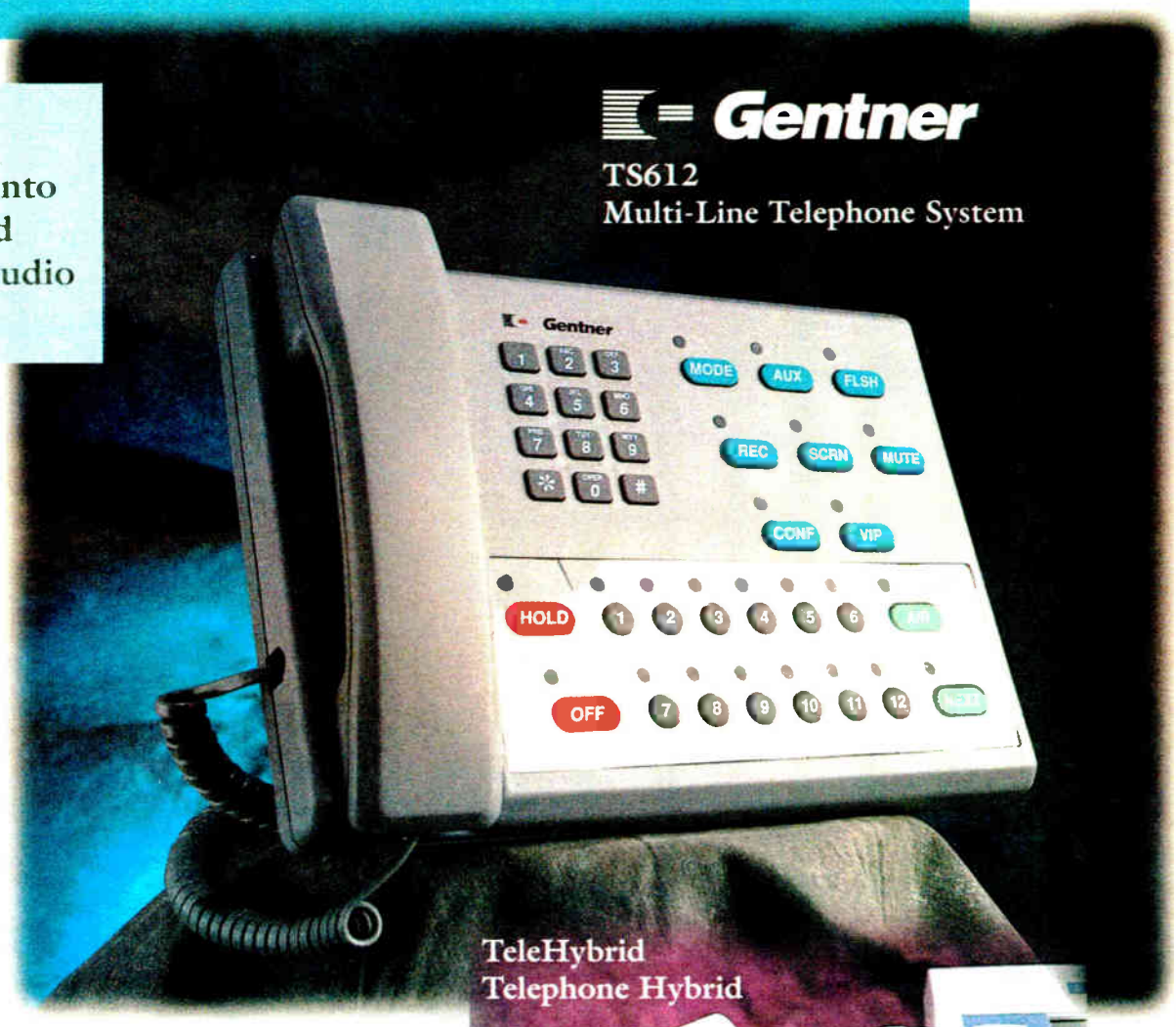
# *Step into the Future*

**If your on-air system is a little out of date, step into the future with Gentner and Harris Allied— your total audio conferencing solutions.**




Gentner's TS612 simplifies the process of bringing callers together by putting the controls right at your fingertips. This means a smoother on-air sound with an audience less likely to switch.

The control surface is easy to use. It looks, operates and even feels like an ordinary business telephone.

But it's far from ordinary.

On-air talent can screen a call, transfer it from the handset to on-air, conference as many as four callers together, and lock in a VIP guest.

Thanks to multi-color line status indicators the user can instantly tell who's on the air, on hold, screened or talking to the producer in the other room.

Installation is a snap.

The TS612's dual superhybrid technology provides crisp, clean caller audio with much more flexibility.

With Gentner's SCREENWAIR software and a PC, a screener uses a keyboard and a headset instead of a control surface, and preselects calls for on-air, adding names, comments, city of origin and other information. An additional monitor is placed in the studio where the talent can see who is on screened hold.

NETWORK INTERFACE lets you expand the TS612 system into multiple studio configurations by adding a Network Interface for each mainframe. This provides the communications link between studios for proper management of 12 phone lines.

Telephone calls for broadcast teleconferencing and pro audio applications are made easier thanks to Gentner's TeleHybrid. Simply connect it to your existing telephone to deliver full duplex audio to your console or conference system without the fear of echo or feedback.

The TeleHybrid is the key to simple, great sounding telephone calls on your professional audio system.

Your telephone can be single or multi-line, analog or digital— the TeleHybrid doesn't care. The only requirement is that your telephone have a detachable handset with a modular connector.

The TeleHybrid "installs" between your telephone and its handset. Audio connections to your equipment are made with XLRs.

With the TeleHybrid, the hassle and expense of dedicated phone lines are a thing of the past. Your regular telephone system becomes your "on-air" system. Anyone in your facility can screen a call or transfer it to the studio or boardroom. Best of all, the TeleHybrid is very affordable.

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USER REPORT

# ComStream Equipment Utilized at NPR

**by Greg Monti**
**Director**
**Future Interconnection System**
**Project Office of NPR**

**WASHINGTON** In 1979, National Public Radio (NPR) inaugurated the first satellite delivery system for radio programming in the United States. Today, NPR is nearing completion on its program to replace that original analog 12-channel mono system with a new network that is converting the Public Radio Satellite System (PRSS) to digital audio.

The changeover to digital is being performed in two stages. First, beginning April 20 of this year, we began transmitting parallel digital and analog feeds to our stations. The digital feed uses C-band operating frequencies on two transponders on the Hughes Galaxy IV satellite.

### Digital signatures

Now in the second stage, NPR aims for a changeover to full digital transmission on Jan. 3, 1996. By Nov. 1 all of the equipment had been delivered, leaving installation the only thing to do through the end of the year.

Installation of the new customized digital audio equipment began in December 1994. A total of 3,132 digital ComStream demodulators have been shipped to 415 downlink sites and transmitting equipment is installed at 22 uplink sites, plus our hub at NPR in Washington.

In September we also signed off on another key part of the new digital system, the Satellite Operating Support System (SOSS) developed by IBM. Audio encoders and receivers for the network will be integrated with this comprehensive computer-based network management and control system. The SOSS allows our producers to release their programs on a subscription basis and to grant access, or permission receivers as required. Unique in-band digital signatures, or subscriber codes assigned at the producer's option, will direct programs to individual subscribing stations. These codes allow producers to continue distributing programs to all stations or to distribute only to specific sites.

**3,132 digital ComStream demodulators have been shipped.**

NPR awarded the upgrade contract after reviewing bids from six leading satellite communication companies. In designing the new system, we wanted to satisfy several requirements including upgrading audio quality and assuring that public radio has industry standard technology for its next generation satellite system.

With Congressional spending being scrutinized more than ever, one of NPR's primary requirements continues to be to run as cost-efficiently as possible. In implementing the new digital transmission system, the PRSS is adopting technology that has been shown to reduce satellite transponder charges by 35 percent to 65 percent over competing transmission methods. Efficiency is gained by compressing audio signals, enabling the ComStream equipment to transmit a full 20 kHz stereo signal in as little as 128 kilobits per second (kbps).

### Adjustable audio rates

Other specially designed equipment will make the PRSS even more efficient. ComStream digital audio receivers, including the new ABR700, specifically developed for NPR, can receive data at multiple rates, which allows broadcasters to use only the amount of satellite bandwidth required for the quality of the radio show being transmitted. For live music concerts, stereo signals up to 256 kbps are available to provide CD-quality audio, yet talk shows or simple news feeds can be transmitted using a single 64 kbps mono channel.

To make it easy for users to take advantage of the adjustable audio rates, ComStream has built an "auto-bauding" function into the ABR700. To search for programming material, this auto-bauding feature has a default order of data rates that it will automatically and continuously cycle through at a user- or system-specified receive frequency. Auto-bauding allows non-technical personnel to set only a transponder and a frequency to receive a program.

Our feedback on the new system has been very positive with only a few small exceptions. One minor problem has been the fan built into the demodulators to reduce heat buildup. The hum from the fan has caused some of our engineers to rethink locating the units in-studio.

### No garbage

But overwhelmingly the engineers are praising the improved quality of digital versus analog technology. The input I had from an engineer at our station in Arcata, Calif., is typical: "Audio quality is — in a word — great." Our usually critical program director and the board-ops for "Performance Today," particularly, have had nothing but nice things to say about the overall audio quality. Especially revealing was one remark from a long-time volunteer board-op who said that he had no idea how bad the compression on the analog system sounded until he could A/B between analog and digital.

An additional positive has been the robustness of the new digital equipment in locations that have had problems with solar outages. More than one location in high-latitude trouble spots have reported that the demodulators did not mute or pick up channel noise during conditions that shut down the analog systems. This comment came from an engineer at the Public Radio station in Geneva, N.Y.: "We were airing 'Talk of The Nation' at the time. No loss of signal, no garbage, no noticeable change in air quality."

Our decision process was a long one as we set out to upgrade our national network to digital. As we have seen the new network come together and received feedback from our stations, we feel good about our choice. We are looking forward to January's changeover to all-digital and many years of excellent performance to come.

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*For more information from ComStream, contact Bruce Rowe in California at 619-657-5248; fax: 619-657-5415; or circle* ***Reader Service 163.***

USER REPORT

# NPR Satellite Services Launch Alabama Network

**by Larry Wilkins**
**Vice President of Operations**
**Alabama Digital Satellite Network**

**MONTGOMERY, Ala.** Alabama Digital Satellite Network (ADSN) is now in operation and capable of delivering programming to over 120 radio stations. ADSN uses Galaxy 4 transponder 1 leased from **NPR Satellite Services**. NPR Satellite services is switching all of its affiliates from analog single channel per carrier (SCPC) to ComStream digital SCPC service.

ADSN consists of over 75 downlink locations statewide as well as an uplink facility located in Montgomery at Colonial Broadcasting. Presently 127 radio stations are capable of receiving programming through ADSN's downlink sites. Nationwide, over 500 radio stations are capable of receiving ADSN programming.

### Full-service network

ADSN is a full-service satellite network with production and origination studios located in Birmingham, Montgomery and Auburn. Additionally, ADSN offers remote capabilities and an eight-track digital production studio at its Montgomery location.

The network uses digital SCPC transmission, allowing two channels of audio to be transmitted on one carrier. ComStream encoders, modems and receivers are used throughout the system. ComStream modems allow the transmission of dual mono, discrete stereo or joint stereo. The receivers follow the mode selected at the uplink site.

Other features of the transmission system include eight end-to-end contact closures for automation. The Alabama and Auburn networks plan to automate sports programming in the near future. Also, a 9600 baud rate channel is available. With the addition of a printer or computer at the receive end, formats, time changes and general information can be sent to the affiliates.

### A word of caution

One of the most important items in a project like this is preplanning. Take time in the beginning to amp out every area from production facilities to receivers. A word of caution about downlinks ... make sure the dish that you select is certified for two-degree spacing. Backyard dishes just will not work, despite what installers say. Use a reputable installer that knows and understands alignment of systems for adjacent satellite nulls. Alignment for just maximum signal is not good enough in the two-degree world.

The uplink facility includes three ISDN lines, dual- and single-line decoders and a full IFB system. In addition to program distribution to its downlinks, ADSN also offers interconnection service to both analog and digital satellites, domestic or international.

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*For more information from NPR Satellite Services, contact Miriam Lenett in Washington, D.C. at 202-414-2613; or circle* ***Reader Service 62.***

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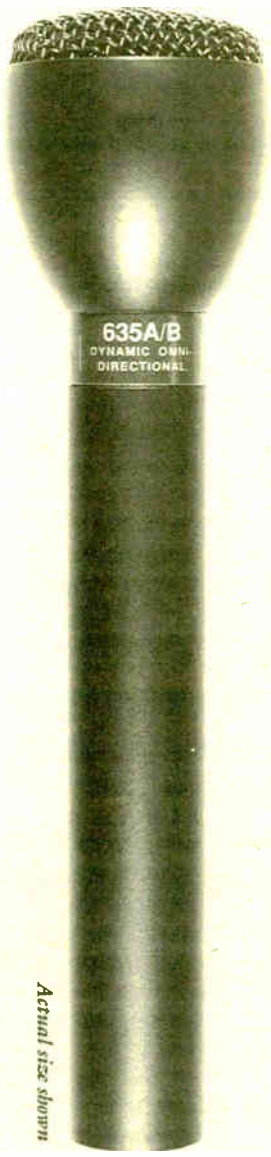


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USER REPORT

# Satellite On Demand with Virtex DSS

**by Richard J. Becvar**
**President**
**Skylight Corporation**

**MINNEAPOLIS** A new satellite system from **VirteX Communications** is changing multimedia communications with innovative digital technology. The new transmission system, dubbed "MX3" for multiple service, channel and carrier, combines features that have traditionally been associated with only single channel per carrier (SCPC) or multiple channel per carrier (MCPC) modes.

Now, thanks to developments by VirteX engineers, when the new satellite transmission system is combined with the StarguideII satellite receiver, a user gets software-controlled virtual bandwidth-on-demand operation across multiple carriers and transponders on the same satellite.

The technology embodied in the StarguideII/MX3 system was developed specifically to work with the VirteX WinDaX, a digital multimedia store-forward platform being deployed in some 3,500 NBC Radio, Westwood One, Unistar and Mutual networks for the Musicam Express roll-out.

## Site-diversity plan

C-band transmissions to SatCom C-5 from GE's South Mountain, Calif., earth station began in mid-August. Both Ku- and C-band MX3 uplink services are also anticipated from the Minneapolis-based Teleport Minnesota and from various other sites across North and South America. Such a site-diversity plan combines the advantages of both SCPC and hub operation.

The MX3 architecture supports up to 32 separate signals per satellite. Each signal will support a maximum of 32 service providers (networks or groups). The service provider can aggregate a maximum of 128 audio channels, mono or stereo. These services can be transmitted with individual, group or broadcast addressability. This feature allows network designers to locate satellite uplinks close to production and data center, minimizing the distribution costs.

An essential element of any economical digital transmission system is bit-rate reduction. The StarguideII/MX3 system uses the enhanced Musicam audio algorithm developed by Musicam USA to achieve the desired analog-to-digital conversion and bit reduction.

## Three basic subsystems

The StarguideII/MX3 transmission/distribution system consists of three basic hardware and software subsystems: the MX3 multiplexer that resides at the satellite uplink, the VBNMS (virtual bandwidth network management system) software and the affiliate StarguideII satellite receiver.

The MX3 multiplexer accepts multiple digital inputs from Musicam USA's CDQPrima encoders, ISDN terminal adapters and other switched or dedicated digital facilities. The multiplexer inserts framing and allocation table information and then generates the aggregate bitstream for transmission to the satellite. The slot allocation process is managed on the fly by VBNMS software and is transmitted through an in-band signaling channel to the StarguideII receivers.

The VBNMS software handles addressing tasks, database management and the virtual partitioning of the aggregate bitstream into multiple channels with variable bandwidth. Through the VBNMS process, all receivers are instantly made aware of service and provisioning changes.

The aggregate digital output of the multiplexer is routed to the satellite modulator, where forward error correction (FEC) bits are added and the bitstream is formatted into a QPSK satellite signal. The FEC scheme that has been chosen for the MX3 system consists of an outer ring of traditional Viterbi coding and an inner ring of concatenated Reed-Solomon processing. The resulting combination yields exceptional near-threshold performance. A 0.1 dB increase in signal delivers an order of magnitude decrease in bit-error rate.

The StarguideII receiver front panel sports LEDs to display signal, sync lock, power-on and fault modes. Also included on the front panel is a "standby" LED which displays the status of any software downloads which have been received (over the satellite channel or through a modem connected to the rear panel port).

Two flash memories are provided in the receiver so that the two latest versions of software are stored in non-volatile memory. With this approach, an aborted software download does not result in a default to the original software supplied in ROM. The software download functionality also applies to audio algorithm replacement. This feature ensures that enhancements made to the audio algorithm can be transmitted through the network to all receivers.

## Vital statistics

The front panel of the StarguideII also contains a two-line LCD display that is controlled by a tactile button keypad. The operator can scroll through several menus which show receiver vital statistics and provider/service information.

Gone are the days of changing crystals or needing to remember channel numbers or frequencies when switching services. The receiver can display all of the formats on a particular carrier and the current permissioning status of each service.

The LCD display can be used for diagnostics when commanded from the network operator. Visual messages from the network operator may also be received on the LCD display to alert affiliates of changes or to aid in troubleshooting.

## Simultaneous output

The LCD display and keypad also serve to set up the output ports. Each StarguideII receiver can simultaneously output as many as five stereo or 10 mono audio channels. Relay outputs, RS-232 data and RS-422 WinDax audio are also available if permissioned.

The flexibility and freedom gained by the software-based approach to channel/bandwidth allocation is as innovative a solution as any I have witnessed in my 15 years in the satellite industry. This system's ability to manage, channelize and transmit digital bits without regard to what information is represented by the bits (audio, video or data) makes it a truly powerful satellite networking tool.

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*For more information from Virtex, contact the company in Nevada at 702-686-5050; or circle* ***Reader Service 153.***

USER REPORT

# Mapping with Radiosoft

**by Randy Michaels**
**President/COO**
**Jacor Broadcasting**
**with J.T. Anderton**
**VP/Managing Partner**
**Duncan's American Radio**

**CINCINNATI** If you buy Radiosoft's new AMR and FMR coverage mapping programs, do not make any plans for the first few evenings after you receive them. Our bet is that you will be so fascinated that you will be up half the night doing map after map in city after city. AMR and FMR allow the user to compare the coverage of all of the signals in a market — or across the country for that matter.

FMR can generate full-color terrain-corrected coverage maps that render a much truer representation of a station's coverage than a simple FCC map generated according to Section 73.313 of the rules. AMR can overlay a color-coded M-3 conductivity map at the touch of a key. One FMR option allows the user to call up a color-coded three-dimensional map of the terrain in the vicinity of any FM station.

Calling up a map on either program is as simple as typing in the call letters and specifying the desired contours. Most of the functions are so intuitive that there is little need for a manual. However, the software does assume that the user has at least a rudimentary knowledge of the FCC's AM and FM allocation rules.

Both AMR and FMR allow the user to select the contours to be represented, which makes it possible to call up the close-in, higher-intensity contours as well as the lower-intensity interfering contours further out. AMR and FMR both allow the user to do allocations studies and FMR includes a function that permits FM upgrade/short-spacing surveys and area-to-locate studies.

Option 4 allows the user to compare the coverage of several stations on the same map. The same function allows for comparison of the daytime and nighttime coverage of a directional AM. As we mentioned, contours must be specified by the user. Currently, the program will not calculate the nighttime interference-free contours of the user. An update of the software is currently being worked on that will calculate NIFs and will be available to clients who have already purchased AMR.

One of the most interesting features of FMR is the capability to generate full-color interference studies between FM stations. Our experience to date is that interference levels depicted in the program correlate very closely to actual in-field signal performance in cases of severe short-spacing. FMR accurately predicts the onset of signal degradation in such cases as the short-spacings between WCBS(FM), New York and WBEB(FM), Philadelphia and between WJFK-FM, Washington and WWMX(FM), Baltimore.

Radiosoft recently released a new AMR/FMR option that calculates the population within a specified contour. Population counts are not new. What Radiosoft adds is a clever program that color-codes population and then

continued on page 64 ▶

dataworld® MAPS

LMA/DUOPOLY CONTOUR MAPS

The **DATAWORLD** LMA/DUOPOLY Market Survey Contour maps present a precise electronic verification of overlapping and intersecting contours.

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To meet the demands of the global market, Harris provides DX transmitters at all power ranges from 10 kW to 1000 kW. In fact, with our 1995 International Broadcasting Award-winning DX 1000, Harris is *the only company in the world that can deliver — and has delivered* — a 1-Megawatt solid-state AM transmitter.

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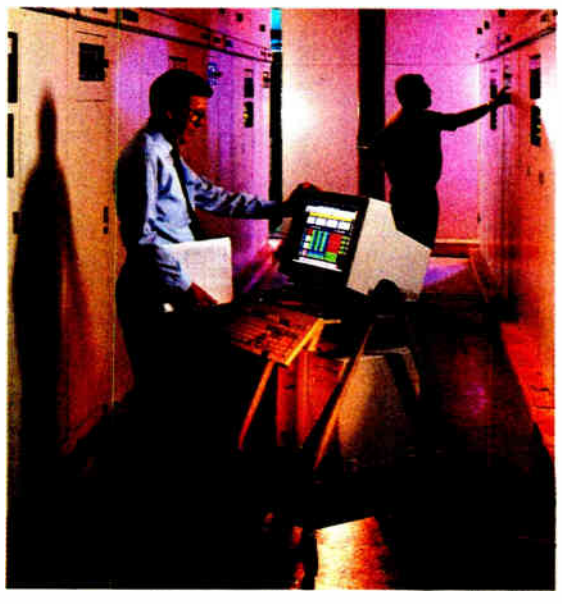
As the only transmitter proven to be capable of digital medium wave broadcasting, Harris DX Transmitters have been used for every on-air In Band/On Channel DAB test to date. And, because DX is the only medium wave transmitter compatible with both analog *and* digital transmission, while meeting IBOC DAB standards, Harris stands alone in its ability to meet your broadcasting demands today, while preparing you for tomorrow.



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Circle (33) On Reader Service Card

World Radio History

USER REPORT

# KSL (AM) Banks on Weather for Image

**by Rod Arquette**
**Vice President**
**Radio News and Programming**
**KSL(AM)**

**SALT LAKE CITY** Standing out from the crowd in today's tough, competitive radio market is not easy. Stations are constantly searching for key elements of uniqueness that separate them from other stations of similar format. Uniqueness achieved from separation empowers the station to become more profitable. Most stations, however, concentrate heavily on sales and minimize or ignore the service aspect. Providing unique, "value-added" programming opens interesting possibilities for radio stations. One element receiving a lot of review lately by stations is weather services.

The recent review of weather services has been triggered by two causes. First, the National Weather Service, once the only source of weather information for broadcasters, has drastically trimmed the products it produces. Highly popular agricultural weather forecasts and statements, fire weather, national weather summaries and marine weather products are no longer available.

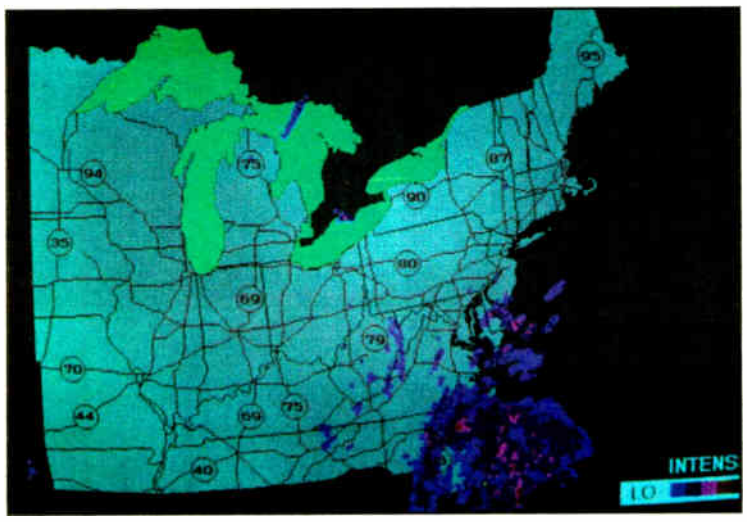
Second, there is a greater demand for more weather information — not only information, but more timely information. The public realizes the value of reliable weather information because its use is so widespread.

### Facing the challenge

Virtually all facets of work-related activities, public safety and emergency preparedness, commercial aviation, military applications, agricultural and environmental concerns are continually influenced by the weather. And, as confirmed by recent studies, the public turns to the broadcaster to meet this need. Herein lies the challenge that faced KSL.

We found that many stations in our market were content to use weather data embedded within news wire services. We wanted a greater variety of information. Because our studios were equipped with color personal computer displays, we decided to incorporate the WeatherBrief Satellite 6.0 Weather System from **WeatherBank, Inc.**, as part of our automated information system for on-air use.

The WeatherBrief Satellite 6.0 is a news director's dream. It is remarkably friendly and easy to use. Station personnel have fingertip access to national, regional, state and local weather information 24 hours a day, seven days a week. WeatherBank's vast library of weather data includes such valuable products as local high-resolution radar, 16-shade satellite pictures, interstate weather reports and all forecasts. We had the ability to select our own menu of 300 products from a listing of over 5,000.




KSL uses the WeatherBrief Satellite 6.0 Weather System for a greater variety of weather information.

### Instant alert notice

What our personalities like most about this system is the near real-time update of all weather alerts and warnings. Our broadcast area covers thirteen western states, so it is reassuring to know that as soon as any alert is released by the NWS, we will see it and can advise our audience.

Many of the WeatherBank products are unique to their service. So, in addition to having weather information faster than other stations, we have unique information unavailable to others in the market. To KSL, that is important, as we provide weather updates every 10 minutes on the spot.

Installing the WeatherBrief Satellite Weather System was relatively simple. A 0.75 meter dish delivers data to a personal computer via an intelligent data receiver (IDR). The PC requirements were standard: a 386 or 486 IBM compatible, 15MB free hard disk space, 2MB RAM, 128KB expanded memory (EMS), 512KB disk caching, DOS 6.0 and a common communication serial I/O card. The satellite earth station was available by purchase or as a leased item from WeatherBank.

Products received from the satellite are displayed in television broadcast quality. Text products, such as city forecasts and thunderstorm watches and warnings, are presented in a concise format that can be read directly on-air. Most important was a feature added by WeatherBank that alerts the user that a warning has expired and is no longer in effect. Every product can be printed and thus given to other board operators.

Two other features we enjoy on the WeatherBrief system are the auto flags and looping capabilities. During adverse weather, special display boxes and audible alarms instantly alert on-air personnel that new product updates have just arrived. This is extremely beneficial in allowing us to announce dangerous weather conditions immediately. Additional flags such as auto-print and auto-save-to-disk may be set if desired.

The looping abilities of the system are quite good. The image quality resembles the television evening news. Our local high-resolution radar displays can be animated in a high-speed loop to show progression of developing thunderstorm cells moving from one county into another.

### Quick, accurate and timely

The WeatherBrief Satellite Weather System from WeatherBank has been in place for more than five years. KSL and I rely heavily on its support for our weather information as much as we do with any other indispensable piece of equipment. It is quick, easy to use, accurate and timely. After all, that is exactly the type service we provide to our listeners.

□□□

*For more information from WeatherBank, contact Rob Goodwill in Oklahoma at 405-359-0773; fax: 405-341-0115; or circle* ***Reader Service 95.***

# *Mapping with Radiosoft*

▶ continued from page 62

superimposes it over coverage contours. The result looks a lot like those NASA satellite photos of cities at night, with high-population areas showing up as bright areas roughly the shape of the built-up sections of the metro.

The first application we thought of was determining how much of a metro's population is encompassed by an AM station's NIF. This feature vividly demonstrates a phenomenon that many AM operators have known for decades — that massive population growth has taken place outside the NIFs since the bulk of America's AM directionals were built in the 1940s and 1950s.

No program of this complexity is without minor flaws. Since the program allows the user to select the scale for each map it draws and the base map must expand or contract to accomplish that feature, city names sometimes overlap and become unreadable at the smallest scales.

We have some quibbles with Radiosoft's selection of which cities are presented on the large-scale maps. Some of the overlays that present roads and water features include either more or less information than we would have opted to present for maximum clarity. On the other hand, Radiosoft has been very quick to incorporate constructive suggestions into later versions of the programs.

Radiosoft's software is a significant contribution to the body of data available about our industry's technical infrastructure. While not inexpensive, and most certainly not a substitute for the counsel of an experienced consulting engineer, we consider it a very valuable program for those who have an engineering or business need for this sort of data.

*For more information from Radiosoft, contact Peter Moncure in Florida at 904-426-2521; or circle* ***Reader Service 105.***

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(Required by 39 USC 3685)

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PS Form 3526, September 1995 (Reverse)

World Radio History

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 Sell

**Crown D150A** in gd cond, $250. K Thomas, Rebel Recording, 5565 Radio Lane, Jacksonville FL 32205. 904-388-7711.

### Want To Buy

**TUBE EQUIPMENT,** record cutting lathes. 612-869-4963.

## ANTENNAS/ TOWERS/CABLES

### Want To Sell

**330' x 36" Utility tower,** on ground in Minneapolis, ready to ship, includes guy insulations, lights, conduit junction boxes. Wind load, 90 mph, ice lead, excel cond, photos avail. Jim Glogowski, Childrens Bdctg Corp, 713-270-5835.

**Myat 1-5/8"** to type-N Female adapter mdl 201-060, new in box, never used, $100/BO. D Michaels, KZRO-FM, POB 1234, Mt Shasta CA 96067. 916-926-1332.


**3" HELIAX STANDARD COAXIAL CABLE**
50-Ohm, unused, cut to length. Priced below market. Shipped instantly.
Call Basic Wire & Cable
(NANCY) 800-227-4292
FAX: 312-539-3500


**280' tower,** 13 sections of 20', 1 section of 10', on ground & ready to ship, matching top beacon also avail, BO. D Lacy, Mtn States Bdctg, Colorado Springs CO. 719-636-2470.

**Jampro 2-bay** 10 kW FM, tuned to 102.3, BO; approximately 100' of unshielded solid wire 8-conductor cable, BO. T Butler, WCVR, Randolph VT 05061. 802-728-4411.

**Jampro JHCP-10** on 94.1 MHz in working cond when removed, BO. J Sands, KJMZ, 2340 Paseo del Prado #204, Las Vegas NV 89102. 702-868-7222.

**Phelps Dodge CFM-HP-12** 12-bay FM bdct antenna rated for 40 KW, tuned for 107.7 MHz, $3000. M Lout, KNKE Radio, Jasper TX 75951. 409-384-4541.

**Phelps Dodge FMP-HP-7** antenna, pole mount hardware, $1500. B Caithamer, WMBI, 820 N LaSalle Dr, Chicago IL 60610. 312-329-4304.

**Shively 6813** 2-bay w/radomes tuned to 96.1 MHz, used 60 days, BO. D Magnum, WBOG, 1021 N Superior, Tomah WI 54660. 608-372-9600.


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**1040' guyed World tower,** complete w/strobes, 6 yrs old, like new, $100,000, located in SE Georgia. M Rowland, 912-267-1025.

**Jampro** 2 bay tuned to 95.3, used 5 yrs, $1700 ea. R Warwick, KLLY, 3651 Pegasus Dr, Bakersfield CA 93308. 805-393-1900.

**New 1200' 2.25" Andrews** air heliax with fittings, dehydrator, ground kits and hoisting grips. 919-781-3496.

**Andrew 7/8" coax,** HJ7-50 Air Dielectric, 3.75/ft. New stock, cut to length! Dielectric 5-bay on 97.1 w/radomes. 40kW input capacity. Jim Mussell Bdct Eng. 805-922-7775.

### Want To Buy

**Hurricane damaged, urgently need** in US Virgin Islands by marine radio station WAH., military surplus tower sections, US Army antenna support, AB-1050 C/FRC, triangular 24" 60 degree folded steel vertical 10' sections, diagonals & horizontals bolted in place, need 5 to 15 sections. Peter Church, 809-776-8282.

**High power** 8, 10 or 12 bay antenna on or near 105.9 FM. R Kelly, KXGJ, POB 2537, Bay City TX 77414. 409-244-4170.

**Radio tower,** 500' needed. Midwest Bible Radio, Sioux City IA, 712-252-4621.

**Transmission line** 3", prefer flex line, but rigid is OK if you have hangers, must be cheap! R Kelly, KXGJ, POB 2537, Bay City TX 77414. 409-244-4170.

## AUDIO PRODUCTION

### Want To Sell

**Lexicon PCM-70** classic reverb, $1350/BO; 503 expander/comp, $350; Roland SRV 2000 classic reverb, $525; Orban 245-E stereo synthesizer; stereo spring reverb, $175; Altec 352-A vintage audio mixer; Altec EQ, $190 ea. T Coffman, 619-571-5031.

**Tascam ES-51** synchronizer & (2) ES-50 slaves, creates & syncs SMPTE time code audio to video, digital keyboard & rack mount slaves, all cables & manual included, $1200/BO. D Michaels, KZRO-FM, POB 1234, Mt Shasta CA 96067. 916-926-1332.

**UREI LA-4** rack mount pair LA4 compressors, $650; UREI 533 EQ's rack mount pair, 533 EQ's, $600. G Robinson, Techworks, 399 Muirfield Pkwy, Charleston SC 29414. 803-769-0349.

**Antex SX-10** digital audio card for PC; Modulation Sciences CP-803 composite processor; UREI 530 stereo graphic EQ. R Lankton, WIKX, 4810 Deltona Dr, Punta Gorda FL 33950. 941-377-1488.

**dbx 150X** (4) NR type 1, half rack mounts, $100/ea or $300/all. J Borden, Handbasket Prod, 2909 S Loger Ave, Milwaukee WI 53207. 414-482-8954.


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**Lexicon PCM-70** classic reverb, $1350/BO; 503 expander/comp, $350; Roland srv 2000 classic reverb, $525; Orban 245-E stereo synthesizer/stereo apring reverb, $175; Altec 352-A vintage audio mixer, Altec EQ's, $190 ea. T Coffman, Rolltop Music Std, POB 17203, San Diego CA 92177. 619-571-5031.

**UREI 527A** third octave EQ. Phil, KMXZ, Hollister CA. 510-895-6358.

**Nexus 96 point patch bay,** 1/4" front & RCA back, 19" rack mount, new, never used, $200/BO; Russound QT-1 48 point patch bay, mini plug in front & RCA back, 19" rack mount w/12 cables, never used, $100/BO. J Diamond, Blue Diamond, 290 Chubbic Rd, Canonsburg PA 15317. 412-746-2540.

**DAP 310** 3 band AGC/limiter, gd cond, $250. J Sands, KJMZ, 2340 Paseo del Prado #204, Las Vegas NV 89102. 702-868-7222.

**Orban 245-F** stereo enhancer; Shure SE-30 compressor/mixer; Ramko audio D/A, 10 chnl; Modulation Sciences MYB-2 stereo max; Audire Cresendo audio pwr amp. D Kannes, KTAR, 602-234-6347 or FAX 602-266-3858.

**dbx 166** stereo compressor, $350. W Gunn, 619-320-0728.

### Want To Buy

**Digidesign Audiomedia LC** sound card for MacIntosh LC series computers. K Baker, Radio Kansas, 815 N Walnut #300, Hutchinson KS 67501.

**Neve, API, MXR** mic pres, EQs, effects, compressors. T Coffman, 619-571-5031.

**Neve-API-MXR** mic pres/EQs/effects/compressors. T Coffman, 619-571-5031.

## AUTOMATION EQUIPMENT

### Want To Sell

**Harris 9002,** ITC, R-R, Carousels, floppy drive back up, $1500. T Bescata, WAQE, 2293 19th St, Rice Lake WI 54868. 715-234-9059.

**Systemation Satfire** satellite hard disk automation; SMC DP-2 automation system with 4 Carousels, 5 reel decks, dual PB cart, will part out. C Springer, KLMR, POB 890, Lamar CO 81052. 710-336-2206.

**Smartcaster Best Teck 3** (1991), full satellite interface & digital prod, in full working cond, $3500. D Fitzgibbons, WARE-AM, 100 Foster St, Southbridge MA 01010. 508-764-4381.


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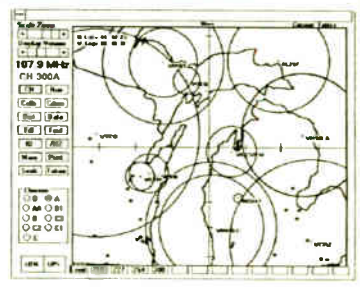
Professional software packages for preparing FCC applications and plotting coverage. For Windows and DOS.



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**SMC ESP2** automation system, complete & working, 20 source model, (4) R-R, (3) single play cart decks, (5) Carousels & remote keyboard w/monitor, $5K or BO, may part out. B Demat, WPTW Radio, 1625 Covington Ave, Piqua OH 45356. 513-773-3513.

**SMC-1977** automation Carousels (4), BO; RSC-50 switchers. B Darling, Syskiyou Country, 316 Lawrence Ln, Yreka CA 96097. 842-4159.

**Sono-Mag 350s** (7) & 452s (2), BO; IGM communications event controllers (2), BO. T Butler, WCVR, Randolph VT 05061. 802-728-4411.

**Be home for the holidays** - not baby-sitting your station! The Auto-Mate is the digital automation system you can afford. For satellite and music on hard drive. Software for your IBM(tm) compatible computer and SoundBlaster(tm) audio card. Call for more information: 503-769-2886.

## CART MACHINES

### Want To Sell

**Fidelipac 300 carts,** large quantity, many new, all gd to excel cond, various lengths, BO. M Sophos, WDFH, 21 Brookside Ln, Dobbs Ferry NY 10522. 914-693-3963.

**ITC SP** stereo play, 3 tones, $450; Tapecaster 701P mono play, $250, or both for $550, both in excel cond w/manuals. Ken Lamson, 510-447-7405.

**ITC 3D** 3 deck & 3 SP single play only cart machine, record amp avail for 3D. C Springer, KLMR, POB 890, Lamar CO 81052. 710-336-2206.

**Tapecaster 500A,** $75; Tapecaster R/P, $85. W Moring, WSCI, 2187 Wappoo Dr, Charleston SC 29412. 803-795-9401.

Great Prices on original equipment tape heads for ITC, BE, Fidelipac, Otari, Tascam & others!
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**Tapecaster 700-P** (2) & a 700-RP carts, BO; ITC PD-II R/P cart; (3) Audi-Cord E11 & (3) E31s, BO. T Butler, WCVR, Randolph VT, 05061. 802-728-4411.


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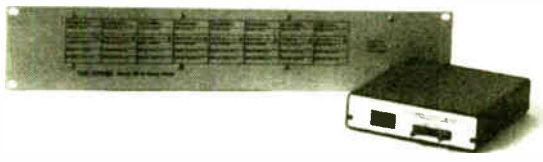
SINE SYSTEMS



RFC-1/B shown above w/ 8 channel relay panel

The RFC-1/BHV3 provides transmitter power control, has alarm dial out for 6 numbers, and provides up to 64 channels of control & metering. Up to 8 action sequences and 80 timed functions can be stored in non-volatile memory. Three levels of security codes are standard for multi-user sites. Data I/O port to a computer or printer is possible with the optional RS-232 adaptor. Only your imagination will limit your uses for the RFC-1/B! Best of all is the actual sampled human voice on the new HV3 model. Call your HE sales engineer for a free booklet or fax describing all of the RFC-1/B's possibilities!

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|---|---|
| **AFS-1** | **Dual Channel Audio Failsafe** |
| RS-232 | Serial Data Adaptor |
| **SP-8** | **Heavy Duty Surge Protector** |
| ACM-1 | AC Current Monitor (for tower lights) |
| RK-3 | Rack Mount Kit; mounts up to 3 units |
| TM-1 | Temperature Monitor Unit |
| DAI-RP | Relay Panel Kit |
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| SU-5 | Update your RFC-1 to real human voice |

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**CART MACHINES...WTS**

**ITC** record amps, 3 tone, stereo $350 or mono $250. W Gunn, 619-320-0728.

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### Want To Buy

**ITC, BE, Fidelipac** cart machines: single, triple, mono, stereo, play & record/play. Call M O'Drobinak @ 619-758-0888.

## COMPUTERS

### Want To Sell

**Okidata Microline 84** printers (2), BO. T Butler, WCVR, Randolph VT, 05061. 802-728-4411.

### Want To Buy

**Tandy 6000 HD** with at least one floppy drive. Mel Crosby, 408-363-1646.

## CONSOLES

### Want To Sell

**Tascam 3** 16x4 mixer, $150. J Hill, Earmark Audio, 206-463-1980.

**Autogram AC-8**; BE 5S-150, excel cond. Phil, KMXZ, Hollister CA, 510-895-6358.

**McMartin** 8 pot, gd cond, $650.00. J Arzuaga, WREI, Clemort FL, 809-895-2725.

**Ramko DC5AR**, 5 ch mono. J Parsons, Parsons Sounds, 2781 Fayson Circle, Deltona FL 32738. 904-532-0192.

**Soundcraft Delta Series modular** 16x4x2 mainframe w/(6) mono mic line, (6) stereo line, (4) sub out, master out modules. 4 yrs old, gd cond, $2000 +shpg. T Stine, KCGQ, POB 2077, Cape Girardeau MO 63702. 314-335-9099.

**BE 150** series 5 chnl mono audio console in gd cond, $260 +shpg. F Hogan, WGLS, 201 Mulica Hill Rd, Glassboro NJ 08028. 609-256-4311.

**Fostex 812** 12x8x2 mixer w/manual, excel cond, $800. J Borden, Handbasket Prod, 2909 S Loger Ave, Milwaukee WI 53207. 414-482-8954.

**Speck mix** 16x8x2, manual & power supply, $800. S Bogart, 817-467-0158.

**Gates Yard board**, new tubes, $395. W Gunn, 619-320-0728.


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### Want To Sell

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**Audiomax 4440-A** compressor, $125; Volumax 4000-A compressor, $125. T Coffman, 619-571-5031.

**Optimod 8000A** limiter/stereo gen. Phil, KMXZ, Hollister CA, 510-895-6350.

**Versital 2073H** RF exciter w/book & (2) random sets of spare parts, $850. W Moring, WSCI, 2187 Wappoo Dr, Charleston SC 29412. 803-795-9401.

**Sennheiser 421**, no clip, $125. Phil, KMXZ, Hollister CA, 510-895-6350.

**AKG** mic power supply, $50. S Bogart, 817-467-0158.

**Countryman Isomax II** (2) hypercardioid lavaliers w/50' cable on reel attached, requires 15-50 V phantom power, $350/pr. E Toline, Audio, Etc, 525 W Stratford Pl #280, Chicago IL 60657. 312-975-6598

**RCA** ribbon velocity mics (several), $800-$1400. W Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

**Shure** Green Bullet harmonica mic. T Coffman, Rolltop Music Std, POB 17203, San Diego CA 92177. 619-571-5031.

**Shure SM5B**, $350. J Hill, Earmark Audio, 206-463-1980.

**EV PL20** (RE20) mics, gd cond, $325; RCA 77DX mics, re-cond w/new ribbons; Neumann KM84 pair. W Gunn, 619-320-0728.

### Want To Buy

**Shure SM-5, SM-5B**. J Garrett, KALC, 1200 17th St, 2300, Denver CO 80202. 303-572-7000.

**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.

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**Capitol & MacGregor** bdct music transcripts. J Hastt, 206-282-0720.

**Jazz record collections,** 10" LP/12" LP be-bop, swing, dixie, highest prices paid. B Rose, Program Recdgs, 228 East 10th, NYNY 10003. 212-674-3060.

## MONITORS

### Want To Sell

**Belar BW-85A**, gd cond, $300. J Arzuaga, WREI, Clemort FL. 809-895-2725.

**Belar FMM-1** mod monitor & FMS-1 stereo monitor; McMartin TBM-4500 stereo monitor. Phil, KMXZ, Hollister CA, 510-895-6350.

**Belar AMM-1** mod monitor. D Kannes, KTAR, 602-234-6347 or FAX 602-266-3858.

## RECEIVERS & TRANSCEIVERS

### Want To Sell

**Bogen TP 160A** solid state AM/FM tuner, $10 +shpg. E Lightman, WEDL, 550 Merchant St, Ambridge PA 15003. 412-266-2802.


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**Collins 6515-1A** receiver, 250 kHz-30 MHz, intermittant operation, $400. D Kerl, 2320 Holiday Dr, Janesville WI 53545. 608-757-9259.

**ICOM IC-W2A** VHF/UHF dual band handheld transceiver. R Lankton, WIKX, 4810 Deltona Dr, Punta Gorda FL 33950. 941-377-1488.

## RECORDERS

### Want To Sell

**Otari 50/50 BIII,** 2 track, like new, $3800; Panasonic 3900 DAT w/controller, like new, $2250. J James, 310-824-4846.

**Ampex AG 440B** w/new heads, $550; Scully 280 w/gd heads. $550; Akai X355, $150; Teac-Realistic X3, $300; ITC 750. $150; (2) ITC 770 record amps, $130 ea. (2) Inovonics 370 in gd cond, $250/pr. J Parsons, Parsons Sounds, 2781 Fayson Circle, Deltona FL 32738. 904-532-0192.

**Otari MX-5050BII** 2 trk; Tascam 22-4 4 trk; Nakamichi MR-2 cassette deck. Phil, KMXZ, Hollister CA, 510-895-6350.

**Otari MX5050B** stereo, R/P R-R, $300. C Springer, KLMR, POB 890, Lamar CO 81052. 710-336-2206.

**Revox PR-99** PB R-R (2) with 25 Hz, one in excellent condition for $350 the other missing head cover & volume button for $250, or both for $500. J Arzuaga, WREI, Clemort FL. 809-895-2725.

**Teac X-2000R**, dbx I NR, 1/4 trk stereo, 10.5" reel capacity, dual capstan closed loop, autoreverse, BO. M Sophos, WDFH, 21 Brookside Ln, Dobbs Ferry NY 10522. 914-693-3963.

**Technic RS 1500** 2 trk tape deck, excel cond. J Gelo, 941-642-6899.

**MCI PCA2700-0917** PB amps for JH-110 (2); Ampex ATR-700; Ampex AG4400; Ampex R/P amps for AG440 (4). D Kannes, KTAR, 602-234-6347 or FAX 602-266-3858.


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**Nagra 4.2L** sync recorder, vgc, $2000; Nagra 4SL stereo sync recorder, vgc, $3500. Don, Scales Film Sound, 3142 Market Pl, Bloomington IN 47403. 812-339-4446.

**Otari MX5050QXHD** 4 trk, $1150/BO; Otari MX5050B-2HD 2 trk, $800/BO. J Hill, Earmark Audio, 206-463-1980.


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**Ampex ATR100 taperecorders** for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

**Nagra 4-S** stereo sync machine, $4500. W Gunn, 619-320-0728.

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**Ampex 440** (2) w/remote controls & Ampex stereo mixer, 2 trk 1/4", $900. W Davies, Virgo Prod. 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

**Marantz CDR610** or CDR600 CD recorder. A Chouffi, Nightshift, 1 Gray Fox Ln, Albany NY 12203. 518-452-0564.

## REMOTE & MICROWAVE EQUIPMENT

### Want To Sell

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**Teletronix LA-2A's**, UREI LA-3A's & LA-4's, Fairchild 660's & 670's, any Pultec EQ's & any other old tube compressor/limiters, call after 3PM CST, 214-271-7625.

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**RCA 77 DX** satin, very nice; Shure Green Bullet original. T Coffman, 619-571-5031.

**ESE ES-203** count-down timers (2); ESE ES510LR timers (2); ESE ES301-ST timers (2); ESE ES301-BRS timer. D Kannes, KTAR, 602-234-6347 or FAX 602-266-3858.

**Mitel SX20** superswitch telephone system, complete w/handset, console, upgraded switch system. Handled 6 lines & 20 extensions w/operating instructions, working when removed, uses regular single line phones, $685. F Lauerman, WLST, POB 609, Marinette WI 54143. 715-735-6631.


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**Marti STL-8** system; TFT 7700 STL transmitter; Moseley MRC-1600 RC system; Moseley TRL-1 system. Phil, KMXZ, Hollister CA, 510-895-6350.

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**SCPC 15 KHz** receivers, some on transponder 3 & 21, tunable demods, some tuneable down converters, offsat 5 meter UPI downlink disks, negotiable. D Holler, Business News Network, 5625 Centennial Blvd, Colorado Springs CO 80919. 719-528-7040.

**Wegener 1806-24** receiver with decoder. D Kannes, KTAR, 602-234-6347 or FAX 602-266-3858.


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**BE C-QUAM** stereo gen & mod monitor, $5900. G Robinson, Techworks, 339 Muirfield Pkwy, Charleston SC 29414. 803-769-0349.

## STUDIOS

**Studio package blowout:** Crown MT1200/Crown MT600, Yamaha 1602 console, (2) Peavey SP-4 speakers, Shure wireless mic (2) crossovers, racks. Mike, Remote Snd Engrg, POB 616, Ooltewah TN 37363. 423-899-8593.

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| 10-19 col inch (per inch) | 59 | 56 | 52 | 47 |
| Distributor Directory | 100 | 95 | 90 | 85 |
| Professional Card | 70 | 64 | 59 | 53 |
| Classified Line Ad | | $1.95 per word | | |
| Blind Box Ad | | $15 additional | | |

To compute ad costs: Multiply the number of ad inches (columns x inches) by the desired rate schedule for your per unit cost. Example: a 3" ad at the 1x rate is $195, at the 3x rate $186, at the 6x rate $174, at the 12x rate $156, etc.

World Radio History

TUBES...WTB

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Hugo, MN 55038
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FAX (612) 429-0292
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## TURNTABLES

### Want To Sell

Harris PX-91 (2) stereo preamps; Russco FMSU stereo preamp; Technics SP10MKII; Technics SH-10E pwr unit. D Kannes, KTAR, 602-234-6347 or FAX 602-266-3858.

Russco 3 speed rim drive TT's (2), BO. T Butler, WCVR, Randolph VT, 05061. 802-728-4411.

NEEDLES, CARTRIDGES, BELTS... all major brands including old/obsolete models, one of the largest stocks in the country. Expert consultation. NEEDLES EXPRESS (800) 358-2030.

### Want To Buy

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**BOOST YOUR SALES**
**Advertise in the Classified Section ~ You'll be impressed with the results!**

# ACTION-GRAM

## EQUIPMENT LISTINGS

**Radio World's** Broadcast Equipment Exchange provides a FREE listing service for radio stations and recording studios only. All other end users will be charged. Simply send your listings to us, following the example below. Please indicate in which category you would like your listing to appear. Mail your listings to the address below. Thank you.

Please print and include all information:

Contact Name _____

Title _____

Company/Station _____

Address _____

City/State _____

Zip Code _____ — _____

Telephone _____

Brokers, dealers, manufacturers and other organizations who are not legitimate end users can participate in the Broadcast Equipment Exchange on a **paid** basis. Line ad listings & display advertising are available on a per word or per inch basis.

I would like to receive or continue receiving **Radio World** FREE each month.

❑ Yes ❑ No

Signature _____ Date _____

Please Circle only one enty for each category:

**I. Type of Firm**

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 engieer
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) _____

WTS ❑ WTB ❑ Category: _____

Make: _____ Model: _____

Brief Description: _____

_____

_____

Price: _____

*Closing for listings is every other Friday. Please be aware that it does take approximately 1 month for your listings to appear. They will then appear for only 2 issues. If more time is needed, please re-submit your listings.

**Broadcast Equipment Exchange**

PO Box 1214, Falls Church, VA USA 22041 • Tel 703-998-7600 • Fax 703-998-2966

## SUBSCRIPTION/READER SERVICE FORM

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:

Name _____ Title _____

Company/Station _____

Address _____

City _____ State ____ ZIP _____

Business Telephone ( ) _____

Please check only one entry for each category:

**I. Type of Firm**

☐ 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
☐ E. News operations
☐ F. Other (specify) _____

### Reader Service

December 27, 1995 Use until April 27, 1996

Please first fill out contact information at left. Then check each advertisement for corresponding number and circle below.

**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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*Your ad appearing in Radio World's* **BROADCAST EQUIPMENT EXCHANGE** *will reach 18,000+ broadcast equipment buying prospects.*
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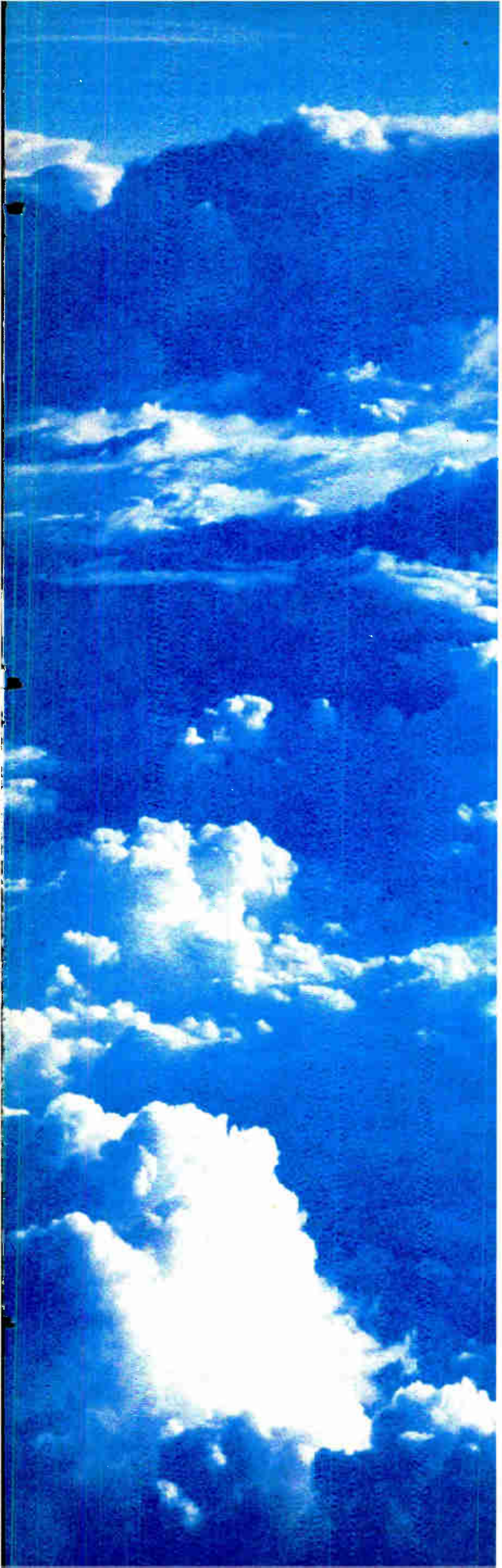

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Wheatstone Corporation

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