Radio World®

Disk Editing:
A Cut Above
Razors, in
Studio Sessions,
pp. 13-18

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FCC Takes Action To Standardize C-QUAM

WASHINGTON Required by Congress to select a standard for AM stereo, the FCC in December issued a notice of proposed rulemaking (NPRM) that would adopt Motorola's C-QUAM as the single such transmission system in the U.S.

Despite their action, however, several of the Commissioners treated the item—the tenth of a ten-piece agenda that otherwise dealt mainly with the Cable Bill—in a somewhat dismissive manner.

Under the terms of the NPRM, the Commission would incorporate the Motorola standard into its rules. Stations using alternative systems, such as the Kahn ISB system, would be required to stop using them "as of one year from the effective date of the rules," according to a release issued by the FCC following its Dec. 10 meeting. "Any stations converting to AM stereo after the effective date of the rules will be required to employ the system adopted by the Commission."

Addressing the issue of available receivers, the FCC has made the adoption of C-QUAM contingent on Motorola's licensing of its patents to other companies, "under fair and reasonable terms." No mention was made of the NAB's AMAX certification for improved fidelity radios.

Following the adoption of the NPRM, several Commissioners commented on the proceeding.

Commissioner James Quello said, "Nine or 10 years ago, I voted for a standard. When there wasn't one, I had to answer to a lot of broadcasters.

"With prodding from Congress, we did (today) what we had to do 10 years ago," he said.

Commissioner Ervin Duggan questioned Thomas Stanley of the FCC's Office of Engineering and Technology (OET), whose department presented the NPRM, on the need for an AM stereo standard. "Is this an empty gesture—one whose time has come, gone and come again, perhaps with a whimper?" Duggan asked.

Stanley replied that AM stereo provided an "off-the-shelf" solution for at least some of the problems plaguing AM. "Alternatives are still years away," he said.

Other Commissioners were less generous in their comments. Commissioner Andrew Barrett expressed the opinion that "broadcasters won't be rushing out" to implement AM stereo. He further questioned the need for a formal proceeding on an issue which he predicted "will probably be outdated in three or four years."

Outgoing Chairman Al Sikes, who has opposed naming a single AM stereo standard since his days with the National Telecommunications and Information Administration, was equally lukewarm in his reaction to the NPRM.

"I may be the only one in this room who has actually converted to AM stereo," he said of his days as an AM broadcaster. "It didn't help me much."

Sikes said that "what's been lacking (in the acceptance of AM stereo) is a critical mass" of broadcasters opting to convert to stereo. This lack, Sikes maintained, was a validation of the correctness of the

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Classical to Nostalgia:
Singer Tony Bennett and staff members of WQEW(AM), formerly WQXR, inaugurate the station's new format, which was broadcast by WNEW for 58 years. See p. 9 for details.

STUDIO SESSIONS

Audio Industries Converge

by Alex Zavistovich

WASHINGTON Audio technology has changed dramatically over the past few years. Digital signal processing, digital audio workstations and related equipment have changed forever the way audio professionals approach their daily routines.

Nowhere is this more clear, however, than in the increasing overlap of responsibilities between radio stations and recording studios. The goal for both is more creative audio products for an increasingly sophisticated audience. To that end, radio stations and studios have each begun drawing on the same kind of technology.

Multitracking the Zoo

Cleveland, Ohio's WMMS(FM) is an example of a radio station that has fully integrated professional audio recording techniques in its day-to-day operations. To produce its "Buzzard Morning Zoo," starring DJs Jeff and Flash, the station has set up a facility dubbed "The Zoodio."

The Zoodio is quite sophisticated by radio station standards: It comes equipped with a Tascam 16-track reel-to-reel recorder, Tascam M600 console with 32 submixers, a Mirage sampler, and a complement of effects and other audio processing, including a Yamaha Rev 5 reverb, dbx and Ashly compressors, and an Orban stereo nine-channel EQ.

Mike Bonasso—or "Coach Mike" as he's called at WMMS—is the producer of the Buzzard Morning Zoo. Bonasso says the Zoo is "by far the most produced morning show in Cleveland." He and Pat Artl, the show's technical producer, went with the Zoodio "because of the type of

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Studio Sessions

NEWSWATCH

Arbitron To Switch To "Personal People Meter"

NEW YORK Arbitron plans to develop a "pocket people meter" to measure radio and television audiences.

The passive device will be worn by audience members, but they will not have to log their programming choices or make any effort other than wearing the device.

According to Arbitron, the devices will detect a unique identifying code that broadcasters add to their radio or TV soundtrack. The code is not audible to the listener.

The BBM Bureau of Measurement, the Canadian audience measurement service, and Australia's AGB McNair also plan to use the technology.

Harris Forms Partnership With British Firm

ROCHESTER, N.Y. Harris Corporation's RF Communications Group (not to be confused with Harris-Allied's Broadcast Division) has formed an alliance with the British Electronics firm Serco Limited.

The joint venture will result in the marketing of radio communications systems and services to the United Kingdom and selected NATO markets.

According to Harris, the alliance utilizes Harris' HF, VHF and UHF design expertise and Serco's experience in radio communications systems. The joint operation will be located in Serco's Middlesex, England offices.

Larry King To Move To Afternoons Next Month

ARLINGTON, Va. After 15 years on the late night circuit, talk show Larry King will move his show to afternoon drive time.

On Feb. 1, The Mutual Broadcasting System's "Larry King Show" is scheduled to begin airing from 3 p.m. to 6 p.m. Monday-Friday.

Mutual's parent company, Westwood One, said it expects King's popular format to have a broader base during the daytime hours. The late night time slot will be taken over by host Jim Bohannon.

Sky Radio Gets FCC OK On Airline Receivers

WASHINGTON The FCC has conditionally approved USA Today's Sky Radio request for authorization to construct and operate 2,000 receive-only receive stations on domestic aircraft.

The authorization request will enable the Sky Radio system to beam audio services to passengers.

The antennas will receive transmissions in the 12 GHz downlink frequency from fixed satellites. To protect fixed satellites from interference, the Sky Radio uplink will fall within the guardbands.

The FCC also said that as a "non-conforming user of frequency band," Sky Radio must accept any interference by services with "superior status" and coor-

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FCC Chairman to Resign January 19

by John Gatski

WASHINGTON FCC Chairman Al Sikes has announced that he will resign as chairman of the five-member FCC the day before President-elect Bill Clinton is sworn into office.

Sikes, a Republican who was appointed FCC chairman by President Bush in 1989, said his resignation will become effective Jan. 19.

The Sikes tenure at the FCC included significant policies and regulations that affected radio, including an increase in ownership limits, a wide-reaching AM improvement program, inquiries into digital audio broadcasting (DAB) and a pending rulemaking that would change the technology used for the Emergency Broadcast System (EBS).

Some of the pending policies initiated by Sikes, however, will have to be completed by his successor, including DAB, EBS, and in television, the much-talked about high definition television (HDTV) standard, which has been in process since 1989.

For his successor, Sikes also is leaving behind a recent mandate from Congress, a law that requires the FCC to choose an AM stereo standard within a year after embarking on the process. A notice of proposed rulemaking on that issue was adopted Dec. 10, 1992.

Although the Sikes FCC moved toward the future on technology implementation, his philosophy at the FCC also was concurrent with the deregulatory spirit of the Reagan/Bush era.

Outgoing FCC Chairman Al Sikes

Because of the change in administrations, Sikes' resignation was not unexpected.

The March 1992 deregulation of radio station ownership rules, for example, angered key congressional members when the FCC approved a large hike in the maximum number of a stations that could be owned. Under pressure from Congress, the FCC reduced the original expanded ownership limit in August.

Because of the change in administrations, Sikes' resignation was not unexpected, although it was believed that he would stay on until after his successor was chosen.

NAB President/CEO Eddie Fritts issued a statement shortly after Sikes announced his resignation, stating that "although we may not have always seen eye to eye on every issue, he (Sikes) has always been willing to give us a fair hearing."

A potential FCC Commissioner list has not yet been made public by President-elect Clinton, but some insiders said Toni Cook, Senate Telecommunications Sub-committee staff counsel, is near the top for the chairmanship.

Clinton also will have to name at least one other commissioner to replace Sherrie Marshall, whose term has expired.

NEWSWATCH

▶ continued from previous page

dinate with adjacent satellite operators to eliminate the possibility of interference.

Canadian Company Buys ComStream Inc.

SAN DIEGO, Calif. ComStream, a satellite communications equipment manufacturer and a player in digital transmission, recently was acquired by Comtel Corporation, a subsidiary of Spar Aerospace Ltd.

Spar Industries, headquartered in Canada, employs 3,000 people in Canada, the U.S. and the U.K. It designs and manufactures systems for space, robotics, communications, remote sensing, electro-optics and aviation services.

"Spar is providing our company with great synergy and resources to take advantage of the large potential markets which are beginning to develop," ComStream President Ron Derry said.

ComStream will continue to operate from its San Diego base, Derry added.

DMX to Switch Satellites

PRINCETON, N.J. Digital Music Express (DMX), a CD-quality cable audio service, will move its uplink from SATCOM 4R to SATCOM C-3, transponder 24, early in 1993.

DMX joins other major cable services on the satellite including Showtime, Nickelodeon, MTV, Arts and Entertainment and C-Span.

Owned by International Cablecasting Technologies, the DMX service was lauched in Sept. 1991 and, according to the company, is accessible to more than 10 million cable subscribers nationwide. It offers 30 audio channels of varying formats.

DCR Adds Business Channels

HATBORO, Pa. Digital Cable Radio (DCR), the other major digital cable audio service, has added four channels dedicated to business clients.

According to DCR, "the new channels (Lite Classical, The Trend, Soft Album Mix, and EZ Blend) have been developed to meet the specific needs of the commercial music market. Although many of DCR's existing channels work well in commercial settings, the new formats have been designed for those customers that require a consistent music pace and programming that appeals to clientele in different day parts."

DCR is available to nearly five million subscribers on 90 cable systems nationwide.

New Year, New People, New Ideas

by Alex Zavistovich

WASHINGTON Happy New Year! Before I go any further, I have to apologize for a glaring omission from last issue's column. I neglected to introduce our readers to **RW**'s newest staff member, Mary Ann Dorsie.

Fresh from the University of Maryland with a degree in journalism, Mary Ann is our new Assistant Editor. She's in charge of assembling the Buyers Guide, a responsibility formerly held by Charles Taylor, who's moved on to become the Managing Editor of our international edition. We all welcome Mary Ann to the **RW** team, and my regrets for not having acknowledged her earlier.

★ ★ ★

This issue also marks the debut of "Studio Sessions," a new section that will find the common ground between radio and professional audio production. With the introduction of digital audio

workstations and digital signal processing devices, these two formerly disparate fields have seen increased overlap in recent years.

The cornerstones of this new section are columns by Bruce Bartlett and Ty Ford, whom we have spirited away from the regular feature section. In this issue, Bruce describes what you need to get started doing hard disk editing with Digital Audio Labs' CardD and EdDitor PC cards; Ty reviews the Studer Dyaxis Lite workstation, and sets up an applications scenario.

Then there's Al Peterson's review of the Roland Sound Canvas, a sound synthesis module that may inspire you to greater heights of creativity in your productions. Finally, there's some interesting reading (if I do say so myself) in my overview for the issue, which seems to confirm that—at least from a technological perspective—radio and pro audio professionals are beginning to draw upon the same resources to do their jobs.

Instead of some new transmission scheme that will be used only for ratings analysis, maybe the Arbitron people can use the RBDS encoder.

One last note, though. Although the debut installment of this section is appearing in this Jan. 6 edition of **RW**, it will ordinarily run in the second issue of each month. The first issue of the month is reserved for "Running Radio." There may be a few exceptions to this rule, so just to be on the safe side, be sure to read every word of every issue. That should cover you.

★ ★ ★

I know someone's going to take this next idea and turn it into a million-dollar business, so remember you heard it here first. (I, in turn, will remember who gave it to me.)

About a month ago, Arbitron suggested a passive "people meter" to improve the accuracy of its ratings service, possibly even doing away with the classic diary approach.

Under this system, an inaudible code is "embedded" in radio and television programming. Survey participants will carry around a meter that will detect the code; the information will be sent directly to Arbitron's computers, either by modem interface or by mailing the device back.

Now here's the million-dollar idea: Why not use the radio broadcast data system (RBDS) to carry this information? Of course, instead of a personal meter, you might need some black box connected to your tuner that would register the station you're tuned to and would keep track of listening hours.

What I like about that idea is that RBDS is going to be a huge growth segment for the broadcast and consumer markets. If you don't believe me, check out the RBDS display at the Winter Consumer Electronics Show in Vegas starting tomorrow. There's potential revenue to be earned from this technology. Instead of some new transmission scheme that will be used only for ratings analysis, maybe the Arbitron people can use the RBDS encoder.

True, the RBDS system is presently working only on FM subcarriers. But a company called Real-Time Designs is experimenting with an AM-compatible scheme (see the story in this issue). Also, Arbitron claims its system will work whether you're listening at home or in your car, or even watching TV in an airport. OK, so there are some bugs to be worked out, but every great idea has some bugs in it at first. Just a thought, anyway.

★ ★ ★

First the Weatherhead Upstart Award, now this. I've just learned that the small circle of Cleveland broadcast equipment manufacturers has gotten a little smaller. On Dec. 16, Telos Systems President Steve Church entered into an agreement to acquire Cutting Edge Technologies!

Before too long, the Cutting Edge operation will take up new residence at Telos' offices on Superior Ave. Cutting Edge's Joe Foti is leaving the business (amicably) to try his hand at developing another company unrelated to broadcasting, and Director of Marketing Margot Daly will continue on an interim basis.

Good feelings all around, it seems. Congratulations to both groups, and farewell to Joe Foti: We're going to miss your off-the-wall sense of humor during the conventions.

There are apparently no plans for any projects that might combine the two specialties of Telos and Cutting Edge, but you never know. Hmm...how about a telephone remote control for your audio processor, so you can use DTMF tones to tweak the sound of your station while sitting in your own living room? Just another thought.

Ah well...If you're like me, your New Year's Resolutions have had a tough time making it through the first week of the new year. But how can I be expected to lose weight if the production department keeps bringing in cookies? It's a conspiracy.

That's it for now. Tune in next time.

Alex

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.

Anything goes?

Dear **RW**,

I have a problem with your Dec. 9, 1992 editorial. (*Editor's note: See* Pilot Tone, *page 4 of that issue.*) You sound like an East Coast type (under 35) with no kids, no values, no limits, no traditions, anything goes, screw the world.

Am I close? I am not a religious type, but I know the values instilled by the founders of this country. Would you give your kids pornography, condoms, limits?

I'm sick of the way this country is going, no values, Howard Stern, porno-art, no responsibility for actions. The liberal media and their First Amendment will be the first to go. If this is deregulation, it hasn't worked. Please re-think your "anything goes" attitude.

Joseph Gaines
Youngstown, Ohio

Editor replies: Mr. Gaines, the point of my column in the Dec. 9 issue was not to advance a political agenda, liberal or otherwise. If you read that piece again, I hope you'll see that I simply explained that the FCC cannot determine community standards from a relatively small number of complaints, no matter how fervent. (By the way, many others who have made this point before me are over 35, with kids, values and limits.)

I also suggested that Evergreen and Infinity, group owners who have been fined for indecency by the FCC, would be interested in whether any punitive action would be taken against NBC for the network's airing of a controversial "Seinfeld" episode. If not, they would be right in arguing that the FCC was engaging in a double standard against radio broadcasters.

As for your opinion that deregulation hasn't worked, I tend to agree. I must point out, however, that deregulation is not a liberal (Democratic) philosophy, but a conservative (Republican) concept. The "liberal media and their First Amendment," without which a letter like yours might never have been printed, had nothing to do with deregulation or the cultural changes that have occurred in this country. Heaven help us all, liberal and conservative, if our Constitutional right to free speech is ever eliminated.

There's not much you or I can do as individuals to alter the direction of popular culture in this country, Mr. Gaines. But we will do future generations a greater service by educating our young people in ethics and tolerance than by restricting or eradicating our civil rights and liberties.

Shock jocks come and go. Consitutional rights, once taken from us, may never be returned.

An unsung point of light

Dear **RW**,

Let me join President Bush in congratulating WRBH(FM) in New Orleans on completing a decade of over-the-air service to the visually impaired. Their high-power, full-day service is impressive and of great benefit to their audience. But "the nation's first FM reading service" they aren't.

Just before their tenth anniversary, WRKC(FM) celebrated the 18th birthday of its "Radio Home Visitor," also a totally accessible over-the-air radio reading service. I don't know if we are the other station referred to in Dee McVicker's article, but we are not very well known outside this area. We started our program here at King's College in Wilkes-Barre, Pa. back in 1974 when no one was doing a main-channel daily program like this (there were SCA operations before us), and are still here every day of the year.

This is not sour grapes; I wish we at WRKC could do as extensive a radio reading service as WRBH. But we'd like everybody to know that up here in Northeastern Pennsylvania is a little operation that's been chugging along in this area of elderly and homebound, doing its part to enrich the lives of many. And currently in its 19th year of service.

Congratulations to Point of Light #257; you represent us all.

Tom Carten
"The Radio Home Visitor"
King's College
Wilkes-Barre, Pa.

An AM advocate

Dear **RW**,

I agree with Mr. Robert Coddington, and everyone else who desires better AM receivers to be available on any quality consumer unit (RW Readers Forum, Dec. 9, 1992). After all, the plain old consumer hears good audio on FM and cassettes but hears really bad AM sound on the same radio! How can we expect the unwary to know that it's not the fault of the transmission medium if he/she hears FM and cassettes just fine through the same two speakers! For the masses, AMAX may as well be FBQT or PLOP or any other snappy but meaningless acronym.

I get several calls every month at WRMR asking if it's really true that we're "Broadcasting in AM Stereo." You can bet your Motorola we are. They wonder why their FM section and CD sections play in stereo, but their AM section does not. I try to explain. They ask about AM stereo receiver costs. They get discouraged, then they go away, unsatisfied. How can we expect them to know any better?

We broadcasters know most of us are transmitting high quality AM (and some of us, stereo) signals. We sound just fine, almost FM-like on our wide-band monitors. There just aren't any out there for the great majority of listeners.

We gave up the stuff above 10,000 Hz. We agreed to an NRSC pre-emphasis standard. The public doesn't hear any of this. The receivers the manufacturers have been cranking out didn't change. I have a real problem in that NRSC for transmission is the law, and NRSC for reception is a "voluntary standard." It seems that if "voluntary" adds 75 cents to the cost of a tuner, then we "voluntarily" have no NRSC options being made.

Remember the 1960s? I recall seeing an FCC decision handed down that at the time stated that since AM is not a high-fidelity medium, then AM stereo wasn't going to be allowed. Ask some of the early AM stereo pioneers! We've been legislated out of high-fidelity AM! Now our FCC of the 1990s adds "points" in some AM applications if the applicant chooses to broadcast in stereo.

Remember the "all channel receiver law"? It was a law that VHF and UHF televisions had to be designed for equal simplicity in tuning either band. Didn't we also have an AM-FM all channel law? Don't we have noise figure minimum standards for television tuners? We need to apply political power to our congress to get higher standards mandated for our AM receivers. We just saw the "DAT bill" go through, passing on a royalty tax to the winners of that lobbying battle.

Even now, broadcasters will have a very small input into the yet to be chosen digital broadcasting standard, and we will be transmitting those signals! There are just too many carts pulling on the broadcasting horse. We seem to have lost control of our own destiny, and it seems to me that it's because we haven't cultivated enough of our political powers-that-be to counter the special interest and money-hungry influences that have stolen our thunder.

We can nit-pick about those owners or operators that flaunt the rules and run stations into the ground. We can bellyache about the huge owners that drive facility prices out of the reach of average guys. We can steam up our windows about the public not having any idea of what AMAX is. But until we can marshall enough political clout to legislate what we need to save our AM industry—and soon enough any other over-the-air aspect of broadcasting—we'll continue to lose to foreign DAB interests, cable and satellite delivery companies, and anyone else hungry enough to gobble another one of us up.

We need to pool our resources and put aside petty differences, to begin working with those that really have the power to help us change things to our better favor: our Washington congresspeople. We need to exert our influence on our own elected and appointed officials, no matter how unsavory that may sound, so that we can strike a compromise, whether it's on receiver specs, DAB standards, royalties, or whatever, so that broadcasters, businesspeople, politicians, and the public can all be part of a win-win situation. Anyone else out there have any other ideas?

Ted Alexander, CE & Air Personality
WRMR(AM)-WDOK(FM)
Cleveland, Ohio

Switching to AM Stereo

Now that the FCC has opened a proceeding to make Motorola's C-QUAM the U.S. AM stereo standard, stations ought to take the step and convert to stereo broadcasting.

The reasons for conversion are numerous. As indicated by Thomas Stanley, head of the FCC's Office of Engineering and Technology, AM stereo is an off-the-shelf solution to at least some of the problems plaguing the band. Most importantly, it will break the chicken-or-the-egg standoff that has immobilized the technology's development.

A groundswell of support for AM stereo from broadcasters will send a clear signal to manufacturers that there is a reason to build high-quality AM receivers. It may even spark increased interest in AMAX certification for the products. That in turn may focus consumer attention back to the neglected band, and give AM broadcasters in some markets a much needed "shot in the arm."

Furthermore, it can be argued that contrary to exiting Commission Chairman Al Sikes, the lack of a "critical mass" of broadcasters converting to AM stereo over the past 10 years is not an indication of marketplace indifference. Rather, it supports the importance of a federally-mandated standard in the industry's implementation of new transmission technology when faced with a raft of competitors.

In fact, there just are no valid reasons *not* to convert to AM stereo. Commissioner Andrew Barrett's argument that the technology might be obsolete in a few years — a veiled reference to the promise of in-band AM digital audio broadcasting — is speculative at best. While great strides are being made in in-band AM DAB, its implementation is likely not to occur before the end of the decade at the earliest.

When AM in-band DAB is implemented, the initial conversion costs may be out of the price range of many smaller operations. In the meantime, interest in the band may continue to wane. Some marginal stations may even fail waiting for the magic pill of DAB when relief could be just an arm's length away.

For AM broadcasters, conversion to stereo is not all that's needed to revitalize the band. But pinning all one's hopes on a future technology, as some in the Commission suggest, is not the answer either. A first step must be made. That step is conversion to stereo.

—**RW**

Correction

In the Dec. 23, 1992 **RW**, the Page 1 article "RBDS To Get Big Push at CES," incorrectly listed the dates for the Winter Consumer Electronics Show in Las Vegas as June 7-10. The correct dates are January 7-10.

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Real-Time Designs Tackles AM RBDS

by Dee McVicker

LOS ANGELES LA-based Real-Time Designs' response to an industry request for information on its potential AM data stream technology could cast AM as a direct player in the new radio broadcast data system (RBDS).

RBDS is a broadcaster-dependent FM technology, based on Europe's RDS, that allows a variety of functions including automatic station selection by format, based on the digital format code assigned to each station using RBDS.

Until now, however, there was no AM RBDS equivalent. A full report of Real-Time Designs' proposed system, which suggests modulating two tones within the AM RF mask to create a digital data stream, currently is being compiled and is expected to be reviewed in mid-1993 by the National Radio Systems Committee (NRSC) RBDS subcommittee.

The two-tone method will require a means at the receiver to extract the AM data stream and package it in an appropriate format...

Previously, AM was involved in RBDS in a less direct way. The RBDS subcommittee had recommended to the NRSC (and it has been tentatively approved) that the FM RBDS standard contain a provision to accommodate AM: ID Logic B. ID Logic was seen as a compromise for AM to participate in the RBDS standard.

ID Logic B is a receiver database technology licensed by PRS Corporation that allows stations to be selected by format through an internally programmed computer chip that must be updated periodically. During the standard deliberations, it was suggested that one FM station in each market could update the ID Logic receiver computers via its RBDS data stream.

ID Logic B critics argue, however, that because all RBDS data for a market's AM and FM stations is stored in the receiver and refreshed by one station in each market, ID Logic B takes the control away from individual stations.

ID Logic is not enough

"ID Logic can at least be used by AM, however, it isn't dynamic," said independent engineer Richard Burden of Burden Associates in Los Angeles, who is the catalyst for the Real-Time Designs proposal and will be conducting field tests of the new system to see whether an AM data stream can be created containing the same RBDS functions available to FM.

The two-tone method will require a means at the receiver to extract the AM data stream and package it in an appropriate format for interface to the receiver's RBDS decoder.

Existing chip technology developed by Real-Time Designs for other applications is the foundation for the proposed AM datacasting. Real-Time Designs Director of Engineering Robert Copriviza is confident that it will work.

"Designing the devices that can filter for a tone at 35 dB down is not unknown in military radio, and a number of people in our firm come from that background," he said, noting that working models of these devices already exist at Real-Time Designs.

Further development of these devices is currently underway to include even more functions. Copriviza believes that the controller device required for extracting the AM data stream can also shoulder most—if not all—the functions of AM reception, thereby not increasing the number of components required by receiver manufacturers.

No added cost, hopefully

The goal, he stated, is to add AM RBDS at no cost to the receiver manufacturer. "We should have a solution that costs radio manufacturers zero, and, hopefully, even reduce his cost by adding things like noise reduction for the same money," Copriviza said. "That has been an operating premise since day one."

Another operating premise, also in keeping with the goal to add AM RBDS at no cost to radio manufacturers, is to "not make any changes to that (RBDS decoder) chip," he added.

To do this, the RBDS decoder will need to accept a hand-off from the AM controller, which is at roughly half the baud rate. Because of the spectral restraints already placed on AM, the system uses a data rate of only 600 bits per second (bps)—a little over half that used for FM—which will result in RBDS running slower on the AM band than on the FM band.

A full FM RBDS 1187.5 bps data rate is possible by applying a second set of tones, Copriviza said, but would likely be at the expense of reduced audio bandwidth to broadcasters.

Unlike FM, which has subcarrier spectrum for RBDS, the challenge with placing RBDS on AM is finding the spectrum. "(FM's) great and glorious bandwidth is not something that was available when AM was invented," he said.

Limited spectrum

Applying two or four more tones to gain data rate speed for AM RBDS would further encroach on the already limited audio spectrum allotted AM. One alternative to this might be a spread spectrum-type system, where tones are dispersed throughout the audio bandwidth, but Copriviza has ruled this out for the time being pending DAB in-band tests currently being done.

The lack of available subcarrier spectrum on AM also poses another challenge for the system: what to do with dead air. "I cannot be broadcasting data when there's no program material, or dead air. So in a way I have to devise a variable data rate and I have to buffer that data up, and in the meantime while I'm buffering it up, I have to give this chip a "no-op"—a non-operative code," he explained.

Copriviza is not certain yet how, or if, the RBDS decoder will accept the no-op code. As of this writing, he has been unable to obtain an RBDS decoder in order to complete development.

The good news, however, is that Copriviza and Burden are confident the system will not infringe on AM stereo, either the more popular Motorola C-QUAM system or the Kahn ISB system.

"I think we have to live with the fact that we have a lot more interference on AM than we do on FM, and there is no guardband like there is in FM, Copriviza said. "Those things are all going to come into play. To what degree, we don't know. That's the next step."

Testing tones

The criteria for tests to be conducted before early 1993 will entail sending tones, with and without program material, paired at 9.2 kHz and 9.8 kHz, 9.7 kHz and 10.3 kHz, and 10.2 kHz and 10.8 kHz.

"These frequencies are the result of long conferencing with members of the (NRSC) committee," Copriviza said.

Burden plans to run the tones at various levels, 25 to 35 dB below 100 percent modulation as referenced to 400 Hz, to check for frequency response through the transmission system.

"The plan is to take 100 percent modulation at 400 Hz, and then come down 30 dB or 25 dB and run these tones to make sure the response on the transmitting equipment is flat, or how much we have to compensate (to make it flat), so that we know we're going to fit inside the RF mask," Burden said, who has a new AMAX receiver and Belar monitor on loan for the tests.

The overriding question this test hopes to answer is if the tones will be inaudible on the majority of AM receivers. If successful, the next step will entail decoding the data stream through a made-for-AM RBDS controller, and handing off this signal to the RBDS decoder. "That test will probably happen in March, and that will dovetail some other testing we're going to be doing," Copriviza said.

So far, testing has been limited to whatever Burden and Real-Time Designs can fund. But Burden and Copriviza are hopeful that AM broadcasters will want to become involved and that, after reviewing a full report of the above preliminary field tests, the NRSC RBDS subcommittee will be able to take on more of the research and development burden, giving this new technology a fighting chance to bring RBDS to the AM band.

Broadcasters can reach Richard Burden at 818-340-4590.

FCC Acts on Standardizing Stereo for AM

▶ continued from page 1

marketplace approach to the technology employed by the Commission under then-Chairman Mark Fowler.

"It's OK we're doing this, but in a practical sense, the marketplace has spoken," Sikes said.

For its part, the NAB applauded the NPRM. In a prepared statement, NAB General Counsel Jeff Baumann said, "It's unfortunate the FCC didn't take this step a decade ago, but we hope the adoption of an AM stereo standard will make a significant contribution to recent radio industry efforts to improve the performance and fortune of AM radio."

The FCC was required by law to take its AM stereo action. Originally proposed as a bill by former South Dakota Senator Larry Pressler, the measure was passed into law by being tied to an appropriations bill.

Comments on the FCC's AM stereo NPRM are due April 5. Replies are due April 20.

Data Compression Is Here to Stay

by Nancy Reist

SAN FRANCISCO "Data compression is here to stay," according to Roger Nichols, an independent audio engineer whose recording credits include Steely Dan.

Nichols was one of several digital experts who hosted a workshop, "Data Compression Techniques and Pitfalls," at the recent 93rd convention of the Audio Engineering Society.

Nichols said there is a growing demand for systems that can transmit digital files, like audio, that are too large to handle efficiently when they are uncompressed. "The only way to be able to mass distribute digital audio is through these compression schemes," he said.

State of the art

The workshop panelists described the current state of the art of data compression and played samples of some compressed digital sound.

Unfortunately, the room acoustics were too poor to permit a reasonable comparison of the quality of the different samples.

The panelists themselves clearly were advocates of digital compression systems. They were enthusiastic when they discussed the potential of these systems, but descriptions of the "pitfalls" were few and far between.

Nevertheless, the panelists provided an interesting overview of the field of digital audio compression and some of the current approaches.

Many digital compression systems use the principle that an uncompressed digital audio code contains a lot of redundant or unnecessary information. This makes digital audio files large and unwieldy, compression advocates say.

Computer specialists are developing coding schemes which are intended to eliminate the unnecessary data, while maintaining the signal's fidelity. These compressed codes can be used in applications where space conservation is an important issue, such as DAB, HDTV, digital cassettes and disk-based storage.

Of course, the determination of precisely what information to delete is both critical and controversial.

Marina Bosi and Roger Nichols from Dolby Laboratories presented both Dolby's AC2 coding scheme and the AC3 scheme, which Bosi described as "the digital audio format of the future." Bosi said AC2 uses temporal and frequency masking, while AC3 adds spatial masking.

Dolby on the forefront

Bosi said that the Dolby compression schemes use psychoacoustic theory. "For example, we know that at low frequencies—as well as high frequencies above 16 kHz—the ear is not so sensitive, while in the middle in between 2 and 5 kHz, the ear is very, very sensitive. By using this information we can reduce the bit rates further, eliminating the redundancies in the signal."

Nichols explained that AC3 will provide five-channel digital surround sound, though it should be compatible with systems with fewer channels. "As we move into multichannel delivery, we have to take into account that not everyone will have five-channel playback, certainly not in every room in their house. They might have a stereo system in other rooms. They might have mono in the kitchen. As those channels are combined together, this has to be done in a way that maintains the artistic content. That will be part of the system configuration that we propose for AC3."

Evaluate compression schemes

John Stautner from Aware Inc. described his company's development of a "scalable" compression system. Stautner said that on Aware's system, users will be able to choose from a range of compression parameters, depending on their specific needs and the complexity of the decoding system available.

Paul West presented the benefits of the consumer-based Digital Compact Cassette (DCC), which uses a data compression scheme.

West provided a list of questions which he felt potential users should consider in implementing data compression:

- Can the system handle existing 16-bit masters and interface with current technology so there is no need for another interface?
- What are the sonic artifacts and tradeoffs? He asserted that all engineering has tradeoffs and it is important that new formats are closely scrutinized by the industry so that these tradeoffs are clearly understood.
- How accurate and robust is the error detection and correction mechanism? West pointed out that field conditions often differ considerably and are less ideal than lab conditions.

continued on next page ▶

Expanded Band Delayed

by John Gatski

WASHINGTON Problems that have delayed the opening of the expanded AM band (1605-1705 kHz) for several months are expected to be resolved "shortly," according to the FCC.

William Hassinger, the FCC Mass Media Bureau's assistant chief of engineering, declined to elaborate on the nature of the delay, but said once the problems are worked out, the FCC will begin processing applications for the new frequencies.

Hassinger said he had hoped the problems would have been resolved before the end of the year.

The expanded band allocation was part of the FCC's AM improvements program (Docket 87-267), approved in early 1992. Receiver manufacturers have been adding the frequencies to tuners and radios for two years.

Although the FCC declined to comment on what caused the delay, it is reportedly a disagreement with the National Telecommunications and Information Administration (NTIA) over Travelers Information Services (TIS).

Travelers Information Services are low power AM transmitters used to relay information to motorists, such as traffic, weather, and airport directions. Disney World, for example, uses TIS to relay information about the theme park as motorists approach it. Most TIS facilities are located on 530 kHz.

The FCC wants to allow the TIS providers to operate anywhere in the existing and expanded band on a secondary, non-interfering basis. The NTIA and other groups, including NAB, said the service should be given set frequencies-530 kHz on the existing band and 1710 kHz on the expanded band.

Another issue had to be resolved before the expanded band could be open to applications: a treaty with Mexico over frequency coordination of expanded band frequencies in the borders areas. It has been settled, according to the FCC.

▶ continued from previous page

Testing should reflect those differences.

• Is the system fully software based? If it is and upgrades can be made with software rather than new hardware, they are likely to be cheaper.

• Does the system enhance existing technology?

• Is the system encoder or decoder "intelligent?" West said the sophistication should be on the encoder side, so that it is possible to upgrade the encoder to improve the quality, and the home consumer would not have to upgrade to more sophisticated decoders (i.e., receivers or players) to get the benefits.

• Will the system be able to accommodate the upcoming developments of 18-bit or 20-bit technology?

• Does the system have applications in other sectors? West explained, "To my way of thinking, if there are other applications for the same general scheme, that tells me that there's a lot of money and companies funding these things. That means more research into actually further improving that same platform. I'm more confident if I see that the same type of scheme can be used in other parts of the industry."

• Does the system have development support and adequate diagnostic tools?

DCC stands up

West said the DCC stands up well to this kind of scrutiny. He explained that it has improved tremendously over its development and has an open architecture that is flexible enough to accommodate future improvements.

The variety of techniques presented in the panel demonstrated that it may be quite awhile before a stable, dominant format emerges. Nevertheless, Nichols urged the audience to "jump on the digital compression bandwagon," because he said consumers are needed to drive the technology forward. Nichols also responded to critics of the quality of the compression systems. He claimed that there is a bias that predisposes many listeners against digital compression.

Fire Destroys AM/FM

by John Gatski

WHITESBURG, Ky. A next-door gasoline tanker explosion and fire destroyed WTCW(AM)/WXKQ-FM's office and studios on Dec. 3, but luckily no one was injured.

The station building, owned by Key Broadcasting, was totally destroyed; a $45,000 Harris AM transmitter was reduced to a 3-inch high cinder. The late night DJ was able to escape following the initial explosion and before the flaming fuel engulfed the building.

According to Contract Engineers Bob Hale and local contract engineer Don Mussell, who used to be the chief engineer at the station, a tanker truck was filling its tanks at the fuel distributor next door when gasoline spilled onto the ground.

A fire somehow ignited, which prompted the truck driver to jump from his truck and run as the tanks exploded. The blast blew out the power transformers on the electric lines (which affected some other local stations, Mussell said), knocked WTCW/WXKQ's equipment racks down, and shattered the building's windows.

Angel, the DJ, was shocked by the explosion, according to Hale, but only had glass in her hair as she made her way out of the studios.

The flaming fuel spill, however, made its way into the station's kitchen; within minutes, it was an inferno, Hale said.

Besides the building, the destroyed equipment included all the studio gear and the AM transmitter. The AM antenna, located about 600 feet from the building, was not damaged. A total damage estimate was not available at press time.

Mussell said the microwave tower he had installed a few years ago was the only thing at the building that survived the fire.

The FM antenna is located a few miles away, which enabled the station to get back on the air by Dec. 6 from a temporary studio at nearby Pine Mount Junction.

Hale said the station borrowed an office trailer and set up a temporary studio, using borrowed gear (and news programming) from other area stations. "All the stations in the area have been real helpful," he said.

Hale also praised Moseley for shipping a replacement STL transmitter for the FM in only a few days.

At press time, Key Broadcasting had not decided when to put the AM back on the air. Ironically, Hale said, the station was slated to move into new headquarters in early 1993. The new building is being equipped by Broadcasters General Store.

WQEW Changes Format

by Frank Beacham

NEW YORK It was a signature sound of New York City—the place where, in 1936, the city's first disc jockey, Martin Block, created "The Make Believe Ballroom." Now it is history.

After 58 years of broadcasting, WNEW(AM) on 1130 kHz in New York, is no more. The historic station was synonymous with American musical legends like Frank Sinatra, Tony Bennett, Count Basie and Ella Fitzgerald. The format that made it great is affectionately called the "American Popular Songbook."

WNEW ceased to exist after its frequency was sold to former investment banker Michael Bloomberg, who renamed it WBBR (for Bloomberg Business Radio).

However, with every ending comes the promise of a new beginning, and so it is with radio. Passing the torch with all the glamour and fanfare of a gala New York opening night, the New York Times Co. christened WQEW(AM) the successor to WNEW.

WQEW—on 1560 kHz, operating with 50 kW—replaces WQXR, a classical format station for the past 56 years. WQXR-FM, on 96.3 MHz, also owned by the New York Times, will continue to air classical music.

Singer Tony Bennett was at the microphone with program director Stan Martin and air personality Jonathan Schwartz, both former WNEW staffers, to kick off the new radio station at a sign-on ceremony on Dec. 2. "WQEW will play the great writers, the great players and the great vocalists, and present them tastefully to an audience that appreciates the very best of the American Popular Songbook," said Martin.

Bennett introduced the first record, Frank Sinatra's "New York, New York." The set followed with "Stardust," by Nat King Cole and Bennett's own "The Best is Yet to Come." Later, at a party to celebrate the sign-on, singer Liza Minnelli and Bennett made personal appearances.

WQEW transmits from Maspeth, N.Y. and covers the greater New York metropolitan area, from Long Branch, N.J. to Newburgh, N.Y. to New Haven, Conn. to Patchogue on Long Island.

As for the demise of WNEW, there was an air of nostalgia that comes when a great institution is lost forever. "It is sad," said former WNEW disc jockey Mark Simone in an interview with New York Magazine, "but it's happened to every great radio station that ever was. I mean, that's what radio is, isn't it...echoes?"

Products & Services Showcase

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Q-TIPS

Build Your Engineering Reputation

Self-Promotion Can Lead To Raises and Advancement

by John "Q" Shepler

ROCKFORD, Ill. Are you getting as much recognition for your accomplishments as you should? Probably not. Even when you put in that extra kick to clean up the audio, launch a new promotion, or reel in an extra rating point, most of what you do will go unnoticed. Can you do better? Probably.

A common myth is that if you work diligently and get things done, then your efforts will be noticed and appreciated. A more likely result is that you'll develop a reputation as "good ole' solid so-and-so," a decent type who gets a job done and doesn't cause any problems.

Unfortunately, this is also the type of person who seldom advances and may be considered expendable when times are tough.

Learn to advertise

The idea is to get as much positive press as possible for each thing you do. Like all advertising, each mention of a task well done won't change anything. However, the sum of a constant stream of positive images will get people thinking that your value is higher than they previously believed.

Here's how to get started. Whenever you accomplish something, routine or special, let people know. If you go out of your way to help somebody, be sure to let them know. If possible, get other people to talk it up around the station. It sounds less like bragging if someone else is doing the talking.

Much of our routine activity doesn't warrant party horns or announcements on the PA system. The place to do your regular advertising is in a report. These can be daily, weekly, monthly, or an annual accomplishment summary to go with your performance review. How often depends on how much is happening.

Presentation matters

The important thing about reports is that they have to be read in order to have any effect. To get a report read, you have to make it interesting. Try a newsletter format. I like the approach in Kiplinger's Washington Letter. The writing is simple and direct. The sentences are short and punchy. Try to find a newsletter that your co-workers think is interesting and then copy the style.

To make sure that others will find your reports valuable, slant the material toward how what you're doing is important to them, not yourself. Focus on what's getting done, not all the problems you're slogging through. If your accomplishments can be counted, like the percentage of the music library converted from vinyl to CD or digital cart, keep a running tally. Charts and graphs can also be helpful. You'll know it's working when people start asking to be on your distribution list.

Some of what you do is more likely to be valued by peers in your field than your peers at work. The engineer who comes up with a better transmitter control scheme will get a lot more kudos from other engineers than from the announcers, who really have no idea how the transmitter is controlled and don't care as long as it doesn't affect them.

Start thinking in terms that everything you do is worth something to somebody

What this says is that you need to develop a circle of friends in the industry and keep them posted on what you're accomplishing. Like internal reports, reports to the industry can also add stature to your career. Write up that new control scheme and mail it to your engineering comrades. Present that new format at a regional program directors conference.

Develop a reputation

What's important is that you get your name attached to something others find useful. As your name keeps popping up, you'll develop a reputation as a leader. It's not that hard. Most people are quite content to be followers and won't make the extra effort to compete.

Don't fall into the trap of thinking that what you're doing isn't good enough or impressive enough to be recognized. All right, the networks may very well throw your brilliant programming ideas into the trash. If so, you're not ready for that level. However, there are people at your level and maybe a few levels higher that are much easier to impress. Learn the art of publicizing your accomplishments, and you'll always find at least some admirers.

Why bother promoting yourself? First of all, it feels good. Second, it leads to other good things. Good things like raises, promotions, and job offers. Given equal qualifications, who do you think is most likely to be hired: the unknown or the person with a reputation of accomplishment?

Here are some other ideas for gaining recognition. Use the press to your advantage. When you finish that studio project, think about pitching the story or an equipment evaluation to a trade publication, such as **RW**. Local newspapers and alumni newsletters love to hear about awards you've won or degrees or certificates you've obtained. If you're doing something that benefits the less fortunate in the community, you'll get lots of free press from the local paper.

(As a word of caution, though, don't take it personally if an editor turns down your idea, or publishes it later than you might like. You won't be the only one submitting stories to him or her, and you may have to wait your turn.)

Another ideas is to try for awards in your field. If there is a contest, enter it. Winning is nice, but getting known is what counts. Have you invented something you can't buy? Talk to your manager about going for a patent. Things written or produced might be worth registering for copyright.

Start thinking in terms that everything you do is worth something to somebody. If it's worth doing, its worth being recognized for. Become your own press agent and work towards getting the most visibility for your accomplishments. Then think in terms of moving on to bigger accomplishments and even greater recognition.

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John Shepler is an engineering manager, writer, and longtime **RW** *columnist. He can be reached at 5653 Weymouth Drive, Rockford, IL 61114.*

FEED LINE

Evaluating an Ideal Antenna System

by W.C. Alexander

DALLAS What is a "broadband" antenna system, anyway? I have heard the term used to describe all sorts of "improved" antenna systems, from those with a simple, rotated common point network or ATU phase shift to complex directional arrays with impedances carefully matched at every junction, to those with special "broadbanding" circuits added.

For all practical purposes, a broadband antenna system will have low voltage standing wave ratio (VSWR) at the sideband frequencies. There are several methods and combinations of methods to achieve such a condition.

Will experimenting with matching network phase shift yield a better sounding radio station? Often it will. The degree of improvement achievable depends on many other variables, but chances are some improvement can be made.

Stop and listen

When looking at an AM station's transmitter facilities, I check for evidence of broadbanding. I start by just listening to the station. If it sounds good, broadbanding is probably not needed. In the phasor or ATU, I look for components added to improve the bandwidth.

Special broadbanding circuits may be added immediately before or after the common point, and usually consist of a coil and capacitor in series. This circuit is adjusted to be series resonant at the carrier frequency. It is capacitive below carrier frequency, and inductive above.

This implies that the load to be broadbanded must be inductive at the lower sideband frequencies and capacitive at the upper sideband frequencies. This condition can be achieved by rotating the phase shift of the common point or ATU matching network (or adding a separate phase-shifting network).

The broadbanding network must be shielded from other components to prevent stray coupling. When everything is set just right, the broadbanding network cancels the reactive component on either sideband frequency.

How else to check

What can you do if you just can't tell whether the antenna system has good bandwidth by looking or listening? It could be argued that if you can't tell, it must be OK, but there is an easy test that can be made in the field.

First, feed a 10 kHz sine wave at 50 percent modulation to the transmitter. With a field strength meter (well out of the near field, preferably several miles away and in the main lobe), first tune the carrier frequency and note the reading. Then, tune in each sideband in turn and note the level of each.

In a perfect system, each sideband amplitude will be 25 percent of the carrier level. If each sideband is between 20 and 30 percent of the carrier field strength, the system probably has adequate bandwidth.

One final thing to consider is the root sum squared (RSS) to root mean squared (RMS) ratio of a directional antenna system. If this ratio is less than 2:1, the bandwidth can probably be improved by modifying the phasor. If it is greater than 2:1, well...maybe it would be better to just walk away.

What makes a sampling system good or bad? Are tower-mounted sampling loops obsolete now that shielded current sampling transformers are available? Which is more accurate? Which is more stable?

The function of sampling

First of all, let me get way out on a limb by saying that sampling system accuracy in an existing system is not all that important. OK, now set your chairs back up, brush yourselves off, and read on.

The proper phases and currents to generate a directional pattern are determined by field strength measurements.

The function of the sampling system in an operating directional antenna system is to detect changes from the values of phase and current originally determined necessary to make the directional pattern. The ability of any sampling system to measure the absolute amplitude and phase of the radiation from each element in a directional antenna is inherently quite poor.

Mutual impedances between elements distort the sinusoidal current distribution along each tower. This destroys the sampling system's ability to measure the absolute values of radiation from each element.

Both sampling loops and current transformers have advantages and disadvantages of which you should be aware. Then, you can judge for yourself whether the sampling system is all it needs to be at any given station.

Loops

Sampling loops consist of a single turn of rigid material, usually galvanized or

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Studio Sessions

Equipment and Applications for Radio Production and Recording

This Issue:
New Products from
Digital Audio Labs, Studer and **Roland**

Radio, Pro Audio See Increased Overlap

▶ continued from page 1

the Zoo is "by far the most produced morning show in Cleveland." He and Pat Artl, the show's technical producer, went with the Zoodio "because of the type of production we do—parody songs in a music-intensive format. The bits have to be quick-hitting and good."

Professional audio recording equipment helps the show, Bonasso says, "because it allows better and more intricate production. It opens a broad spectrum of creative opportunities for produced bits."

The jobs undertaken at WMMS can range from down-and-dirty fun spots to a "production extravaganza," as Bonasso calls it. He and Artl recall a recent session in which they spent six hours producing a show intro based on "Leave It," by the AOR band Yes.

"The (Zoodio's) technology can let us parody even tech-rock bands," Bonasso says.

According to Artl, "if there isn't already convergence of pro audio and radio industries (in most markets), there will have to be for radio stations to stay competitive.

"The Zoodio, for example, is completely outfitted to record music in a multitrack environment. The only difference between producing a song in the Zoodio and an album in a recording studio is the length of the project."

In fact, Artl says, the only thing the Zoodio lacks to be a full-service recording studio is "a place to put the band."

Bonasso agrees that the radio and recording industries are increasingly overlapping. "Radio is about the recording industry anyway, isn't it? Even the early jocks would occasionally use plate reverb on their voices—essentially a recording studio technique.

"There are sometimes gaps because of the rate of technological advancement in the professional audio industry, but people in radio do make use of the audio technology to further our own progress," he said.

Other side of the fence

Bob Yesbek is co-owner of Rockville, Md.'s Omega Studios and director of its School for Applied Recording Arts and Sciences. He categorizes the overlap between radio and pro audio in terms of technology and production services.

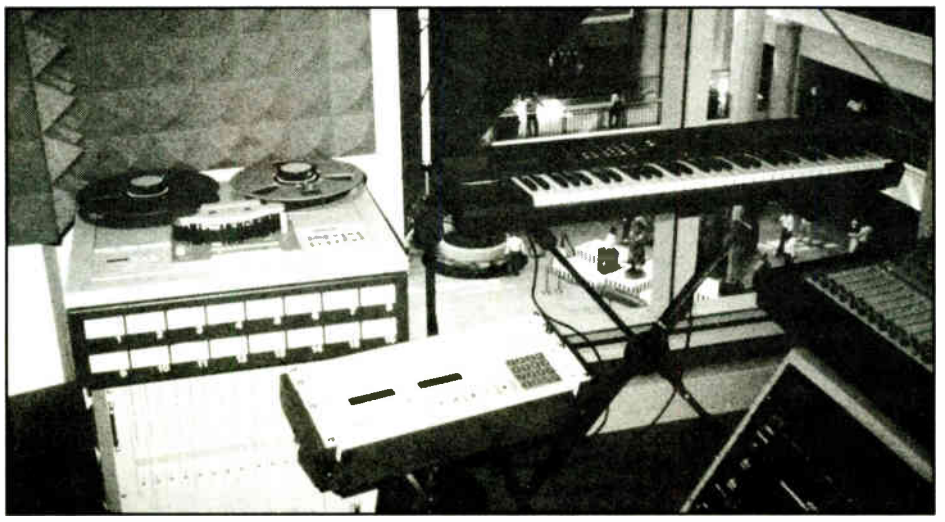
"Several students in our basic and intermediate classes here at Omega are employed at radio stations, and take our programs to become familiar with the techniques of multitrack production and operation of signal processing devices," Yesbek says.

For Yesbek, the real convergence between the two fields came with the development of affordable digital audio workstations (DAWs). With the DAWs, he maintains, "the formerly esoteric process of PC-based direct-to-disc digital editing, previously reserved for high-end music studios, CD mastering labs and jingle production companies, has found its way into the radio station."

As for production services, Omega has been "producing radio shows for years that are pre-packaged here at the studio and aired at a later date." Most recently, he said, a national "Top 30" show was fully produced at Omega for over a year.

Equipment suppliers agree

The belief that the two sides of the audio industry are coming together is held not only by studio operators and station personnel.



WMMS(FM)'s Zoodio comes equipped with a 16-track Tascam reel-to-reel and an arsenal of processing gear.

Equipment distributors from both sides have noticed the trend as well.

Don Holloway, manager of Russo Music Center in Trenton, N.J. acknowledges the change. Russo Music is a dealer of musical instrument and professional audio equipment; its clientele includes both recording studios and radio stations, such as WMMR(FM) and WHYY-FM in Philadephia, Pa.

Among Russo's biggest selling items for broadcast facilities, Holloway says, are disk editing systems, "portastudios," processing gear and keyboard samplers for production—products originally developed for the musical instrument (MI) and professional audio markets. Holloway suggests that these sales indicate the changing face of broadcasting—a trend toward greater creative sophistication.

"Originally, radio tried purely to recreate the personalities of its DJs on the air, just trying to stay faithful to the personalities," Holloway explains. "Now, more and more, radio has to *create* product. Program content is now a creation, not a *re*-creation."

With the proliferation of digital effects processors, Holloway says, radio listeners have become more sophisticated and more demanding of radio. That, in turn, has led to a synergy among radio personnel to create material for this increasingly sophisticated audience.

"Technical people have been given a lot more creative room (in radio), and creative people have been given more of a hand in the technical side of things," according to Holloway. Broadcasters have begun to demand more elaborate equipment as an outlet for that creativity, and that equipment seems to be coming from musical instrument and professional audio manufacturers.

"Most of the innovations have come from the MI field," Holloway says.

Tim Schwieger, VP of marketing for Broadcast Supply West in Tacoma, Wash., agrees with Holloway's assessment.

"It used to be that broadcast companies designed products for broadcasters, but most of the advancements now seem to come from the MI and consumer markets. These products are then souped-up for broadcast use."

As examples, Schwieger points to such products as the recently-introduced Tascam DA-88 eight-track digital recorder and the growing acceptance of DAT machines.

"DAT machines are increasingly used (in radio stations) instead of reel-to-reels for two-track mastering," Schwieger says.

Looking for help from MI

Like Holloway, Schwieger believes that "more and more, air talent are beginning to find that, to enhance their shows creatively, they have to look to MI and pro audio gear." Even such items as sampling keyboards are becoming integral to radio stations, although in many cases the equipment may actually belong to a staff member, rather than the station itself.

What has caused this trend? Schwieger believes it's largely an economic consideration. "Stations are looking for lower-cost alternative ways of getting a job done," he says, "and that often comes from outside the broadcast industry."

Professional audio and radio seem to be enjoying a closer camaraderie than ever before, thanks to the introduction of new, more powerful and more affordable audio equipment. But at the same time, some speculate whether the ramifications of new technology will, in the end, specialize the two sides of the audio industry again.

Omega's Bob Yesbek reflected on the production services now offered to radio by studios. "As radio stations climb on the digital production and effects bandwagon, I feel that...outside production will become less of a factor in the overlap between station and client/promotion."

Digital Made Simple

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Sound Canvas: A Producer's Palette

by Al Peterson

DANBURY, Conn. Japan's Roland Corporation has come out with a small and inexpensive MIDI sound module that is very useful for radio production work—not just for its musical capabilities, but also for an entire bank of sound effects that can be called up with the touch of a key.

The Roland SC-55 Sound Canvas is a 16-part multi-timbral module that MIDIs together with the rest of your production rig to provide 315 sounds and instruments, all with the crispness of a CD player. That's a pretty big accomplishment for a three-pound box the size of a mobile CB! Add to this eight types of digital reverb and chorusing modes, eight drum sets and the aforementioned sound effects library, and there are more than ample sources of inspiration for the aggressive production pro.

LCD window to the world

The Sound Canvas' window to the world is the backlit LCD display. At a glance it shows you settings for output level, pan position, reverb depth and which parts are active (in this way, the LCD display is similar to a 16-track meter bridge). With a couple of keystrokes the display shows—in bargraph form—MIDI receive channels, velocity pan position in graphic form and more.

Those keystrokes do get a little confusing, as many of the front panel controls are dual-function. It takes a little bit of memorizing to get that "Press ALL, then press both PART buttons simultaneously, use ALL and MUTE to scroll through selections, press INSTRUMENT..." down to a science.

Despite the scrolling procedure, the controls are clearly marked, with a very positive feel. Owing to the small size of the Sound Canvas, the buttons may be too small for some ham-handed producers—a minor tradeoff given the versatility of the unit.

This is not really a tweaker's toy—this gutsy little lunchbox puts out sound for custom music production.

The SC-55 was designed for speedy plug-in-and-go operation. This is not really a tweaker's toy—this gutsy little lunchbox puts out sound for custom music production. Synth pads right out of Star Trek, guitars to blow away any AOR razor rat (they even put in the finger-screech on the strings), New Age-y flutes and bells for that earthy effect. There are eight drum kits for powerful Dance and CHR beds designed from scratch...even that weird "*poink*" drum you find on Whitney Houston and Paula Abdul records (it's the TR-808 cowbell—part 10, program 26, note 56. You'll know it the moment you hear it).

For the Nostalgia station across the hall, the SC-55 offers big shiny horn, sax and rhythm sections. The "Jazz Lagoon" demo built into the Sound Canvas is a great example. Symphonic effects are ably handled by a full complement of strings, harps, kettledrums and choir "*ahhs*" and "*doohs*."

However, it's the sound effects bank that puts the Sound Canvas right at home in the production studio (or even live during the morning show!). All are quite versatile and some are downright hilarious. While most are applicable to rap rhythm beds, many will find their way into promos and spots. Part 10, Program 57 gives you a barking dog, car crash, human heartbeats and thunderclaps. Hit a few more keys on the MIDI board to get early morning birdies and a running stream, a door being shut and a karate hit.

Effect at your fingertips

Without accessing a single effects CD, an entire promo's worth of effects can be produced in one pass with two fingers. Best of all, the Sound Canvas can do it while also laying down the music bed; with 24-note polyphony (the ability to play more than one note at a time), there is plenty of time and room for full productions on the Sound Canvas.

Connections to the Roland Sound Canvas are minimal. Two RCA output jacks send the -10 dB signal in stereo to the console. There is the usual MIDI jack trio on the back panel (IN, OUT, THRU) along with a very pleasant surprise on the front panel: a MIDI IN 2 jack, so you don't have to climb behind the rack to plug in that five-pin DIN. RF rejection appears to be excellent, and the sound output lacks grit and is very clean.

With the built-in complement of reverb and chorusing along with the Sound Canvas' capability to pan signals, external processing isn't needed. In fact, a fairly respectable MIDI studio can be set up "quick & dirty" with a Roland SC-55, a consumer-type MIDI keyboard and a low-priced sequencer.

Taking up a half rack in width, the Sound Canvas can just sit on top of a cassette deck and use a single stereo input to the console. For any station set up for sophisticated MIDI production or one with lower-end gear looking to upgrade inexpensively, a lot of mileage can be obtained from the Roland SC-55 Sound Canvas.

For more information, contact Al Dugas at Roland Corp.: 7200 Dominion Circle, Los Angeles, CA 90040; phone: 213-685-5141, or circle **Reader Service 90.**

□□□

Al Peterson is Production Manager for WLAD/WDAQ, Danbury CT and has been into synthesis since the mid-'70s. Contact him at 203-744-4800.

LINE OUT

Digital Audio Labs Makes Disk Editing Affordable

by Bruce Bartlett
with Jenny Bartlett

ELKHART, Ind. You can edit digital audio for just over $1,000 if you already have an IBM-compatible computer. Just install the CardD/EdDitor system by Digital Audio Labs. At $1,045 to $1,340 list, it's the least expensive two-track digital editor that has CD sound quality.

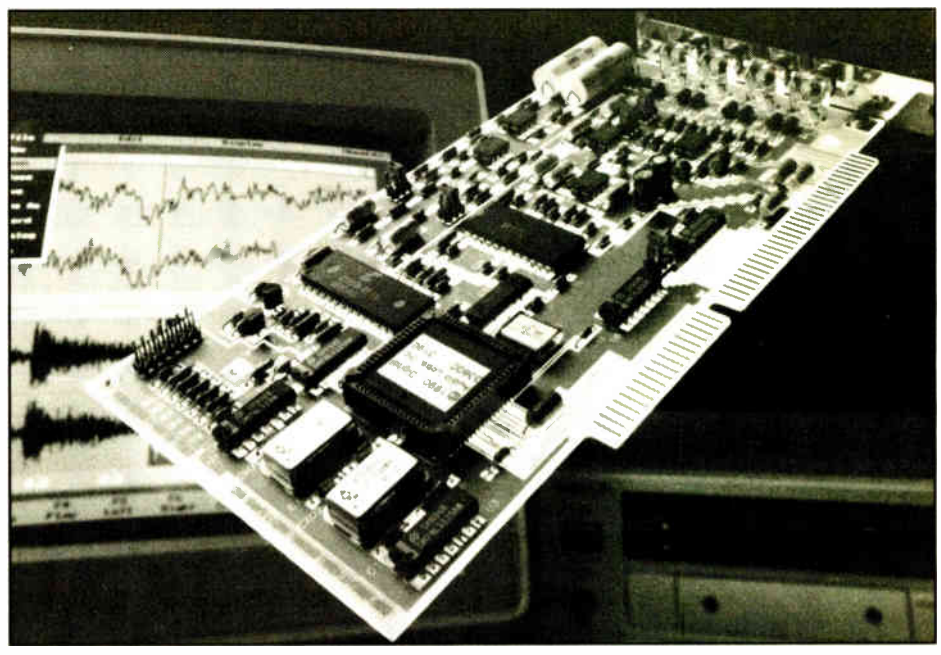
The CardD/EdDitor system includes one or two circuit cards and software:

•CardD (Compatible Audio Recording Direct to Disk). This is a circuit card that plugs into a 16-bit slot in your computer. The CardD converts analog audio to digital and formats the signal for storage on your hard disk. If all your audio sources are analog, this is the only card you need. It has RCA connectors for analog stereo inputs and outputs. Sample rates of 32, 44.1, and 48 kHz are supported. Price: $795.

•I/O CardD (Digital Audio Interface). This is a circuit card that plugs into an 8- or 16-bit slot. Use this in addition to the CardD if some or all of your audio sources are digital. This way, you can bypass the A/D converter for better sound quality. The card has digital input and output connectors in the IEC/SPDIF format. Price: $295.

•The EdDitor (Digital Audio Display Editor). This software is for digital audio recording, playback, and editing. Version 2.0 runs under DOS with keyboard control; Version 3.0 runs only under Windows 3.1 with mouse control. Price: $250.

An alternative editor is available from Innovative Quality Software; it's called the Software Audio Workshop (SAW). Running only under Windows 3.0 or 3.1, SAW's developers claim to offer faster, more intuitive operation—but at a higher price: $599.



The CardD, from Digital Audio Labs

What you need to use it

The CardD/EdDitor system requires:

•An IBM-compatible 386 or 486 computer (SX or DX) running at 16 mHz or faster.

•For Version 2, 2 megabytes (2MB) of RAM, for 25 minutes of continuous recording time. Each additional 1MB adds 20 minutes. QEMM memory manager is recommended—not the MS-DOS EMM-386 memory manager. For Version 3.0 or SAW: 4MB of RAM; 8MB recommended.

•IDE or SCSI hard disk with 1:1 interleave disk controller with a 16-bit bus. You'll need at least 11MB of disk space per minute of stereo audio. Disk controllers that operate in Bus Master mode are not compatible with the CardD.

Recording and editing

When recording a program onto your hard disk, you can set various recording parameters such as sample rate. 48 kHz sounds best; 44.1 kHz is for CD premastering, and 32 kHz uses the least disk space. Simulated bargraph meters show the recording level.

Two windows appear on screen, one in the top half, one in the bottom half (See Fig 1.). The bottom window, called "Read Only," holds the raw material you want to edit. The top window, called "Modified," is for editing. There's also a clipboard—a temporary edit buffer in memory.

In the bottom window appears a stereo soundtrack of your recording. This is the waveform—a graph of signal voltage versus time, one for each channel. Its time axis is measured in minutes and seconds. Waveforms are drawn very fast, thanks to a "metasample" graphics file which is usually created while recording. If you wish, you can zoom in on a selected area to view it in fine detail. The waveform can be scrolled forward or backward in time.

The uncluttered screens have pull-down windows and dialog boxes. Because of the high-quality A/D converter in the CardD, the playback sounds exactly like your original program.

Editing by region

When editing, you use a mouse and cursor to highlight "regions," or segments of the recording, such as a song or sound effect. You save each region for later manual cueing, or to create a playlist of regions. Two soundfiles can be open at once, each appearing in a separate

continued on page 18 ▶

PRODUCER'S FILE

Dyaxis Lite Targets Newsroom Production

by Ty Ford

BALTIMORE Driven by a Mac Classic II with only a 16 MHz clock and a 122 megabyte (122MB) internal hard drive, some might consider the Dyaxis Lite the stepchild of the Studer family of digital audio workstations, which also includes the Dyaxis and the Dyaxis II.

Still, there's enough space in the Lite for 10 minutes of stereo recording (or 20 minutes of mono) at 44.1 kHz. The Mac and the Dyaxis Lite processor communicate via MIDI exclusive commands. According to product manager Rick Evans, the Mac acts as the remote control and is not involved in the audio. For $9,950 you get the Mac Classic II (system 7.01, Norton and Speed disk Utilities, Teach Text, keyboard mouse and hard drive), the Dyaxis single-rack space processing unit, the remote control pad and all of the cables needed to hook them together.

But wait! There's no DSP card for EQ or time compression, and the Classic II has no NuBus slots so you can't upgrade processing later. There's also no SMPTE input or output. When I asked Evans what market they hoped to hit, I was a bit surprised at the answer—The Journalist's Workstation.

Hmmm...there's a thought. Imagine a small office with sound absorbent material on the walls and ceiling. On the sleek designer desk sit the Mac Classic II, remote control pad, keyboard, mouse and a small mixer like the Mackie 1202.

Suddenly the door opens and in walks our news person. Let's call her Helen.

Out of her kit Helen pulls a portable DAT machine. As she powers it up, she kicks off one shoe and toes the rocker switch of the power strip under the desk to the "on" position, bringing all of the equipment on the desktop to life.

STUDER Dyaxis Lite digital audio production system

She connects the DAT machine to the S/PDIF input of the Dyaxis processor to the desktop, clicks opens the "5PM News" folder on the Mac screen, launches MacMix software and hits the record button on the remote control panel that sits to the right of the keyboard. Several seconds pass. The record and pause lights on the remote control indicate that the Dyaxis is ready to record.

Helen hits the "play" button on the Dyaxis remote control and on the DAT machine and pipes the digital audio from the DAT to the Dyaxis. Listening through the small self-powered speakers on the corner of her desk, she waits until she gets what she needs, and then stops the DAT.

Finding the sound bites she needs, Helen edits them together using the edit commands on the remote control panel and Mac keyboard. Shifting from the editing "view" window to the "mix" window, she "cuts" and "pastes" the sections to get the right sequence.

After opening the word processing software, she writes the intro, bridges and outro for her part of the newscast. Using the mic attached to the boom mounted on her desk, Helen hits the record button on the Dyaxis remote control again.

Moments later, with both "record" and "pause" lights lit, she hits play and records her parts into the system. Since the parts are all small, she can read them directly from the resized word processor window on the Mac screen. Helen routes longer scripts to the printer.

A few more minutes of trimming, cutting and pasting and the 'cast is complete, including intro and outro sounders. The sounders are stored in a file on the hard drive so they can be brought up for each newscast. The flick of a switch routes the Dyaxis output to the on-air console. At the right moment she hits the play button on the remote control. Within 0.6 of a second, the audio is on the air.

Sounds like a scene taken from the cover of one of those slick computer magazine covers. And it can work out that way, provided Helen keeps the following few things in mind:

- Even if she already knows how to get

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Digital Audio Lab's Disk Editing Entry

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window. You can insert one region into another, or mix them together—a process like sound-on-sound.

How do you define an entire song as a region? As you record a song, drop markers at the approximate beginning and ending of the song, and fine-tune their timings later.

You also can cut or remove selected regions. This is useful for editing mistakes out of a narration track. These edits are non-destructive: They don't affect the soundfile data on disk. Speech editing with the CardD/EdDitor system is fast and easy.

Besides editing and mixing, some other features include fades and crossfades, multiple un-do's, and on-line help. There's also a catalog manager, which is a menu to play selected sound effects or music at random, like a cart machine.

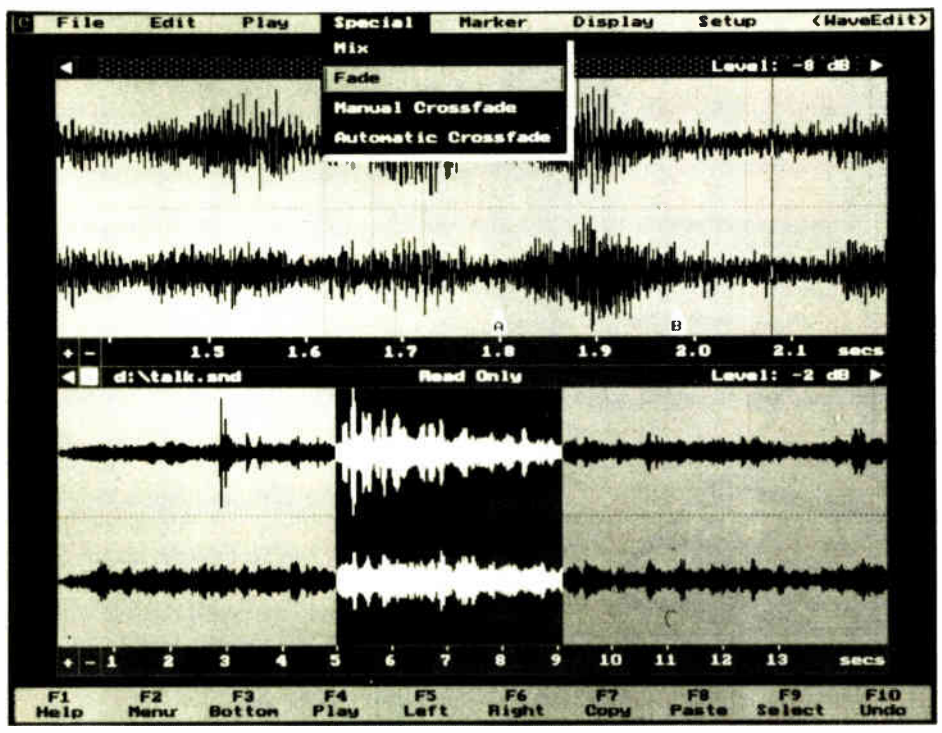

Figure 1. The CardD's software features a split-screen video display.

Version 3.0 adds MIDI and SMPTE triggering, sample reversal, playlist editing, pitch shift, and a multimedia driver.

Here's a typical method of producing a spot with the CardD system. Let's say you've recorded three soundfiles onto hard disk: a music bed, an unedited voice-over, and sound effects. You want to duck the music under the voice, then fade out the music at the end of the spot. To do this, set various marker points and their levels in the music soundfile. This sets a fade profile for the music. Next, edit mistakes out of the voice-over. Then mix the edited voice-over with the music. Add the sound effects to the voice/music mix, and you have your spot.

Digital Audio Labs is at 6311 Wayzata Blvd., Suite 200, Minneapolis, Minnesota 55416; phone: 612-559-6104, or circle **Reader Service 63**. Information on the Software Audio Workshop can be obtained by phoning Innovative Quality Software: 702-733-7854 or circle **Reader Service 183**.

□□□

Bruce Bartlett is a microphone engineer and technical writer for Crown International. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.

Dyaxis Lite Targets News

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around on a Mac, Helen must do the MacMix tutorials and read the manual. There is no other way.

• Helen has to become familiar with the intricacies of the digital I/Os. When the system is configured to accept an outside digital source (like a portable DAT machine), it uses that source's digital clock. If after she digitally transfers her field recordings to the Dyaxis she disconnects the DAT machine from the Dyaxis S/PDIF ports, she'll have to reconfigure the input to "Internal" or she'll see a screen message telling her that lock has been lost. The Dyaxis also loses lock if it senses a different clock rate than it was configured for, like when the DAT tape contains material recorded at different sample rates.

• Helen will probably find that she needs a very directional mic like a Sennheiser 431; anything less tight wouldn't eliminate the noise of the Mac fan and hard drive motors. She'll also learn that placing the left side of the remote control too close to the right side of the keyboard results in the edge of the remote control accidentally pushing down the keyboard "Enter" key. When this happens the system becomes confused and irritated, and could lock up on her.

• Helen will learn that resizing windows, making a permanent waveform display and any other changes take time. (It took the system 3:17 to create a permanent waveform display for 3:30 of stereo, and :39 to process :60 of mono.) She'll probably use waveform editing only for special jobs, like editing particularly bad actualities.

The Dyaxis Lite can handle incoming digital audio at 32, 44.1 and 48 kHz sample rates. It will also record through the analog ports at 24 kHz. But, since it doesn't have a sample rate converter, mixing sample rates within a production can cause dramatic and unwanted pitch shifts.

Evans told me that Studer also has a "soon to be shipped" removable magneto-optical (MO) drive that uses 128MB disks capable of about 10 minutes of stereo at 44.1 kHz. You could have a separate MO for each newscast or project, as long as it gave you the time you needed. For archiving, Dyaxis currently offers a DAT backup option. For $2,195 you get a data DAT machine that hooks up to your SCSI bus (cables included) and StuderBacker II backup software.

The Dyaxis Lite, as its name implies, is more affordable than its full-blown siblings, with fewer bells and whistles. If you're an active Mac user, comfortable with computer file management, willing to learn the system and ready to move to a workstation to compose a newscast, the Dyaxis Lite can be fun. For more information, call Studer/Revox: 615-254-5651, or circle **Reader Service 11**.

□□□

Ty Ford is an independent audio consultant and regular contributor to **RW**. *Reach him by phone at 410-889-6201 or by MCI mail 347-6645.*

INSIGHT ON RULES

This Is a Test: A Look At the EBS Overhaul

by Harold Hallikainen

SAN LUIS OBISPO, Calif. I was recently invited to attend a local EBS meeting from which several interesting ideas were sprung. In addition, the FCC has issued a Noticed of Proposed Rule Making (NPRM) looking towards a total revamp of EBS (comments are due Jan. 15, 1993, reply comments Feb. 16, 1993). So, let's look at what's going on with EBS.

In 1989, the NAB petitioned the FCC to shorten the length of the existing EBS tone, revise the EBS test script, and permit stations to operate EBS equipment by remote control.

The NAB argued that the existing 20- to 25-second tone resulted in listener tune-out during EBS tests. A shorter tone (eight seconds was suggested) would allow reliable detection, continue the low rate of false tone detections, and reduce listener irritation.

Short-term modifications?

Existing decoders require a minimum of eight to 16 seconds of tone before unmuting the speaker. This would require all existing decoders to be modified or replaced before any stations could reduce tone length below eight seconds. Further, since the tone decoders used by stations are required to be FCC certified (and encoders to be FCC type accepted), various tests would be required on the modified equipment, FCC reports filed, and filing fees paid.

Is it worthwhile to do an interim modification of the EBS or just replace it?

NAB has proposed allowing stations to modify the EBS test script, perhaps giving the public emergency preparedness information, such as the location of hospitals, etc.

The FCC is seeking comment on allowing the use of Public Service Announcements (PSAs) to heighten awareness of EBS and permitting the commercial sponsorship of EBS tests "to foster good will between the stations and the businesses in their communities."

Many stations are using "off premises control" and may or may not be complying with FCC EBS requirements. Part 73.932(a) of the FCC Rules requires the EBS reception equipment to be installed to "instantaneously" alert the operator and allow the operator to immediately monitor the emergency programming.

It appears difficult to meet this requirement unless the control point has an EBS receiver tuned to the proper station, or a dedicated circuit carries the EBS signals and programming to the control point. Perhaps the FCC could specify the number of seconds allowed between reception of the EBS attention signal and notification of the operator.

The existing system relies upon an operator hearing the EBS attention signal, hearing the emergency announcement, broadcasting the locally generated EBS attention signal, broadcasting the script from the EBS checklist, and, finally, rebroadcasting the common emergency program. The entire system is rarely tested.

Proposed automation

The FCC has proposed three levels of automation. In the first level of automation, receipt of the EBS attention signal would automatically interrupt the station's normal program and rebroadcast the emergency program, without any operator action.

Level 2 automation would provide the operator with a "veto" time to prevent the emergency program rebroadcast, allowing the operator to retain ultimate control of the program. The FCC has proposed five seconds, though I'd expect 30 seconds to be more reasonable.

In level 3 automation, operator action would be required to put the emergency program on the air. This is quite similar to the current system. The first and second level automation systems would be much more practical with the addition of an end of message (EOM) signal.

The lack of an EOM signal is the major shortcoming of the existing two-tone system. The FCC is looking at replacing the existing EBS attention signal, which was put in place in 1975.

There are several interesting proposals, including the use of the existing two-tone system, FM radio braodcast data system (RBDS) subcarrier, the National Weather Service's WRSAME, and DTMF systems. The latest FCC NPRM on EBS shows several possible "system boxes," each of which has several encoders and decoders.

Systems comparison

Let's look at the capabilities and limitations of each of the systems.

The existing two-tone system might be compared to a DTMF or Touch Tone signalling system with "just one button." Pressing this one button has notified us of emergency conditions for the past 17 years. It can be used over any medium that supports voice grade audio. The "one button" limitation prevents implementation of an EOM signal.

The FM RBDS (Radio Broadcasting Data Service) subcarrier system provides a sophisticated addressable data circuit that could carry EBS attention signals, EOM signals and other data. Under this system, however, primary control stations are on the FM band.

The WRSAME (Weather Radio Specific Area Message Encoder) consists of audible codes transmitted before and after specific message types over the existing weather radio network. Since these are voice grade signals, they appear appropriate for broadcast EBS—if there are enough codes to satisfy broadcast requirements.

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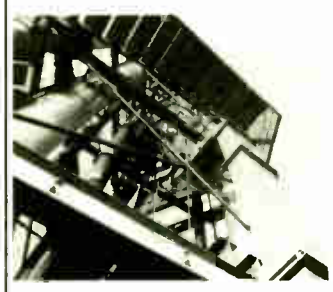

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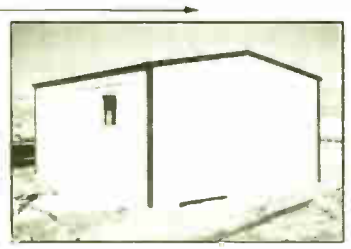

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WORKBENCH

Pull a Transmitter Switch

by John Bisset

FALLS CHURCH, Va. In this time of doing more for less, today's engineer can be faced with a real dilemma—solving a problem at the lowest possible cost. Usually, lowering cost means cutting features. If the problem to be solved involves changing transmitters, there's a limit to how many features you can do without.

We faced just such a dilemma recently. A daytime AM was adding a second transmitter and needed a reliable means to switch between the main and aux. Multiphase engineer Kevin Strom came up with the scheme in Figure 1, which solved both the transmitter interlock problem and the potential for a jock to switch the transmitters hot.

Even though this circuit was designed for use in AM, using a Kintronics RF contactor, it can be easily adapted to motorized FM transfer switches.

Operation is simple. There are two switches on the front of the panel. The first is marked "Transfer Enable." To switch transmitters, this switch is thrown. It opens both sets of interlocks on each transmitter. This switch also routes "switched AC" to the transfer selector switches.

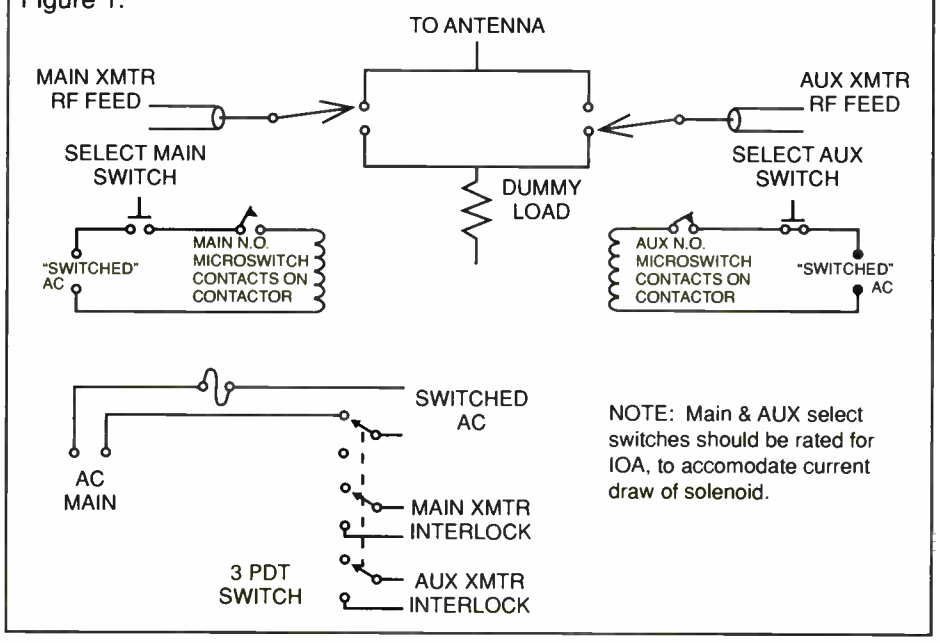
This circuit was designed for use in AM but can be easily adapted to motorized FM transfer switches.

When either the "Main" or "Aux" selector switch is depressed, 120 VAC is fed to the "Main" or "Aux" solenoid contacts on a barrier strip mounted to the rear of the panel. This AC should be wired through the contactor microswitches so that when the solenoid has transferred, the AC will be interrupted.

When the transfer is complete, toggling the "Transfer Enable" switch back to the "Normal Operation" position closes the transmitter interlocks and restores the transmitter to "on air" status.

There is no question that more elaborate circuits can be engineered, but for a station on a tight budget, Kevin's scheme is not only jock-proof (meaning no fried switch contacts), but it's also cheap, and can be constructed out of "junk box" parts. Kevin Strom can be reached at 703-379-1665. For information on Kintronics RF contactors, circle **Reader Service 89**.

Figure 1.



★★★

Next time you need to solder wires to push-on contacts, try this suggestion from Nortronics. Nortronics tape heads use these push-on type pin clip contacts, and the trick has always been getting the solder to stay just on the end of the contact where the wire is located.

Wicking effect causes the solder to be drawn up the contact from where the wire is soldered and into the spring fingers that mate with the head pins. When the pin clip contact is contaminated in this way, it either cannot be inserted onto the pin (because the solder is in the way), or it fits partially on the pin—neither case is desirable.

The solution is found in a box of round toothpicks. Take a toothpick, slip it in your workbench vise, and slide the spring contact onto the end of the pick. The wood acts as a "dam," preventing solder from flowing into the spring contact of the pin clip (see Figure 2). A shaved-

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A Look at the FCC's EBS Overhaul

▶ continued from page 19

The CATV industry has suggested the use of DTMF codes, since DTMF is heavily used in the CATV industry. DTMF can, of course, be used on any voice grade circuit, making it usable on all the broadcast media.

It is a relatively slow method of data transmission (about 40 bits per second), but may be quite adequate for EBS activation requirements.

Personal preference

Without a strong argument otherwise, I'd prefer the use of an audio Frequency Shift Keyed data stream over the main broadcast channel for EBS signalling. It is quite simple to get 1200 bits per second, allowing short data bursts to handle EBS requirements.

The FCC has proposed several "system box" configurations for station EBS equipment. Each box has several decoders and encoders.

As discussed above, I'd suggest settling on a single signalling scheme that would work over all circuits. The FCC boxes show several inputs driving each decoder. These audio sources include a NOAA receiver, an AM receiver, an FM receiver, RPU receivers and telephone lines. Use of a single decoder driven by several audio sources will probably result in unreliable operation.

Many decoders use an "in band" to "out of band" energy comparison to ensure the signal to be recognized is present while avoiding "talk off" where a wide spectrum signal falsely trips the decoder. Combining several audio signals would probably degrade the reliability of any decoder.

I'd therefore suggest that each station have one or more identical encoder/decoder boxes, using whatever the standard decoding scheme becomes. Each encoder/decoder box would receive audio from one EBS source. On reception of the emergency trip signal, a front panel speaker (and remote output) would unmute, allowing the operator to hear preliminary emergency information. A front panel indicator would indicate how many seconds the operator has to exercise his or her veto over the program interruption.

Should the operator take no action, 30 seconds after receipt of the emergency trip signal, the encoder/decoder box would interrupt a loop-through program audio circuit, send a locally generated emergency trip signal, then send the received emergency programming until an EOM signal is received.

These "one or more" identical encoder/decoder boxes would have program audio looped-through each. As such, the program loop-through should support discrete stereo (a common shortcoming in current EBS encoders). To allow the EBS encoder/decoder to be put at a transmitter site between a composite STL and an FM transmitter, it should also include switchable pre-emphasis, allowing the received emergency programming to directly replace the composite stereo with mono pre-emphasized audio.

The encoder/decoder boxes should include full provision for remote control and monitoring.

Sample case

In my area (San Luis Obispo, Calif.), encoder/decoders at each station could be driven by an AM receiver, an FM receiver, a NOAA receiver, a state emergency radio network receiver, a dedicated telephone line from the county Emergency Operations Center and a dedicated radio link from the county Emergency Operations Center. On sending the appropriate signal, the county EOC could be on the air on every station in the county within 30 seconds.

EBS can serve to alert the public of an emergency and can provide emergency information to the public, once it has been alerted. In the San Luis Obispo area, a radio linked siren system is available to alert the public of emergency conditions, causing them to turn on their radios.

EBS is then relied upon to inform the public of any emergency information or instructions. The public also could have receivers that react to the EBS attention signal, though such receivers appear to be rather rare. With a uniform signalling system, perhaps such receivers could become more common.

The current system rarely receives a complete "end to end" test. With level 2 automation, operator training requirements are reduced, since an operator failing to take action results in the emergency programming going on the air. As such, occasional end to end tests (such as from the county EOC to on the air on all broadcast stations) could be run when audience levels are low.

The use of non-dedicated radio links (such as occasional use RPU or local government radio channels) may open the system to false activation. If the frequencies and codes used to activate the EBS system become known, someone could transmit false or non-emergency information on all the stations in an area.

□□□

Harold Hallikainen is president of Hallikainen & Friends, a manufacturer of transmitter control and telemetry systems. He also teaches electronics at Cuesta College, San Luis Obispo and is learning Contra dancing. He can be reached at 805-541-0200. He can also be reached on internet at ap621@cleveland.freenet.edu or through CompuServe at >INTERNET: ap621@cleveland.freenet.edu.

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THD- .008%, Dynamic Range >85dB,
Freq Response- (+)(-).5dB 10Hz-15kHz

Physical Specifications
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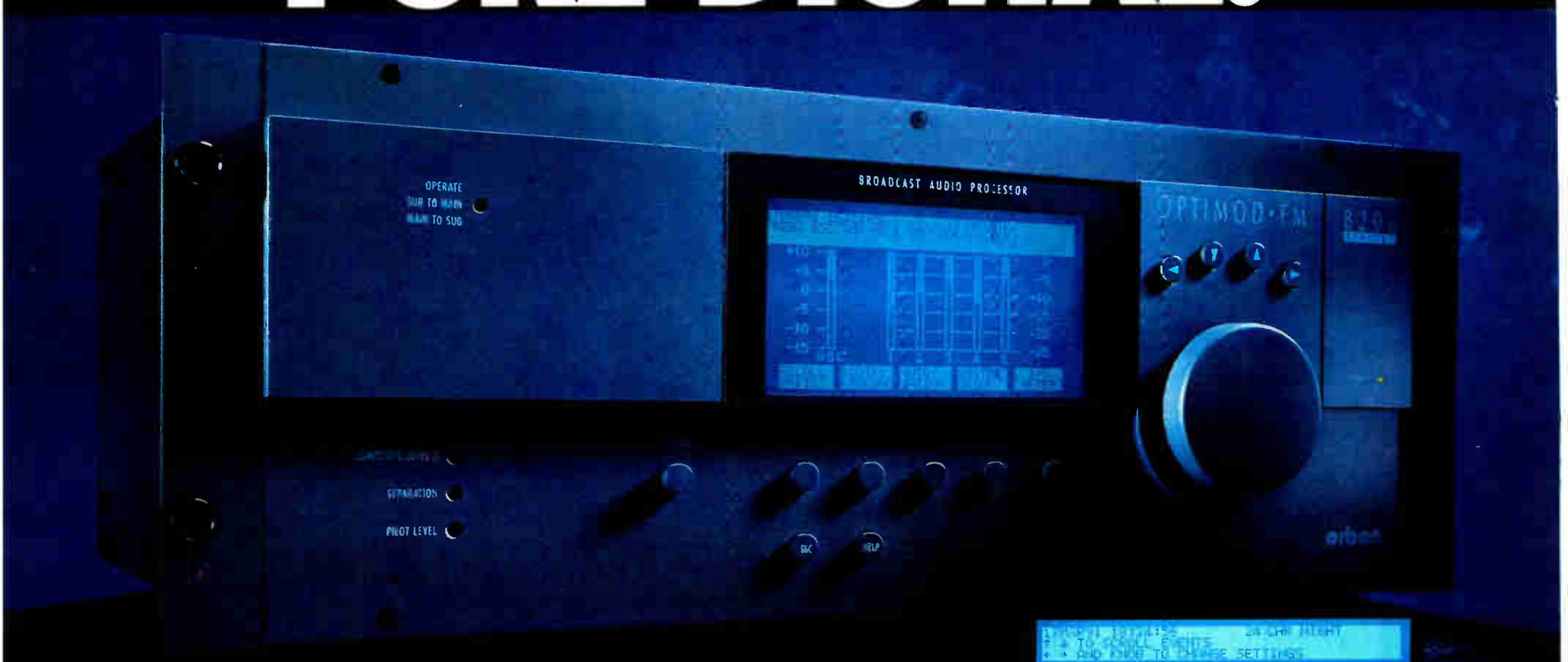

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At the Core of Coils and Transformers

This is the third in a 10-part series called Fundamentals of AC. Northern Virginia Community College will offer 1.2 CEUs (Continuing Education Units) to registered students who successfully complete an examination mailed at the conclusion of the course.

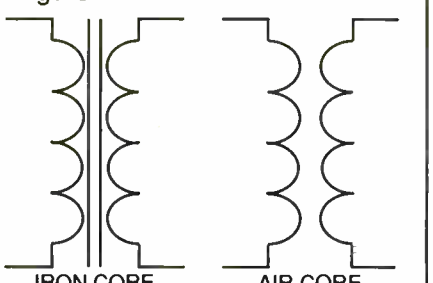
To register, contact the Community Education Office, Annandale Campus, 8333 Little River Turnpike, Annandale, Va. 22003, or call 703-323-3168 or 323-3528. The fee for the course is $30.

by Ed Montgomery

Part III of X

ANNANDALE, Va. All electrical conductors have a magnetic field around them when electrons are flowing. The magnetic field can be condensed by winding the conductor into a coil, making it appear stronger. The magnetic flux can be concentrated around the coil windings if a ferro-magnetic material, usually soft iron, is placed in the center of the winding. This is known as the "core."

Figure 1.



Lenz's Law states: The voltage a coil induces will oppose the current flow that originally created it. This is known as self-inductance.

Self-inductance creates some interesting characteristics for coils. The AC properties of voltage, current, and resistance are much different than what would happen if DC were passed through the device.

A transmitting antenna, for example, can measure a minimal resistance if measured with a multimeter. Yet when the transmitter feeds the radio energy to it, a "load" is established. At the radio frequency, a short circuit is not present. The antenna resistance, or impedance, is developed by the properties of inductance and capacitance working together. More on capacitance in a later chapter.

Coils

Coils, also known as inductors, are measured in henrys. The size of the coil, how much inductance it has, is determined by its construction. The length of wire determines how much inductance can be produced.

If coil "A" has twice as many turns as coil "B," then the inductance of coil "A" will be four times the inductance of coil "B." A coil that contains a larger turn circumference will have greater inductance. Inductance decreases when more length is used for the same number of turns of wire because the magnetic field is less concentrated.

Figure 2.

$$\frac{Np}{Ns} = \frac{Vp}{Vs} = \frac{Is}{Ip}$$

N = Number of turns in transformer winding
P = Primary winding
S = Secondary winding
V = Voltage
I = Current

All these factors must be considered when coils are designed. In the age of circuit boards and microwave technology, all these factors are considered to permit these devices to fit on or in the circuit board. Sometimes the proper amount of inductance can be generated by an etched strip of copper on a circuit board.

Transformers

When two coils are wound together they become a transformer. Schematics of transformers are illustrated in Fig. 1. The transformer consists of one coil that is energized by an AC electrical source. This is the primary coil. The second coil has voltage induced into it through the principle of inductance. Coils that receive their energy this way are known as the transformer secondary. More than one secondary coil can exist in a transformer.

The relationship of voltage and current can be changed by adjusting the number of turns of wire in the primary and secondary windings. The relationship between primary and secondary windings is known as the turns ratio. If, for instance, the secondary winding has twice as many turns as the primary, twice as much voltage will appear on the output. The available current's value will be halved. This would be a step-up transformer.

Reducing the number of turns in the secondary will reduce the voltage, increasing the current proportionally. Fig. 2 is an illustration of the turns ratio, showing the relationship of "N," the number of turns of wire in the windings, "V" being the voltages in the windings, and "I" being the current flowing through the windings.

Current, of course, only flows in the secondary if a a load is attached across the windings. The power relationship in the primary and secondary is, for all practical purposes, equal. Transformers do not increase or decrease power. Iron core transformers transfer almost 100 percent of all their energy from the primary to the secondary. Air core transformers are less efficient but operate more effectively at radio frequencies where less inductance is required.

Eddy currents

Transformer and coil cores can produce an internal magnetic field that can oppose the currents in the windings. This opposition generates heat. An electrical current flows in a circular motion within the core. These "eddy currents" need to be contained because they can reduce the amount of energy that can be passed by coils and transformers. This is illustrated in Fig. 3.

Figure 3a.

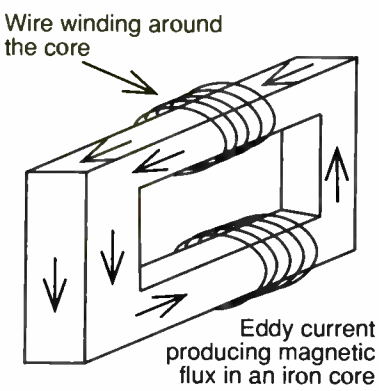
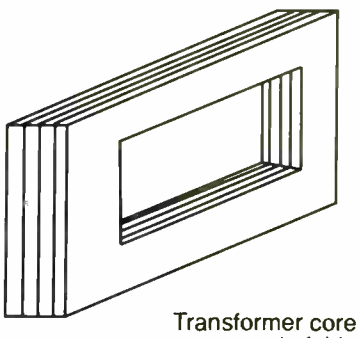


Figure 3b.



The effects of eddy currents can be greatly reduced with a laminated iron core. An illustration of this is in Fig. 3 "B." The laminated core consists of thin wafers of soft iron glued together. As the transformer ages, the glue often lets go and the laminated plates vibrate. Plate modulated AM transmitters often have modulation transformers acting as loudspeakers, with audio emanation caused by vibrations of the laminated core.

Coils, also known as inductors, are measured in henrys.

Transformers and inductors are used throughout broadcasting. Adjustable coils in combination with capacitors are used to tune the transmitter. They are also used in the phasing arrays of directional AM antennas to divide power and adjust the current phase in each tower.

Coils and transformers can be tested quite easily with a multimeter for DC resistance or with an inductance meter

continued on page 34 ▶

OFFBEAT RADIO

DCC Format Has Its Coming-Out Party

by Dee McVicker

UNIVERSAL CITY, Calif. Andy Warhol once said eveyone will be famous for 15 minutes. If that's so, then DCC, or digital compact cassette, recently got a lot more than its share of fame.

In a 90-minute show hosted by comedian Sinbad, the first radio satellite broadcast from DCC source was transmitted to 100 stations to kick off the release of the new album by recording artist Bobby Brown.

"Bobby" was among the first titles released on DCC by MCA Records, the label company for the new release and the sponsor for the event. "We decided to launch it the night before it was in stores by doing a live party on the air," said MCA Records' Ron Shapiro.

A national party

The on-air party was aired from Universal City, Calif., through Entertainment Radio Networks satellite syndication in order to share the highly charged evening with a nationwide audience. Seven cuts from the new album were aired from DCC tape and call-ins, and interviews were conducted by Sinbad.

Technics' new RS-DC10 DCC deck was rolled into Entertainment Radio Networks studios to make the DCC debut, and according to Barry Freeman of the radio syndication network, "Instead of running the music off of CD, we just ran it off of DCC."

This event marks the introduction of a new format that may have a significant impact on radio. Two years in development by Philips and Matsushita—the parent company of MCA Records and Technics/Panasonic—DCC is now making good on a promise to deliver CD quality audio on digital cassette tape.

The DCC format boasts compatibility with existing analog cassettes and sound quality comparable to CD. Along with its rival in the new digital format wars, Sony's Mini Disc, DCC has been keenly anticipated by consumers and has many supporters in the broadcast industry as well.

Expecting widespread consumer acceptance of DCC, major recording companies and labels such MCA, Geffen, DGC, and GRP Records have begun releasing album titles on DCC.

On the first day of December, 38 titles by MCA had been delivered on DCC to stores nationwide; over 200 more are expected to be on the shelves before early 1993.

Hardware is ready

Paralleling software availability, DCC hardware is also now starting to hit major consumer stores. On October 27, Panasonic Company Vice President Richard Lovisolo delivered the first consumer DCC deck to Rabson's, a high-end audio/video store in New York City.

The delivery was made after a DCC kick-off campaign that included promotions in conjunction with "Rocktober," the annual music fest hosted by New York rock station WNEW-FM.

More DCC machines—priced in the $1,000 range—have been shipped since. Proponents of the format hope to make DCC the successor to analog cassettes for home, car and even in radio applications.

The features of DCC most likely to be met with approval by broadcasters are its recording method, its ability to store and retrieve record title information and the wide availability of record titles expected to become available, once fueled by consumer acceptance.

DCC is considered more spectrally efficient than CD technology—by 25 percent

DCC is considered more spectrally efficient than CD technology–by 25 percent.

or better, according to the manufacturers. DCC uses the selective PASC (Precision Adaptive Sub-band Coding) system to record only what can be heard by the human ear, freeing up tape space for other important digital information, including song title, artist, and record label.

This last feature could be attractive for radio, which recently adopted a radio broadcast data system (RBDS) standard, making the reception of this information possible on new RBDS-equipped radios. In fact, the first DCC decks available from Technics have built-in LCD screens for this information.

Moreover, unlike digital audio tape (DAT), which uses a mechanical "helican scan" recording drum that spins at high speeds to read a tape, DCC uses a stationary digital record/playback head and is mechanically simple, a plus for reliability.

□□□

Dee McVicker has been covering the broadcast beat for four years as a regular contributor to **RW** *and as a freelance writer specializing in industry newsletters, manuals and brochures. She can be reached at 602-545-7363.*

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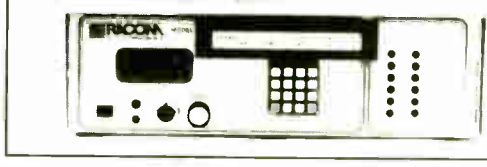

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BOTTOMLINE BROADCASTER

Resurrecting Studio and Production Room Boards

Give a Console New Life With Updated Electronics

by Jim Somich

BROADVIEW, Ohio In the last installment of *Bottomline Broadcaster*, I covered the mechanical considerations of rebuilding an audio console. This time we will conclude with electronic considerations. Many audio consoles will not require mechanical rebuilding and just need up-to-date electronics for a new lease on life.

The building blocks

The electronic building blocks that are a necessary part of every audio console are: power supplies, line amplifiers, microphone amplifiers, power amplifiers and balanced-to-unbalanced interfaces. In past issues of *Bottomline Broadcaster* we have covered each of these blocks in some detail. Our purpose here will be to see how these blocks can be implemented in a full console rebuild.

The best chance of your work standing the test of time is good documentation.

If you keep a file of back issues of RW, we covered balanced-to-unbalanced interfaces in March and April, power supplies in May, line amps in June, mic preamps in July and power amplifiers in October.

Be sure you have plenty of time. Don't try to rebuild your main production console in a weekend. Try to think out the entire project ahead of time and have all of your modules built and tested before tearing apart a console you may need in short order.

If you can salvage the wiring harness in the board you are rebuilding, you will save dozens of hours over building a new harness. In most cases, the existing harness will work with only minor modifications.

The console wire I prefer for new harnesses or additions is Mogami Neglex Console cable. It is available from Marshall Electronics as part #2574 or #2944 with drain wire. Marshall's phone number is 310-390-6608. Other companies make similar wire. If you have a company you prefer to do business with, find out whether they make anything comparable.

Draw it first

Start by sketching a block diagram of the console as it existed and how you wish to change it. In many cases the block diagram will not change much at all. You will just be replacing each module with a new one.

This is a good time to sketch the basic circuit elements of your new modules. In most cases, these can be single chip replacements. The power supply can be externally mounted for best noise performance.

Remove each old module and carefully label the wiring. In most cases, you will have an input, output, and power connections. Mechanically it is easiest to fabricate the new modules to interface directly with the old console. If slide-in cards are used, have your PC boards made to size. If the modules are in cans, often you can salvage the cans for your new modules. In most cases you will not be dealing with modules that are an integral part of the front panel, since this method of fabrication has only been used on recent boards.

The preferred method of fabrication is a PC board. You can lay out your boards on a PC using software such as SmArtwork or you can use stick-on wiring and etch and drill your own boards. Professionally fabricated boards are less expensive than you might think, especially if you need more than one.

Making PC boards is beyond the scope of this article, but the back of most of the experimenter magazines list the components necessary.

Stuff your boards with top-quality components. Use low-noise film resistors and film-type coupling capacitors where possible. All ICs should be socket-mounted. When given a choice, try to use components with a higher voltage rating than you think necessary. Remember, your work may have to stand the test of day-to-day operation for 10 years or longer!

Fine tuning

Once you have your new modules installed, your only problems will probably be ground loops and small wiring errors. You might have to juggle the gain of certain modules a little to make things come out right, but this is easy with most op-amp blocks. Check every function and cook your new board for at least a week to work out bugs.

The last step may be the most important: documentation and measurements. Every project of this magnitude requires documentation. Be considerate of those that will come after you and how they might feel about a "home-brew" console.

Draw detailed block diagrams and schematics of your work. If you have a schematic program for your PC, this is a good chance to give it a workout. The best chance of your work standing the test of time is good documentation.

Perform every audio measurement you can and document them all. If you have done your job well, you will exceed every specification of the original console.

Rebuilding an old console can be a great source of pride and satisfaction...and you can save thousands of dollars in the process.

This article completes my involvement with my *Bottomline Broadcaster*. I hope you have gotten a few good tips and have had as much fun reading them as I have writing them.

□□□

Jim Somich is president of Somich Engineering and chief engineer of WOIO(TV) in Cleveland.

DIGITAL DOMAIN

Take the Long View When Considering Digital Editing

by Mel Lambert

STUDIO CITY, Calif. In the course of my consulting functions, I am asked a number of questions about digital technologies. Aside from the inevitable quizzing on emergent recording formats, it seems that a number of stations are still coming to terms with the basics. Realizing that digital recorders and editing workstations can offer substantial advantages, many chief engineers that I talk to are unsure about the best way to take that important first step.

Their concerns are well founded. Replacing existing reel-to-reel multitracks with a hard disk-based system can be expensive. Also, there is the inevitable learning curve as station staff come up to speed with recording, editing and mixing software.

Where to start

As with all new technologies, getting to first base can be confusing. There are literally dozens of choices, ranging from relatively simple two-channel cards that plug into PCs and Macintoshes, to full-blown, stand-alone systems with dedicated controllers. Somewhere along the complexity continuum lies your "perfect system."

One question that I'm asked a couple of times a week goes along the lines of: "Should I start with a small, plug-in board design, and then upgrade as our requirements develop?" Or: "We aren't sure if our non-computer literate staff can handle the change from razor-blade editing, so we need to find an easy-to-use system." All reasonable considerations, but maybe missing the obvious.

My advice to such users is that they need to make a clear decision. Is the technology going to replace an existing system, and be viable from day one? Or are we talking about transitioning from analog-based recording and editing to a random-access system whose final size and complexity will be subject to review over an extended period of time?

Yes, it makes a great deal of sense to evaluate your needs, and then proceed to select a digital system that best suits your needs. And, if you have little experience of random-access recording and editing, proceeding step by step offers a number of advantages. What I would counsel against, however, is to base your buying decisions solely on hardware costs.

Not for one minute am I suggesting that you lay down whatever it costs to secure access to a reasonably high-speed PC/Mac platform, hard drives (at least 100MB; 300MB is better), monitors and peripherals. Rather, I am advising that you examine the software being offered with the technology, instead of simply expecting all designs within your price bracket to be basically the same.

Take the slow road

Conventional wisdom, for the inexperienced, is that you can upgrade a level-entry system into a more complex workstation as your needs develop—and the sophistication/expectations of your station staff increase. Unfortunately, this is not always the case. With rare exceptions, the majority of recorder, editor and workstation manufacturers offer only one or two products.

Also, such systems are usually targeted at a specific market niche: maybe a relatively simple card for recording analog/digital signals to hard disk, or a segment-based editor with no on-board mixing/DSP functions.

In these instances, having mastered the system's functionality, when the time comes to upgrade—add more tracks, for example, or maybe signal processing—you will probably be out of luck. The only viable alternative is to replace the unit with another brand, and start the learning curve over again.

Don't expect all designs within your price bracket to be basically the same.

As an alternative, I would suggest that it make more sense to carefully define your operational needs, and then shop for the software that best covers the bases. Then and only then should you consider the hardware that is going to achieve the results for you. (OK, the software/hardware decisions are not totally unconnected. But separating one from the other will at least allow you to appreciate the system's functionality.)

Resist the urge

In my experience, some stations that have "experimented" with digital by selecting a relatively simple PC card have been either disappointed or frustrated with the results. These stations have found that the companies whose products they selected didn't offer them the support and scope they needed, in terms of upgradeability.

Why not contact your local dealers and have them come by to demonstrate their wares to you and your staff? (And so much the better if you can organize several demonstrations on the same day.) Have your operators carefully examine the front-end software for the proposed editor or workstation.

Examine the way in which the user will need to navigate through on-screen menus and dialog boxes to record, replay and edit sound files. What about the sample-accurate edit window, and the scrub-edit functions? Are these mouse-driven, or implemented from a separate controller?

By concentrating on the in-use applications for the new digital recording, editing and mixing system, you and your station staff will be in a far better position to make a viable decision, rather than simply adding more confusion to an already complex buying decision.

Mel Lambert has been intimately involved with the production and broadcast industries on both sides of the Atlantic for more that a dozen years. Now principal of Media&Marketing, a Los Angeles-based consulting service for the professional audio industry, he can be reached at 818-753-9510.

ECLECTIC ENGINEER

Grab Your Listeners by the Ears

Careful Planning Can Help You Reap the Rewards And Avoid the Pitfalls of Station Promotions

by Barry Mishkind

TUCSON, Ariz. Broadcasting is an exciting business. The sense of immediacy and being part of a live entertainment medium with rapid feedback from listeners comes from precious few other careers.

Yet, out in the field, in the listener's shoes, sometimes we can be downright boring. Few personalities can command the listeners' attention for very long. To overcome that, and prevent the dreaded button push, there's a constant effort to develop ways to grab listeners by their ears.

Often the answer is for the station to present a promotion or contest.

Promotions alleviate boredom

Usually it's the programming department that comes up with the idea for a promotion. It's the program director who usually has the most at stake. His goal is to improve the station's visibility and ratings.

Knowing his job may depend on the next "book," he has to come up with a better promotion than the other stations, and then sell the general manager on funding it.

What we hope to do here, is examine the reasons for staging a station promotion, as well as some of the tricks, tips and traps that make the difference between a successful promotion and a disaster.

Like anything else in life, proper planning is the key. Having definite goals for the effort will prevent diffused promotions that don't grab the audience.

For example, giving away tickets to a rock concert likely won't help improve your 25-49 demographic very much, even if the tickets are supplied free by the concert promoter. Among other reasons, that demographic just doesn't go to too many rock concerts.

Of course, a promotion to benefit a client is not prohibited, or even necessarily doomed to failure. A good match-up of station, client and promotion can produce super results. But the station must know going in whether the contest is designed mainly for the client or the station's long-term success.

How committed are you?

Another question that must be addressed early is what kind of commitment the station has to the promotion. That's commitment as in budget. Money. Depending on what expectations the station has, the contest may be the cheapest part of the promotion.

Yes, good results can be had on a minimal budget in some demographics. Giving away albums or theater tickets to designated callers or through some simple trivia questions can be very effective because it allows for having lots of winners from among your audience.

On the other hand, if you desire to reach into the market and grab listeners, especially those that don't normally listen to you, you'll need to spend some serious money. Print ads, TV, bus cards, billboards, etc. are all important in communicating to the public that "something interesting is going on right now at K-109."

Which comes first, the promotion or the money? It depends. Some ideas lead to tremendous all-out promotions. Some result in quiet, friendly contests. One trap to avoid is saying, "Well, we've got X number of dollars to spend, so let's run a contest." That can not only be wasteful, but owners tend to resist repetition and cut budgets.

An essential step for all but the most experienced promoters is to talk to the air and sales staff. Find out what ideas or concerns they can contribute to the planning. They may know about a similar promotion run just before you came to town.

Outline everything

What kinds of prizes will be awarded, and how many, may depend on the sales department. Often, they can get some clients to add prizes to the pool, creating opportunities for more prizes, more winners, more excitement.

Some contests can sound great but be a nightmare in the control room.

The staff can also be helpful in developing the rules and procedures for the contests. Some contests can sound great but be a nightmare in the control room. What's more, sometimes a contest can turn into a lottery while you're not looking, creating potential problems with the FCC Rules.

What's a lottery? According to Section 73.1211 (b), the key factor is, with some exceptions, when you have prizes, chance and consideration all tied together: "...if in connection with such program a prize consisting of money or other thing of value is awarded to any person whose selection is dependent in whole or in part upon lot or chance, if as a condition of winning or competing for such prize, such winner or winners are required to furnish any money or other thing of value or are required to have in their possession any product sold, manufactured, furnished or distributed by a sponsor of a program broadcast on the station in question. (See 21 FCC 2d 846 [18 RR 2d 1915].)"

Another sort of promotion to avoid is one that will upset public order. Scavenger hunts and similar contests can create crowd or traffic problems with police and with citizens that don't appreciate hordes of listeners racing around them or tearing up their property. It might sound cute, but the costs afterward—financially and in terms of public relations—might not be worth it in the end.

Once you're sure the promotion is safe, and won't create problems, it's time to set the contest rules down on paper.

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Barry Mishkind, aka **RW***'s "Eclectic Engineer," hides out in Tucson, AZ. He can be reached at 602-296-3797. Or, try BMISHKIND on MCI Mail, or "barry@coyote.datalog.com" on Internet.*

WORKBENCH

▶ continued from page 21

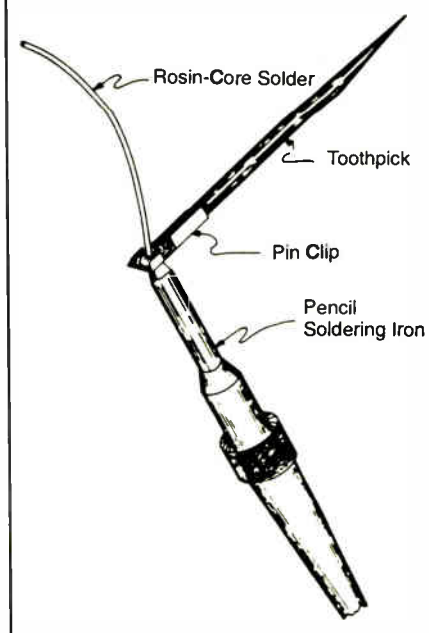
down wooden swab will work just as well, and are usually more plentiful around a radio station than toothpicks!

Nortronics provides an interesting set of instructions with its replacement head kits. The instruction sheet discusses head wear, alignment, height, and replacement procedures for record, playback, and erase heads. For information, contact Nortronics Company at 612-545-0401 or circle **Reader Service 40**.

★★★

Most console furniture has rack space located under the console, or down the side of the pedestals. These spaces are ideal for locating such things as console power supplies or monitor amps. The only problem is the occasional bumping of these devices. When the bump involves the power switch, expect a call at 3 a.m.

Figure 2.



Rather than leave the warmth of your bed, make a minor investment in the perforated ventilation panels manufactured by Mid Atlantic. These panels come in all sizes, and can be mounted as "security panels" over the front of the equipment you want to protect. They'll protect the switches or knobs from being bumped, and the perforations allow you to still see the front panel indicators.

The same wooden swab you used for the pin clips can be easily inserted through the perforations to toggle a switch on or off. In the case of rotary knobs, a nibbling tool can be used to cut away a hole big enough for finger access, but the rest of the panel protects the knobs from being inadvertently bumped. For information on Mid Atlantic Ventilated Security Panels, circle **Reader Service 135**.

□□□

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Transformers And Coils

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for a direct measurement of inductance. If a coil or transformer's windings are good, they will show a small amount of DC resistance and some value of inductance. If the windings are open, infinite resistance will be measured. If the secondary winding of a transformer or its load shorts, the primary windings current will increase producing heat.

If the transformer is not fused, the windings could burn out. A color code for coils and transformers exists to assist technicians in determining primary and secondary windings of a transformer as well as the inductance value of a particular coil. This code can be found in many electronics handbooks as well as equipment manufacturer catalogs.

Further study of coils and transformers can be found in Chapter 17 of "Basic Electronics," by Bernard Grob and published by McGraw-Hill.

□□□

Ed Montgomery is a communications teacher at Thomas Jefferson High School for Science and Technology. He has taught broadcast engineering at Northern Virginia Community College and worked as a broadcast engineer for several radio stations. He can be reached at 703-750-5090.

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Circle (133) On Reader Service Card

Evaluating an Ideal AM 'Broadband' Antenna

▶ continued from page 11

stainless steel angle iron, permanently attached to the tower. They are usually mounted at least 10 feet above ground, and may be insulated or at tower potential (although it is more common and better to operate sampling loops at tower potential).

In the case of non-insulated loops, the sample line is wound into a coil (called an isocoil) inside the ATU enclosure, the bottom of which is returned to ground. The sample line itself is usually bonded to the ATU output or tower, where a spark gap can protect the line against lightning damage.

Loops have the advantage of better accuracy when initially adjusting an array. The isocoil provides a DC path to ground, thus functioning as a static drain choke. The main disadvantage is instability, largely due to exposure to the elements. All the electrical and mechanical connections are subject to the elements—moisture, corrosion, wind, ice, snow and lightning, to name a few.

If a ground system needs to be replaced, count on $15,000 per tower to do so.

After a really big thunderstorm, whacked-out antenna monitor readings may well be caused by loops that have rotated and are no longer mounted perpendicular to the opposite tower face.

Shielded current transformers have the advantage of small size, and are mounted in the (somewhat) controlled environment of the ATU housing. These devices are inherently stable, and their use eliminates the isocoil necessary for loops at tower potential.

Their primary disadvantage is that in addition to measuring current flowing up the tower, they also measure the current flowing to ground through the base insulator capacitance. On towers taller than about 130 feet, their use is impractical. Also, a separate static drain choke is needed.

When examining a sampling system, look at the tower heights. Taller towers probably require sampling loops. Otherwise, it may be practical to change to current transformers. If sampling loops are present, examine them for corrosion and structural integrity, and look at all the electrical connections. Be especially alert for cracked or broken insulators. If transformers are used, look for evidence of lightning damage. Such damage often leaves black soot marks on the outside of the transformer and may short part of the coil within to ground.

Finally, find out if all the sample lines are of equal length. If they are, the lines from the closest tower(s) must have excess length coiled up somewhere. Find out where.

Filter systems

Sometimes, when another AM station is close by, it is necessary to control the current on a station's tower(s) on the other frequency in order to avoid disturbing this pattern or causing intermodulation products. Such filters consist of series and parallel resonant circuits at the desired and undesired frequencies.

The goal is to achieve a low impedance (pass) on the desired frequency and a high impedance (reject) on the undesired frequency. A low L/C ratio is desirable in such circuits to avoid excessive losses.

If you find filter circuits in place at a station you are checking out, ask a lot of questions. What are the filters for? Under what circumstances or FCC order were they installed? Who designed them? Who installed and tuned them?

Several AM stations can operate from a single antenna tower if the frequencies of the individual stations are not too close together and the electrical height of the tower is not too tall or short at any of the frequencies.

If the operation you are examining has a diplexed or multiplexed site, find out all you can about the multiplexer. Who designed it? Find out and discuss the design, installation and operation with that person. Who built it? Who maintains it (often, this is an independent third party)? What is the frequency and power of every station using the system? Talk to the engineer at each of the stations and get his impressions. Find out if the system is troublesome, and whether good isolation and bandwidth exist.

Multiplexed systems can result in great economy of operation and are desirable in many instances, but they can also be nightmares. The only way to find out is to ask questions.

Ground systems

The best way to find out about a station's ground system is, again, to ask questions. When was it installed? Does it conform to the station license? Has it ever been damaged/repaired? I recently asked these questions about a ground system installed under a freight terminal's asphalt parking lot and found out that there was an "as-built" drawing showing the location of each and every radial!

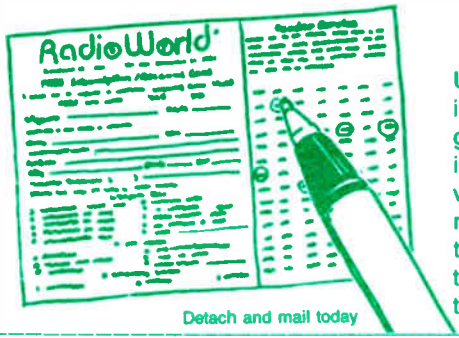
Look at the exposed portions of the ground system. If these parts are eaten up with corrosion, chances are good that the buried parts are also corroded. Look for evidence of trenching (such as signs warning of buried telephone/power cables or pipelines) within the area occupied by the ground system. Find out who did the trenching, and whether or not any radials were cut/repaired.

If a ground system needs to be replaced, count on $15,000 per tower to do so, unless you do it yourself (in which case it will be a little less).

In this series of articles, we have touched on all the major things to look for when examining a radio station's technical facilities. You may be looking over the station because your employer is considering purchase of the station, or you may be a contract engineer thinking of taking on a new client.

□□□

Cris Alexander is director of engineering for Crawford Broadcasting. He can be reached at Box 561307, Dallas, Texas 75356.



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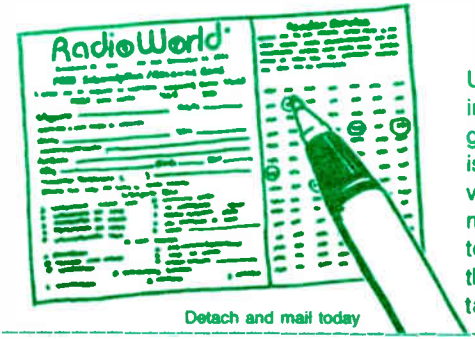

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OLD TIMER

Inventor Beams Signal Across the Atlantic

by George Riggins

LONG BEACH, Calif. We last left Guglielmo Marconi and his two assistants in St. Johns, Newfoundland, ready, waiting and listening for the pre-arranged signal from Poldhu, England. The date was Dec. 12, 1901 and the clock read 1500 Greenwich Mean Time (GMT).

The pre-arranged signal was to consist of the letter "S" on a repetitive schedule. The transmission was set to begin at 1500 GMT and last through 1800 GMT.

The St. Johns crew first detected the signal 30 minutes into the vigil. Marconi and his assistant, Kemp, heard the signal, although Paget could not, because of his partial loss of hearing. The signals were not picked up on a continuous basis.

The second day's watch was continued with intermittent reception. The difference in the signals was later attributed to a 2,000 mile cold front that lay between Poldhu and St. John's.

Immediate fallout

After the second day of reception, the three felt that they had established the fact that wireless signals could be sent across the Atlantic Ocean on a regular basis. The announcement to that effect was made to the world on Dec. 14, 1901. The cost of the test? An estimated $200,000.

The announcement of the successful reception of the wireless signal caused the prices for cable company stocks to

drop. Marconi predicted that the price for wire messages would drop to one cent per word or less in the near future (at the time, the going rate was 25 cents per word).

A short time later, the Anglo-American Telegraph Co. served documents asserting exclusive rights to a monopoly of telegraph in Newfoundland. There are those who were of the opinion, at the time, that the claims of the Anglo-American Telegraph Co. did more to boost Marconi and his efforts than almost any other action taken at the time.

The result of the filings by Anglo-American was to cause Marconi to place the first commercial stations in Nova Scotia and on Cape Cod.

Professor Fleming estimated the wavelength of the signal to have been about 960 meters. This estimate was made using the length of the aerial and the size of the series coil—called a jigger at the time.

We should note that Professor Fleming was of the opinion that there should be some method of measuring wavelength. It would take him another three years to build his first cymometer, or wavemeter.

The world reacts

There was much discussion of the event in the news media of the day. Reactions ranged from the ridiculous to the sublime. There were questions as to whether anyone could listen to the signals (as Marconi asserted). Others predicted the scrambling of messages or the use of some sort of code.

Marconi predicted that the price for wire messages would drop to one cent per word or less in the near future (at the time, the going rate was 25 cents per word).

On Sept. 28, 1901, Professor Reginald Fessenden applied for a U.S. patent on an improved method of receiving electro-magnetic waves. Among the statements in the patent application was a comment about the "reproduction of words or other audible sounds." The proposal was to build a high-frequency alternator to generate the waves instead of the spark generator.

An earlier patent filing by Marconi (No. 7777), on April 26, 1900, for a "tuned syntonic and multiplex telegraphy on a single aerial" foresaw the use of tuned circuits and protected much of his later work in both transmitters and receivers.

Gazing ahead

There were two predictions made in 1901 that have taken shape 91 years later. Nikola Tesla, an electrical engineer and inventor, foresaw a more efficient source of light. RF is now being used in a new series of lamps to produce useable light (although they are believed by some, including the NAB, to be a source of interference to broadcasters).

Another prediction that appeared in the newspapers of the day was the belief that eventually even families and friends might each have their own wireless with individual secret "tunes." Does CB radio service fit that prediction? Or perhaps cellular telephony? Naturally amateur radio fits in there somewhere.

Then there was the theory that signals followed the earth much as a worm might crawl on an orange. Oliver Heaviside was the first to suggest that there was something in the atmosphere that reflected the radio waves. Fleming suggested that longer wavelengths could overcome the curvature of the earth and concurrently get better daytime distance from the same power.

Another scientist of the day, Arthur Kennelly of Harvard University, furthered the work. We now know about the Kennelly-Heaviside Layer. We also now know that the longer waves reflect better than the short ones.

Marconi acknowledged the importance of the contributions by others to his ongoing work. On one occasion, when feted by his peers in New York, Marconi commented, "My system is based largely on the works of others."

Several years ago a science fiction writer suggested that radio waves once radiated do not disappear. The previously emitted waves are just lower in strength than currently radiated waves. We only need learn how to detect these waves to be able to hear all that has been transmitted in the past. Sounds intriguing.

□ □ □

George Riggins has experience in radio and electronics dating back to the 1930s. He also is a licensed ham radio operator and has had his own broadcast sales and service company, Riggins Electronic Sales, for more than 20 years. He can be reached at 310-598-7007.

62 YEARS AGO

Reprinted from **Radio World** January 1931. Editor's note: The **RW** of old, printed for a time in the 1920s and 1930s and today's **RW** are unrelated except in name.

Right or Wrong?

QUESTIONS

(1)—Condenser type microphones are used in nearly all broadcasting stations in this country and in Europe.

(2)—Short-wave converters usually don't work effectively with superheterodyne receivers in which there is no radio frequency amplification ahead of the modulator tube.

(3)—A carbon microphone works on the same principle as a compression type, carbon rheostat.

(4)—A B supply filter having series tuned circuits across the line and parallel tuned circuits in series with it, can be made more effective at a given cost than the ordinary filter consisting of shunt condensers and series chokes.

(5)—When the volume is controlled by means of varying the grid bias on the radio frequency tubes, modulation hum usually results.

(6)—When the tone quality of a radio receiver suddenly goes bad it is usually necessary to put in a new set of tubes.

(7)—When a radio receiver is equipped for the playing of phonograph records and the pick-up unit is connected in the grid circuit of the detector, it makes no difference whether the grid bias on the detector is changed or not.

(8)—A resistance is usually connected across the terminals for the field winding of a dynamic speaker when the field is connected in series with the B supply because without the resistance there would be too much current through the field.

(9)—A large by-pass condenser wound inductively may be entirely valueless at short waves, whereas it may be all right at audio frequencies.

(10)—A loudspeaker can be used as a microphone by connecting its terminals to the input of a sensitive amplifier and then talking to the speaker diaphragm. The more sensitive the speaker as a speaker, the more sensitive it will be as a microphone.

(11)—When the grid bias in radio frequency amplifiers utilizing the 224 tube is made very high for the purpose of reducing the volume, hum results due to modulation.

ANSWERS

(1)—Wrong. While microphones of this type are used in most stations in this country, a special carbon type microphone is used more frequently in Europe.

(2)—Right. When there is no radio frequency amplification ahead of the modulator in a superheterodyne there are two frequency changes in succession without any amplification in one of the frequency levels, and it seems that satisfactory results are not obtained with converters under these conditions. Modern superheterodynes now have at least one stage of RF ahead of the modulator.

(3)—Right. When carbon is compressed its resistance to electric current is reduced. It is on this principle that the compression type rheostat works. The carbon microphone works on exactly the same principle. As the diaphragm vibrates under the influence of the sound that impinges on it, it causes changes in the pressure on the carbon granules.

(4)—Right. If a parallel tuned circuit is put in series with the line and adjusted to the hum frequency, the impedance to that frequency will be much greater than that of a choke having the same inductance as the choke in the tuned circuit. Likewise, if a series tuned circuit is put across the line and adjusted to the hum frequency, the impedance of that circuit to the hum frequency current will be much smaller than the impedance of a condenser of the same size as used in the series circuit. Indeed, it will amount to a short-circuit at that frequency.

(5)—Right. This is due to the fact that when the bias has been increased to the point where amplification is poor, the tubes are good detectors or modulators.

(6)—Wrong. If the tone is poor on loud signals, it is indicative of bad tubes, but the probability is that only the output tubes are bad, because these give out first under normal operation.

(7)—Wrong. If the detector operates on the negative bias principle it will not function as an amplifier of the phonograph signals unless the bias is reduced to the value it would have in an amplifier stage.

(8)—Wrong. The main object of the resistance in shunt with the field winding is to insure some current even if the field is disconnected, accidentally or intentionally. If the current should stop entirely the voltage might rise so high as to endanger the condensers.

(9)—Right. A condenser in which the two electrodes are wound so that there is inductance may act as a choke coil for high frequencies and such a condenser would do more harm than good.

(10)—Right. This does not make a very sensitive microphone but it does make one that works. Low sensitivity in the microphone can easily be offset by high amplification in the audio amplifier.

(11)—Right. If there exists any hum voltage in the grid circuits, as is usually the case, it intermodulates with the carrier and passes through the tuners as part of the signal. This condition is manifested by the appearance of hum when the circuit is accurately in tune.

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AMPLIFIERS

Want to Sell

Dynaco ST120, not working. R Robinson, 203-269-4465.

Apt Holman pre, $200; Gates Solidstatesman limiter, $80. P Wells, KJQY, 625 Broadway #1200, San Diego CA 92101. 619-238-1037.

Altec 1570B, $450; 1593B, $100; 1594B, $175; 2200 incremental, $500; QSC 1400, $618; others. S Krams, Intl Cinema Equip Co, 100 NE 39th St, Miami FL 33137. 305-573-7339.

Bdct Audio BA-235 stereo mon amp, 35 W/chnl, MOSFET rack mount w/manuals, $175/BO. R Bauer, Price Bdctg, 35 Century Park Way, SLC UT 84115.

Microtrak 6401 (2) phono pre-amps, $50 ea/BO. M Guidotti, 408-946-9466.

Marantz 8, $1200; McIntosh MC240, $1200; MC225, $750; MC40, $600; A116, $600; MC2300, $1500; Nak PA7AMk2, $1750; NRG PA1, $4500/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

RCA, Altec, Dynaco tube amps, sell of trade. Tracy Eaves, 615-821-6099 (evenings before 10PM EST).

New 250 W solid state amp, $1800. Call for details. Bill Hoffman, 518-583-9490.

Want to Buy

RCA, WE, Gates, Collins. W Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Stereo preamp 0.24 V for driving xmtr. F Smith, 615-624-7126.

Denon POA8000; Sansui B2301, B2302, C2301, C2302; Fisher SA(K)1000; Nak PA5/2; B&W MPA810; ARC M360, D150, D79, D75, D76; Crown Macro Ref; Marantz 1-10; McIntoshes; Peploes. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

McIntosh/Marantz tube gear, working/not, tubes/parts. R Gleen, WJGR, 1718 Shannandona, Wimauma FL 33598. 813-634-1940.

ANTENNAS & TOWERS

Want to Sell

Rohn 45G galvanized 200'tower, gd cond, $2500; (2) Scala HDCA-SEB, 5-element yagi at 97.7 MHz, $175 ea. G Thomas, Oasis Ntwk, POB 1924, Tulsa OK 74101. 918-455-5693.

Phelps Dodge 4-bay horiz HFM series, 4.0 gain on 96.7, exc cond, $2000. 614-286-3023.

Scala 950 MHz (2) paraflector, 6' dia w/mounting hardware, $400 ea/$700 both. T Kolnar, 815-459-7000.

AM phasor & matching components. T McGinley, WPGC, POB 10239, Washington DC 20018. 301-441-3332.

Gates/ERI CP-239 3-bay w/deicers & twr brckts on chnl 240, 3 kW, $750, will deliver reasonable distance for $200. D Vobbe, Great Northern Bdctg, POB 5031, Lima OH 45802. 419-228-4199.

ERI 3-Bay rototiller, medium power, excel. 816-635-5959.

Cablewave APD 1030 dehydrator; CBS Labs Automax 3, mono, $45 ea; CBS Labs DPE 450, $45; Electro Impulse 5 kW load, bad load resistor & oil must be replaced, 1 7/8" EIA conn, $50; Mod Sci CP 803 composite clipper. B Umberger, WMTX, 18167 US 19N #500, Clearwater FL 34624. 813-536-9600.

RCA (8), 3 1/2" hard line bullets, fair cond, BO. M Everhart, KXYQ, 111 SW 5 #1550, Portland OR 97204. 503-226-6731.

Andrew 87G-83799 (2) 1 5/8" EIA flanges, new, gas blocking, $100 ea; Andrew 34660 inner conn assembly, new, $15. B Brewer, KOKL, 410 W G, Okmulgee OK 74447. 918-756-5400.

Andrew 50 ohm (2) reducer conns, 1-5/8" to 7/8" $125 ea; 7/8 to N adap 2260B, $75; 5 1/2' LDF5-50A w/L45R 7/8" flange on ea end, $150; (2) 204989 1-1/2" grid kits, $10 ea; 204989-2 7/8", $15. M Guidotti, 408-946-9466.

Gentner VRC-1000/2000, high pwr, tuned for 93.7 MHz, BO. P Anderson, KZBQ, POB 97, Pocatello ID 83204. 208-234-1290.

Utility/Rohn 400' tower for FM, gd cond. G Gilbert, CSRG, POB 50539, Denton TX 76206.

Harris/ERI 6-bay FM on 96.9 MHz, 450' 3" Heliax, EIA flanges, BO. T Green, North Star, Hwy 35 E, Bay City TX 77404. 409-245-4642.

ERI 1-bay circ, 95.3 MHz, 9 kW, exc cond, 4 yrs old, $1400. M Persons, KAGE, 402 Buffalo Hills Ln, Brainerd MN 56401.

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Want to Buy

FM 4-bay 1 kW tuned to 96.5, call collect. F Malpica, 52-29-31-86-23.

3-bay FM near 94.1 MHz for 6 kW, immed. B Dunkle, WTYS, POB 777, Marianna FL 32447. 904-482-2131.

Phelps Dodge/FM w/8+bays on 93.3/lower freq; Rhone 80 42" w/2-4 sections. E Moody, 501-273-9039.

AUDIO PRODUCTION

Want to Sell

Eventide H969 Harmonizer, $3250; FL201 instant flanger EFX, $400; Orban 787A prog voice proc, unused, $1500; Dolby 334A FM stereo audio proc w/type 66FM peak limiter bd, GC, $800; Koss dig delay/EFX, GC, $300; Sansui QSE-5/QSD-1B, 4-chnl encoder/decoder syst, GC, $500. E Stolz, KWOD, 1425 River Pk Dr, Sacramento CA 95815.

Sine Syst News Dlr, $950. Randy, WHFS, 8201 Corp Dr #550, Landover MD 20785. 301-306-0991.

Dyaxis dig prod, 30 stereo mins on 320 meg hard drive, analog & dig I/O, $6000. G Ziot, KZST, POB 100, Santa Rosa CA 95402. 707-528-4434.

Eventide BD 980 audio delay unit, $4800. Shawn, WGNY, 429 Little Brittian, Newburgh NY 12550.

ROH 202B dist amp syst, 9 card rack, ea card 1x6, 600 ohm bal outputs, level trimmers on ea card, cards mdl 211B/ADA, $250+s/h. D Vobbe, Great Northern Bdctg, POB 5031, Lima OH 45802. 419-228-4199.

JVC 4-DD-5 CD-4 quad disc demod, unused, $75/BP. D Pulwers, 703-751-9346.

RTS 405 phono preamp, (3) balanced out, 2 level present, exc cond, $150 ea/$400 all. J Somich, Somich Prods, 1208 Stoney Run Trl, Broadview Hts OH 44147. 216-546-0967.

SAE 5000A impulse noise reduc, gd cond, $150; dbx 118 expander/compressor, exc cond, $125; JVC SUA-400-J surround sound proc, new w/rem, $150. R Gleen, WJGR, 1718 Shannandona, Wimauma FL 33598. 813-634-1940.

Studio Sound S305, vintage passive filter sets, matched pr, consec #, rackmount, rare, $175/ea/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

dbx stereo noise reduc unit w/manual, rack mount, $100/BO. M Guidotti, 408-946-9466.

NRSC-PR pkg w/standards, pre-emphasis & audio filter, $200. B Brewer, KOKL, 410 W 6th, Okinulgee OK 74447. 918-756-3646.

MCI JH110A 2-trk in stand w/sound & vision remote/locator, $1200; **Orban 674A** paragraphic stereo EQ, $600; **Fostex 3070** comp/limiter, $150; Foxtex 3180 reverb, $50. W Gunn, 619-320-0728.

TT (Bantam) ADC patchbays, 144 pts, 1 rack sp, $129; **Tannoy HPB385A** 15" coaxial monitor pair in cabinet, $1750; **Altec 436A** tube compressors, Daven attn, both $700. W Gunn. 619-320-0728.

Laserline 90 CD strg rk (8), nw $18 ea; **dbx 150X** noise reduct (2), $125 ea; **Sony 7506** hdph (8), nw, $66 ea; **Radio Systems RS-1000 DAT** (2), $2200; **Radio Systems RS-1000 DAT** (rblt), $2600; **Nakamichi MR-1,** $600. Berler Communications, 708-263-6400.

Prophet 600 synthesizer, $450; **Spectro Acoustics** rack mount 200 W amp, $150; **Crown VFX2** electronic crossover, $125. W Gunn, 619-320-0728.

AKG 414 P48 like new, $675; **Dynaco 410**, 400 W amp, $400; **dbx 1BX** expander, $135. W Gunn, 619-320-0728.

SKL HI/LO variable filter (pair), $200. W Gunn, 619-320-0728.

Roland SPH323 phaser, $75; **Rockmann** sustainer & stereo chorus/delay, $350/both. W Gunn, 619-320-0728.

Want to Buy

Burwen/other, phonograph transient noise eliminator. J Baker, 716-223-1526.

Crown EQ2; Sony SEQ555ES/333ES; Technics SH9090; dbx 10/20, 20/20, 14/10; Yamaha REV5, REV7; Burwen TNE7000. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks 91403. 818-377-5264.

Harris MSP 95. B Lacy, 95.7 KAR, 3611 Soncy #6A, Amarillo TX 79121. 806-359-4000.

Fairchild 600 conac or 602 Conex high freq limiters. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

Ampex MX10 or MS 35 mixers. W Gunn, 619-320-0728.

AUTOMATION EQUIP

Want to Sell

BE 16 w/3000 software events, pwr sply, audio & main procs, rem ctrl, CRT, printer, customer & sat interfaces, 10 audio cards, 6 interface cables, spare cards & parts, IGM Go-Cart II 78-tray, (2) 42-trays & IGM spare parts, manuals, (4) Scully PB decks w/(4) BE racks, $6000+s/h. D Brown, KVLE, POB 832, Gunnison CO 81230. 602-645-8181.

Tape-A-Thon Programmer III cont music PB syst w/(4) 10.5" PB decks, master and sub-ctrlers, clock, line & mon amps in self-contained 7' locking rack, current mdl, $5000. E Stolz, KWOD, 1425 River Park Dr, Sacramento CA 95815.

SMC 250 (4) Carousels, $200 ea; (4) 350s, $250 ea; Harris 90s (2) w/consoles, encoder syst w/T1 733 printer, working, 2 encoder systems not working/trade for computer. E Konwinski, WSOY, 1100 E Pershing, Decatur IL 62524.

SMC MSP-1 w/3 SMC R/S Carousels, 3 Ampex R-R PB decks, Gates 55 cart, manuals & spare parts, $5000/BO+s/h. B Ray, KXOX, Box 570, Sweetwater TX 79556. 915-236-6655.

SMC R5350 (2) 24-tray Carousels in rack, $500; Extel printer, $150; Infoton term for Schafer encode center, $50; ESPI auto w/(2) RSM 350 Carousels, $2500. D Rose, KAAA, 2534 Hualapai Mtn Rd, Kingman AZ 86401. 602-753-2537.

AUTOMATION...WTS

Harris SC-90 switching syst w/console, logging equip & 2nd syst for spares & manuals, $1000. G Hamilton, KNTR, POB 308, Ferndale WA 98248. 206-384-5117.

Sentry Format, used 1 yr w/everything, $6500. G Gilbert, CSRG, POB 50539, Denton TX 76206.

SMC MSP-1 2000-event prog w/batt backup, logging printer, (4) SMC 450 Carousels, (3) mono cart P/B, sat switcher in 2 racks, $5995. D Kelly, KWPN, Box 84, West Point NE 68788.

IGM EC w/PC, audio switcher, interlace cards for SMC 250 Carousels; 3 SMC 250 Carousels w/spare Carousel for parts & access, $3000/BO. J Parman, WRNZ, 324 W Main St, Danville KY 40422. 606-236-7106.

SMC RS350 (2) 24-tray Carousels in rack, $500; Extel printer, $150; Infoton term for Schafer 903 w/encode cards, $50; ESP1 automation w/2 RSM 350 Carousels & 4TS 25 tone sensors, $2500. D Rose, KAAA, 2534 Hualapai Mtn Rd, Kingman AZ 86401. 602-753-2537.

Harris 9000 w/3 SMC 350 Carousels, SMC 250 Carousel in 2 racks, $2500. M Persons, KAGE, 402 Buffalo Hills Ln, Brainerd MN 56401.

IGM Go-Cart (4) 42-tray, $2200 ea; (2) 78-tray, $2700 ea. R Klotz, KCNQ, POB 3434, Lake Isabella CA 93240.

Harris Syst 90 w/2 Instacart machines, (4) R-R's, Brain kybd & printer, manuals & racks. J Reardon, KFJB, 123 W Main St, Marshalltown IA 50158. 515-753-3361.

Harris 9000 w/kybd mon, disk drive & 4 Carousel stereo carts; 3 Gates mono cards, BO. A Russell, WNLC, 90 Foster Rd, Waterford CT 06385. 203-442-5328.

Otari ARS-1000 (9), very gd cond, $1000/BO; (2) MW Persons 3A, $5000/BO, 1 extension, adds 5th unit, $150; 6' rack, 2 yrs old, $200. T Green, North Star, Hwy 35 E, Bay City TX 77404. 409-245-4642.

CAMERAS (VIDEO)

Want to Sell

Sony RMP-3 rem paint boxes for Betacams, $700. Dennis, Valley Prods, 6633 Van Nuys Blvd, Van Nuys CA 91305. 818-988-6602.

Sony Trinicon OX-1600 w/CCU, AC adap, Canon zoom, cables, $150+s/h. G Kirby, Gray Fox, 13613 US 36, Marysville OH 43040.

CART MACHINES

Want to Sell

Ampro CT4500 plyr, Audicord rec, 3-tone, w/o hd block, $500. D Rose, KAAA, 2534 Hualapai Mtn Rd, Kingman AZ 86401. 602-753-2537.

BE 2000PS, runs slow, may nd new motor hd, pinch roller, elects OK, $125/BO. S Morse, KWOS, 3109 S 10 Mile Dr, Jefferson City MO 65109. 314-893-7857.

Fidelipac CTR-12, (4), used 11 mos, exc cond, $1100 ea. R Frisch, CERM Bdctg, 6300 Variel Ave #D, W Hollywood CA 91367. 818-887-4246.

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BE 2100 (2) play, $600 ea+s/h; BE 2100 CRPS, R/P, $1000, both stereo, very gd cond w/manuals. F Spinetta, KCEA, POB 2385, Atherton CA 94026.

Dynamax ES10, $600. Randy, WHFS, 8201 Corp Dr #550, Landover MD 20785. 301-306-0991.

ITC SP-0006 (2) stereo PBs, HS recue, $800 ea; (4) SP-0004 stereo PBs, $800 ea; (2) WP-0002 stereo PBs, $800 ea; PD-II rec/PB, $800; RP-0004 stereo rec, PB, $1400. E Stolz, KWOD, 1425 River Park Dr, Sacramento CA 95815.

ITC SP (2) stereo play, Audiometrics elects, recent hds, roller & tape guide, very clean, 3 tones, exc cond, $800 both/$450 ea; (2) Audicord S-series mono R/P, 3 tones, exc cond, $400 ea. T Stine, KCGQ, POB 2077, Cape Girardeau MO 63701. 314-335-9099.

Tapecaster X700RPS, very gd cond, $495; (2) Tapecaster X700PS, very gd cond, $295 ea; Tapecaster RP&P, gd cond, RP, $395, P, $225. A Ishshanian, Advent Duplication, 132 Arbor Oak Dr, Ashland VA 23005. 804-752-6942.

ITC RP, mono, rack mount, new hds, gd cond, $300/BP. K O'Malley, 804-446-2731.

BE 5000 mono R/P, $400. S Keefe, WCNI, CT College, New London CT 06320. 203-447-1296.

ITC 3-deck mono w/WRA, stereo 3-deck, P/B R/P mono, mint cond, BO. J Phillipd, WZOM, 414 Washington Ave, Defiance OH 43512. 419-782-8591.

ITC R/P, mono R/P w/3 tones, desktop, superb cond w/cases, $600+s/h. J Emmer, Paragon Bdcters, 509 3rd St, Peckville PA 18452.

Ampro CT 4500 plyr & Audicord 100 rec w/o head block, $500 both. D Rose, KAAA, 2534 Hualapai Mtn Rd, Kingman AZ 86401. 602-753-2537.

Gates mono, R/P, $500. K Jones, KTLR, 105 W Moore, Terrell TX 75160. 214-563-1071.

ITC 3D play only, stereo triple deck, gd cond, $1100. M Everhart, KXYQ, 111 SW 5 #1550, Portland OR 97204. 503-226-6731.


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BE 3000A stereo R/ P/B, 3 cues in desktop case, $1325. D Kelly, KWPN, Box 84, West Point NE 68788.

Tapecaster 700P P/B, new belts w/150 Hz tone sensor, $475+s/h; PD, single tone, $295. T Crockett, Hot Tracks, POB 10501, Blacksburg VA 24062. 703-953-0222.

ITC SP9003 mono P/B, exc cond w/spare hd & drive wheel, $300+s/h. G Hutchins, Hutchins Sound, 116 Roberta Dr, Hendersonville TN 37075. 615-264-1373.

BE 5300C tripledeck, stereo, PB, mint less than 50 hrs, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

ITC Delta 3D stereo. 2 yrs old, like new, $2295; **Henry Telecart II** (4) avail, $125. Phil Davis, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

Want to Buy

ITC Delta IV stereo rec amp; ESL-V eraser/splicefinder. C Waltman, KSAN, 750 Battery St #200, San Fran CA 94111. 415-291-0202.

CASSETTE & REEL-TO-REEL RECORDERS

Want to Sell

Ampex ATR700 new cond, bdct type, $700; TEAC A3300SX, new cond, $400; Pioneer RT1020L, gd shape, $300; TEAC X1000R, like new, $400; JVC CD1636 pro-cass, new, $300. J Parsons, Parsons Sound Svc, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

MCI JH-110BX 2-trk stereo w/rem in orig rollaround 4-trk cab, $1500; ITC SP mono, $350; UMC 11 mono, $225; ITC Delta I mono reproducers, $950 ea. P Wells, KJQY, 625 Broadway #1200, San Diego CA 92101. 619-238-1037.

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Otari MX5050, mono, 2-trk, gd cond, $500/BO. K O'Malley, 804-446-2731.

Akai X-zoom D w/3 spds, custom deck, great shape, auto rev, manual, $100. D Rushing, Rushing, 11710 Hoyt St, Tampa FL 33617.

Technics RS-1700 auto-rev, 6 hds, 10.5", 4-trk, 3 3/4, 7.5, 15 ips, timer, 3-motor, fair hds w/manual, exc cond, $950/or trade for CD player. D Fields, 501-451-8803.

Otari MX-5050 MK III 8-trk audio, exc cond, less than 50 hrs us, $3800. 619-436-2112.

Tascam DA-50 Pro DAT
R/P w/remote & manual, recently overhauled, BO.
Steve, 703-998-7729.

Otari ZA-52L metal roll around floor stand for MX-5030 prods, $100; Tascam CS-60713 metal roll around floor stand holds 19" rack equip, $150. T Stine, KCGQ, POB 2077, Cape Girardeau MO 63701. 314-335-9099.

ITC 770 (4) PB, stereo, $450 ea/$1600 all; (2) Ampex 350s, $75 ea; (2) Scully 280B, PB, mono, $100 ea. E Konwinski, WSOY, 1100 E Pershing, Decatur IL 62524.

Nakamichi 550 stereo w/pwr sply, case & manual, $400+s/h. F Spinetta, KCEA, POB 2385, Atherton CA 94026.

Akai GX-620 like new, low hrs, 10.5 x 1/4", 1/4-trk, manual, box, hub adapters, empty reel & wired rem, $425; TEAC A3300SX parts, gd motors, $150. M Gray, M Gray Prods, Rte 4 Box 149, Sedalia MO 65301. 816-826-6025.

Scully 280-2 (2) stereo, HS, auto lifters in RusLang roll-around cabs w/overbridge, $1000 ea; (4) Scully 270-2 stereo PBs, HS, late mdl, $2400 all; Ampex 351 w/440B elects, $400; Telex 230-L, 4-chnl, slow-spd logger syst w/2 decks, 4 elects chnls, change over panel, current mdl, $1500. E Stolz, KWOD, 1425 River Park Dr, Sacramento CA 95815.

EMPLOYMENT

To place ads in this section, use the ActionGram form. To respond to box numbers write Radio World, PO Box 1214, Falls Church, VA 22041. Attn:_____

POSITIONS WANTED

Professional Broadcaster experienced in calling on broadcasters. Currently employed, marketing software and systems, looking for new challenges. Based in Southeast. Open to all offers. Write to Radio World, POB 1214, Falls Church VA 22041. Attn: 93-01-02RW.

Freelance engr w/heavy duty exper for any job, anywhere w/great refs, audio, RF, automation, xmtrs, ants/construction, domestic/intl. 813-849-3477.

C&W music personality can provide you w/a new music show every week, radio/TV, no reruns/repeats. SCV, POB 766, Bound Brook NJ 08805. 908-271-8244.

Bdcter desires to make contact w/owner of big signal station for pay radio concept. You'll take over the market w/this one! 813-844-3823.

Exper engr, seeking maint pos w/lite air shift, SW pref, not ltd. Engr, 7894 Palm Grove, Indianapolis IN 46219.

Studio & xmtr plant construction, xmtr plant construction, direc ant field work, spec projects, many years exper in top 10 mkts. 412-942-4054.

Former CE seeks engrg pos, will relocate, knowledgeable in repair, maint, oper, alignment of station, studio, auto equip. 305-962-2181.

Take charge, revenue, ratings, driven GM, 25 yrs sales exper, prog expert, new construction, updates, prefer South/Midwest. John, 502-247-0090.

20 yr radio vet seeking FT on air w/sales, C&W format, CHR/easy listening. 501-337-7218.

20 yrs exper on air, PD, OM, prod, remotes, traffic. G Gilpin, 919-739-8219.

21 yr old, 6-yr AT, 3 yrs PD/MD at C&W station, Dec coll grad w/youth, talent & exper. Jason, 717-423-6200.

Beginning on-air personality seeking entry-lvl pos in announcing/prod; exper in oper CD plyrs, carts, turntables, copy & news writing, will relocate. Tracy, 210-654-7530.

New DJ/trainee wants to break into NC mkt, any format/shift, anywhere, tape & resume avail. John, 919-838-5731.

20+ yrs exper in news, prod, copywriter, morning man, mgmt, hard worker, team plyr, good voice, consider all offers. Box 174, PA 17364.

DJ w/4 yrs exper in Christian radio, some prod work. 908-671-6491.

HELP WANTED

Chief engineer needed for AM/FM Northern New Jersey combo. Successful applicants must have experience with AM Directional systems, FM transmitters, computers, automation, and general studio equipment. Send resume and references to: Chris Edwards, WMTR/WDHA, 55 Horsehill Road, Cedar Knolls, NJ 07927. EOE.

ENGINEER NEEDED ... NOW!
50 kW FM reaches into Philly, 1kW AM has six tower array. Transmitter, studio equipment and maintenance knowledge is necessary, computer knowledge is a BIG plus. 3 years+ experience.
Send resume and references to:
Joan Gerberding, VP/GM,
Nassau Broadcasting,
PO Box 1350,
Princeton NJ 08540.
EEO, M/F

CCA ELECTRONICS
Manufacturer of AM, FM & Shortwave Commercial Broadcast Transmitters is expanding and looking for Sales Engineers. Person must have good RF background, able to communicate effectively, and really love working in radio. A successful sales background is a plus. Must be willing to relocate to Metro Atlanta, Georgia area. Send resume to:
Steve McElroy, VP Sales
CCA Electronics
Box 426,
Fairburn, GA 30213

Engineering Technician
New York City station seeks individual with a minimum of an Associates degree in electronic technology & at least five years related work experience in major market, commercial radio. Candidate must be capable of installing, operating, maintaining & troubleshooting broadcast, data processing & telephone systems. Remote broadcast production & engineering experience is essential. This is a union position.
Absolutely no phone calls will be accepted. Please send resume to: John Rosso, WNEW-FM 655 Third Ave., New York, New York 10017.
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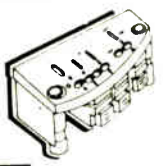

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POSITIONS WANTED: Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 2 issues of Radio World. Contact information will be provided, but if a blind box number is required, there is a $10 fee which must be paid with the listing **(there will be no invoicing)**. Responses will be forwarded to the listee, unopened.

Mail to: BROADCAST EQUIPMENT EXCHANGE
PO Box 1214, Falls Church, VA 22041
Attn: Simone Mullins

CASSETTE...WTS

Tascam MS-16 16-trk, 1", 15 ips, hydraulic rack, noise reduc, $6000/BO. R Somers, 404-350-9549.

Crown stereo, dual balanced tube preamps, very clean, $400/BO. G Becker, GB Engrg, 4110 W Bank Ave, Tampa FL 33624.

Ampex 1200 bias cards, new, $150. F Lang, Metropical, 20 E 13th St, Hunt Stn NY 11746. 516-549-8851.

Otari MX-70 16-trk 1" w/rem & 14 chnls or dbx 150x noise reduc, $11500. C Bluschke, RW Video, 4902 Hammersley Rd, Madison WI 53711.

Russco Studio Master 505 mono, recond, $500. K Jones, KTLR, 105 W Moore, Terrell TX 75160. 214-563-1071.

Revox A77 1/4-trk in wood case w/manual, clean VGC, $350/BO; A77, parts, $75/BO. M Guidotti, 408-946-9366.

MCI (2), not working, $500 ea/BO; ITC 750 mono, not working, $250/BO; Scully 280B, stereo R/P, not working, $250. T Green, North Star, Hwy 35 E, Bay City TX 77404. 409-245-4642.

Otari 7308 8-trk, 1", low hrs, exc cond, 15/30 ips w/rem, $3900. L Wagner, 407-299-1299.

Studer A807-2 (4) VUK 2-trk analog mastering w/rare 4th hd for 1/4-trk P/B, $6950/BO; Studer HS77 Mk IV full-trk mono, 10 hrs use, $875/BO/trade; port case for A77 w/mon spkrs & pwr amps, exc cond, $375. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Ampex 350 (5) P/B w/Schafer elects, $50 ea; (2) 350 mono, tube-type, $50 ea; 350 xport in Russ Lang roll around cab w/P/B elects, very gd cond, $300. B Umberger, WMTX, 18167 US 19N #500, Clearwater FL 34624. 813-536-9600.

Ampex 440 2-trk workhorse, P/B w/rollaround cab, 1 owner, $975; Otari MX-5050BII 2-trk mastering, 2 yrs old w/documentation, 1 owner, looks/sounds new, $1950. B D'Anjon, Ewing Enterprises, 2927 W 141st, Gardena CA 90249. 310-532-9216.

Otari ARS-1000 P/B, new; (3) Ampex. J Phillips, WZOM, 414 Washington Ave, Defiance OH 43512. 419-782-8591.

Roberts 990 old tube-type 4-trk stereo w/amps & mon spkrs, nds work, handy man's special, BO+s/h. J Emmer, Paragon Bdcters, 509 3rd St, Peckville PA 18452.

ITC 770 (3) P/B, $400 ea; (2) ITC 750, P/B, $300 ea; (2) MCI-110, low profile, VGC, $1995 ea. M Phelps, Terrapin Sound, 3526 Shore Ln, Charlotte NC 28277.

Ampro Scully 10 1/2" w/2-chnl stereo elects, BO + s/h. J Emmer, Paragon Bdcters, 509 3rd St, Peckville PA 18452.

Sony/MCI JH110C 2-trk in roll around metal cab; Technics RS1500 2-trk, excel cond. J Gelo, 813-642-6899.

Ampex ATR800 mono, like new, $1200 & AG440-8 1" 8-trk; **Otari 7800** 1" 8-trk, $2900.W Gunn. 619-320-0728.

Otari Mark II-IV 1/2" 4-trk, multi-trk, mint, less than 50 hrs, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Otari MTR-90 1" 8 trk recorder w/CB-113 24 trk, remote on stand, very low hrs, excel cond, $3500. RMR 212-599-2446.

Tascam 32 2-trk & 38 8-trk, like new, $2000/both; **Teac 3340** 4-trk, 1/4" deck, $375; **Tascam 80-8** 8-trk never really used/perfect, $1600. W Gunn. 619-320-0728.

Scully 270 14" PB, 1 stereo plus 1 mono for parts, $200/both; **Ferrograph Super 7**, 10", 3-7-15 ips, 2 trk, $300. W Gunn. 619-320-0728.

Tascam 40-4 w/dbx & flight case, $950; **Tascam 48** 8 trk, excel for sync, $2950. W Gunn. 619-320-0728.

Otari MX-5050 BQII 4 trk R-R, 2 yrs old, like new, $2295; **Dictaphone** 8-day logging machines (2) avail, 1984 vintage, $995 each. Phil Davis, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

Want to Buy

Otari MK III 8-hd bridge w/o hds. R Robinson, 203-269-4465.

Nagra 3S/4S w/NAB hds; Sony TC880/8750; Revox B215. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Tascam 32/34 & rack ears. S Keefe, WCNI, CT College, New London CT 06320. 203-447-1296.

PR99 case. 919-587-3451.

Technics RS-1500/RS-1506 remote control unit. J Newberry, Golden Ntwk, 1450 Chapin Ave, Burlingame CA 94010. 415-348-4836.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 1131 Virginia Ave, Campbell CA 95008. 408-866-8434.

MCI/Sony capstan & reel motors, any cond., recdg heads, most mfgs, machines, new, used. Relapped then sold. Amp Services, 224 Datura St No 614, W Palm Beach FL 33401. 800-826-0601, in FL 305-659-4805.

Ampex ATR100 tape-recorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

CD's

Want to Sell

Studer A-725 (4), gd cond, $400 ea/BO. J Swett, 602-526-1975.

COMPUTERS

Want to Sell

Xerox Diablo daisywheel printer w/cheap software. P Wells, KJQY, 625 Broadway #1200, San Diego CA 92101. 619-238-1037.

Tandy 1000 w/mon, printer, manuals, $500. M Latham, KAGY, POB 1307, Buras LA 70041. 504-657-7003.

Adeus CP2000 printer w/daisy whl, clean, whl slips, $50/BO. M Guidotti, 408-946-9466.

CONSOLES

Want to Sell

Ramko DC5RA rack mount, 5-chnl w/mon amp, $100. K O'Malley, 804-446-2731.

Gates Yard board, tube type, mono, working w/pwr sply, BO. J Michaels, WMVR, 2424 Russell Rd, Sidney OH 45365. 513-498-1055.

Gates Gatesway 80 audio, mono, 8-chnl, 12 input, $1800; Ampro 501 audio, mono, 6-chnl, 24 input, $2000. H Jernegan, WGAI, 179 Lovers Ln, Elizabeth City NC 27909. 919-335-0856.

Ramsa WR8118 18x4x2, just tweaked, refadered w/Calzone 1/2" wood & alum transport case, $1900. F Lang, Metropical, 20 E 13th St, Hunt Stn NY 11746. 516-549-8851.

1642 Biamp, 16 in, 4 out, gd shape, nds pots cleaned, $1500; (2) Numark DM 1450 stereo, 4 in, 2 out, $50 ea/BO. H Sewell, Oakridge Music, 2001 Elton Rd, Ft Worth TX 76117. 817-838-8001.

Ramko DL5AR (2) 5-chnl, mono, clean, $350 ea. J Parsons, Parsons Sound Svc, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

SMC 6-chnl, solid state, perf cond, $200+s/h. F Smith, 615-624-7126.

Gates M5421A TV audio ctrl w/10-input chnls, info dual chnls, gd cond & instruc book, $300. S Gardner, 3-G Comms, POB 387, Hillsville VA 24343. 703-728-9114.

Opamp Labs 2008-RS 20-input, 8+2 out, very clean, (2) 16x2 remix/cue sections, $2500. L Wagner, 407-299-1299.

Sparta AS-30B 5-mixer stereo consolette, exc cond, $450; Micro-Trak Sport IV port 4-mixer for rem use, built-in dialer, batt oper w/case, exc cond, $250; Shure M-267 4-input rem amp, like-new cond, $300. J Somich, Somich Prods, 1208 Stoney Run Trl, Broadview Hts OH 44147. 216-546-0967.

Harris/Gatesway 80 mono, gd cond, $1000/BO. T Green, North Star, Hwy 35 E, Bay City TX 77404. 409-245-4642.

Snake, 16 phantom-pwrd inputs w/ext ps; 250' Belden 19-pr cable/mil conns/ss strain reliefs, 10' Neumann XLR snake mates w/box or Belden snake, top qual, exc cond, $750/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Tascam M-308 8x4x2 stereo mixer mic/line inputs & EQ in ea chnl, like new w/documentation, 1 owner, $950; dbx 160x, like new, $200. B D'Anjon, Ewing Enterprises, 2927 W 141st, Gardena CA 90249. 310-532-9216.

Sound Workshop Logex 8 16-chnl w/low, mid & hi EQ & separate mon, aux echo & mic trim ctrls ea chnl, $1500/BO. D Coffman, WSOR, 940 Tarpon St, Ft Myers FL 33916. 813-334-1393.

Gates Yard Board, painted white, $300; **Bogen CSM** remote mixer, $125. W Gunn. 619-320-0728.

McCurdy SS8824 24 chnl dual stereo console w/on board mic processing, etc. 1984 vintage modular slide pot console, $6995. Phil Davis or Jon Hall, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

RCA BC15A console, $300; **Sparta A15B** console, $180. 505-522-4162.

Want to Buy

WE 23-C audio bd. W Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Shure M67/M68, any cond. L Houck, Rollin Rcdg, 210 Altgelt, San Antonio TX 78201.

Russco 505S stereo parts, whole/part. J Parsons, Parsons Sound Svc, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

Collins IC-10A. B Lacy, 95.7 KAR, 3611 Soncy #6A, Amarillo TX 79121. 806-359-4000.

Autogram, LPB, & related consoles. Will buy or trade for new equipment. Jon Hall, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

DISCO & SOUND EQUIPMENT

Want to Sell

Gemco SG800 (10) 8" JB1 8120 spkrs in 13" x 11" wall box, $10 ea. P Russell, Bowdoin Coll, Sills Hall, Bruswick ME 04011. 207-725-3066.

Cheetah kybd, MIDI, nds cable, $100. H Sewell, Oakridge Music, 2001 Elton Rd, Ft Worth TX 76117. 817-838-8001.

BSR real-time audio analyzer, 10-band flourescent display w/calibrated rem mic, built-in pink noise gener, little use, $120/BO+s/h. R Kelly, KLOO, 1221 SW 15th, Carvallis OR 97333. 503-933-2217.

Klipsch La Scala horns in cases, 300 W/chnl, exc cond, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625.

Altec 811B/908A (2) horns & drivers, BO; (2) EV DL15X 15" woofers, BO/amp trade. G Becker, GB Engrg, 4110 W Bank Ave, Tampa FL 33624.

TOA SM-60 (5), dual spkr w/stands, $75 ea. J Diamond, Blue Diamond, Box 102C Chubbic Rd, Canonsburg PA 15317.

Klipsch Lascalas horns in road cases, will handle 300 W per chnl, excel cond, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Dolby 301 A-type stereo, discrete, $500. W Gunn. 619-320-0728.

FINANCIAL SERVICES

EQUIPMENT Financing, Lease Purchase Option. Need equipment for your radio, television or cable operation? New or Used. No down payment. Carpenter & Associates, Voice 504-764-6610 Fax 504-764-7170.

LIMITERS

Want to Sell

Orban Card O for 8100A11 Optimod, BO. W Long, LM Comms, 1300 Greendale Rd, Lexington KY 40511.

Orban 222A/U stereo enhancer, $450. Randy, WHFS, 8201 Corp Dr #550, Landover MD 20785. 301-306-0991.

CBS 400, 411 (2), mono, 1/2", $50 ea; Gates M6543 AM w/manual, $100+s/h. E Konwinski, WSOY, 1100 E Pershing, Decatur IL 62524.

Somich DEB-1000 comp proc, $950. Randy, WHFS, 8201 Corp Dr #550, Landover MD 20785. 301-306-0991.

Altec 1591A, clean, $125. J Parsons, Parsons Sound Svc, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

Mod Sci comp clipper, $350/free w/Moseley STL purchase. T Kolnar, 815-459-7000.

CBS Volumax 4000A, gd cond, $150/BO. J Swett, 602-526-1975.

Optimod 8100A, $4000; (2) Texar Audio Prisms, $1200 ea. J Morgan, 401-433-1000.

Ashley CL50 peak detection, compressor, superb cond, $125 ea/BO+s/h. J Emmer, Paragon Bdcters, 509 3rd St, Peckville PA 18452.

CRL PMC-300A (2) single-chnl, gd cond w/manual. C Hicks, WEAX, W Park Ave, Angola IN 46703. 219-665-7310.

Dorrough 310 discriminate processor, $300/BO; PR&E Multimax MX AM, $200/BO. L Houck, Rollin Rcdg, 210 Altgelt, San Antonio TX 78201. 800-798-5468.

Orban 8000 w/new parts, fact calib, $800. K Jones, KTLR, 105 W Moore, Terrell TX 75160. 214-563-1071.

Optimod 8100A, exc cond, $3500/BO. T Green, North Star, Hwy 35 E, Bay City TX 77404. 409-245-4642.

Optimod 8000A, mint cond, $2000/BO. P Thurst, WPTR, POB 12279, Albany NY 12212. 518-456-1144.

BE AGC, $250. K Jones, KTLR, 105 W Moore, Terrell TX 75160. 214-563-1071.

Mod Sci Modminder, 6 mos old, works well, $2000/BO. P Thurst, WPTR, POB 12279, Albany NY 12212. 518-456-1144.

UREI LA-4 stereo pair, comp/limiter, like new, $700. J Somich, Somich Prods, 1208 Stoney Run Trl, Broadview Hts OH 44147. 216-546-0967.

Texar audio prisms, pair, $1995; **Orban 418A** compressor limiter, $395; **Orban 111/B** stereo reverb, $295. Phil Davis, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

Want to Buy

Symetrix 501 mono. C Waltmann, KSAN, 750 Battery St #200, San Fran CA 94111. 415-291-0202.

Orban 8100A & 8000A optimods. Will buy or trade for new equipment. Jon Hall, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

MICROPHONES

Want to Sell

Neumenn U-89 wo/mnt, $1400; **Beyer M-500** ribbon mic (rblt), $300. Berler Communications, 708-263-6400.

Laserline 90 CD storage rack (8), new $18 ea; dbx 150X noise reduct (2), $125 ea; Sony 7506 hdph (8), nw, $66 ea; Radio Systems RS-1000 DAT (2), $2200; Radio Systems RS-1000 DAT (rebuilt), $2600; Nakamichi MR-1erler Communications, 708-263-6400.

EV 635, exc cond, $50/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd, Canonsburg PA 15317.

Virgin Telex PH-61 (2) head sets, $90 ea. B Umberger, WMTX, 18167 US 19N #500, Clearwater FL 34624. 813-536-9600.

Beyer M500 diaphragm, nds work, $75/BO. M Guidotti, 408-946-9466.

Telefunken/Schoeps CM61 tube, rare, orig ps, new cable, mint cond, $2475; CR-176 large diaphram tube, new, $1250. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Audio Technica 813R cardioid, super cond w/cases, $125 ea/BO+s/h. J Emmer, Paragon Bdcters, 509 3rd St, Peckville PA 18452.

Telefunken tube mic pre amps V-76, U-73 limiter's; RCA BA-21As, BA-1As; Altec tube mic-pres. Tracy Eaves, 615-821-6099 (evenings before 10PM EST).

EV 676 supercardioid mics 3/$200; EV RE10 mic, $125. W Gunn, 619-320-0728.

Telefunken M-250, U-67, 221-A; Neumann U-67, KM-56, UM-57; RCA KV3A-10,0001, 44-BX, 77-DX, BK-4, BK-5, 74-B, varicustics; Altec M-20, M-11, M-30 tube type mics. Trade or sale. Tracy Eaves, 615-821-6099 (evenings before 10PM EST).

Telefunken M921 dual (2-way, not front/back) nickel capsules, cardoid only, classic tube mic; **Neumann KM84** pair, mint, $1100. W Gunn. 619-320-0728.

Want to Buy

RCA, WE, Shure ribbon mics. W Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

AKG C24. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

RCA 77DXs/44BXs ribbon, chrome/TV grey, gd cond, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

MISCELLANEOUS

Want to Sell

Waveform 454A attenuator box, 37.5/150/250/600 ohm, balanced in/out, $50+s/h; Bird 8133, 50 W, 50 ohm dummy load w/type N conn & mounting flanges, $25+s/h; Sonex (2) sheets, tan color, 4' x 4', $100+s/h. D Vobbe, Great Northern Bdctg, POB 5031, Lima OH 45802. 419-228-4199.

Weschler RT 351 0-15 amp, RF ammeter, new, $75. D Heinen, KRSE, 2120 Riverside Rd, Yakima WA 98901.

WE 189D xformers, $35/pair; UTC LS-141 hybrid xformer, new, $50; UTC LS-33 20 W line to line xformers, $100/pair; Cinema Engrg #64266 xformers, $30/pair. R Robinson, 203-269-4465.

TEAC AN50 & AN60, $70 ea; Concord Dolby unit, clean, $70. J Parsons, Parsons Sound Svc, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

CBS Labs 450-DPE 19" x 3" rack, $150. D Rushing, Rushing, 11710 Hoyt St, Tampa FL 33617.

MISCELLANEOUS...WTS

Bardwell McAllister 2000 W large stage lights w/barndoors, clamp, $200 ea; 1000 W Kleig boards, $100 ea. 212-969-0240.

1/16" (2) console knobs, (1) 1-7/16" knob, (6) rotary attenuator scale plates, console switches, $10. M Guidotti, 408-946-9466.

Dayton W3056 5000 W gener, 220 & 110 AC output, $1250. K Jones, KTLR, 105 W Moore, Terrell TX 75160. 214-563-1071.

Radio sales (16) VHS training tapes covering 30 topics, $2000. R Trumbo, KNLE, POB 117, Quincy CA 95971.

Anvil rack case, large w/wheels, 6' high, $1000. R Robinson, 203-269-4465.

Shallco 820Q-2B3 10K stereo rotary faders w/Q 2; 320Q-2B3 600-ohm stereo rotary fader w/Q 1; Daven 600/600 2dB/step rotary fader w/Q 2; Langevin RMS-1430 mono fader w/Q 3, $35; (2) UTC A11 A20 & A21 xformers, Triad S-58X, Freed Q6a-7, Ampex 4580116-20 & 4580116-10 for AG35x series, $10 ea. M Guidotti, 408-946-9466.

Rotron Blowers for Elcom, CCA, CSI, McMartin, rebuilt & new. Goodrich Enterprises Inc. 11435 Manderson St. Omaha, NE 68164 402 493 1886 FAX 402 493 6821

Sony educ training tapes on TV prod, color systems, dig elects, basic video rec, exc cond, $50/set. C Burke, Chnl 19, Atlantic Ave, Aberdeen NJ 07747. 908-290-2840.

TIE Comms 516B telephone key syst w/12 stations, 1 master; TFT 730A subcarried mon, 67 kHz, BO; (2) Ampro 2505B P/B carts, works; Belar RFA-1 amp, new on 96.9, $450/BO. T Green, North Star, Hwy 35 E, Bay City TX 77404. 409-245-4642.

R-R & cart racks, white & oak bases, BO. J Phillips, WZOM, 414 Washington Ave, Defiance OH 43512. 419-782-8591.

Phasemaster T10000 rotary phase converter, gd cond, BO. D Murray, WKLT, 745 S Garfiled Ave, Traverse City MI 49684. 616-947-0003.

Racom 1700X digital voice rewinder, telephone message repeater for info-lines. Bill Baker, 616-772-2300.

Want to Buy

UTC LS-10X, 12X, LS-18 xformers; schematic for West Electroacoustic Labs Cond 120A; Hycor 4201 passive EQ. R Robinson, 203-269-4465.

Conex AS-101/AS-401 Conex 10-input audio switcher & rem ctrl panel. C Waltmann, KSAN, 750 Battery St #200, San Fran CA 94111. 415-291-0202.

6' racks, 16" panels. H White, 612-888-5306.

Stepper relay w/(3) switch decks, 10 pos ea w/reset, CP Clair A-22751, CRY 29982 or equiv or CP Clair DS-11. D Williams, LC Bdcter, 1103 Utah Ave, Libby MT 59923. 406-293-6234.

50s studio rec equip; hi-fi tube gear, 45/78 recs. K Gutzke, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

Radio transformers by Chicago, UTC, Triad, Peerless, Freed, Sola, send list. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

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.

Old radios, including microphone style & other promotional radios, older plastic & early transistor radios. Will buy or trade for broadcast equipment. Jon Hall, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

MONITORS

Want to Sell

Belar AM1 AM mod, calibrated on 5/1/92, working, $850+s/h. D Vobbe, Great Northern Bdct Co, POB 5031, Lima OH 45802-5031. 419-228-4199.

Want to Buy

Any older McMartin mod monitors. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886.

MOVIE PROD EQUIP

Want to Sell

16-35-65/70mm cameras, projs, telecine, recs, dubbers, editing, film lenses, B&L anamorphic lens, $99; Arriflex 16mm outfit, $2500; Arriflex 35mm outfit, $4500; RCA TP-66, $2500; 8mm Distagon lens, $1500; others. S Krams, Intl Cinema Equip Co, 100 NE 39th St, Miami FL 33137. 305-573-7339.

RECEIVERS & TRANSCEIVERS

Want to Sell

AM STEREO RECEIVERS
Portable, Home/Studio, Auto
RRADCO GROUP
708-513-1386

GE Exec II 4-chnl, 100 W, VHF mobile w/PL & access, $100; GE Delta 40 W, 1-chnl mobile w/prog PL, clean, $125; Motorola Pagecom, VHF tone & voice pager on your freq w/tones & new chrgr, $35. P Russell, Bowdoin Coll, Sills Hall, Bruswick ME 04011. 207-725-3066.

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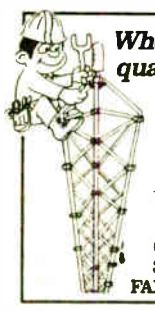

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RECEIVERS...WTS

Loran coordinate/navigation unit, port. R Strawn, 208-452-3149.

Want to Buy

EBS mons (2). J Bumgardner, KQRO, POB 864, Cuero TX 77954. 512-275-3430.

REMOTE & MICROWAVE EQUIP

Want to Sell

McMartin TBM-1100R dual-chnl VHF rackmount rcvr, GC, $600; Motorola Expo 2-chnl, micro-HT, VHF highband w/desktop chrgr, $200; Motorola Maxar VHF high-band xcvr, 10 W, $200. E Stolz, KWOD, 1425 River Pk Dr, Sacramento CA 95815.

Moseley PCL-505, 950 MHz comp, TX & RX avail, $4500. T Kolnar, 815-459-7000.

TFT 7601 dig telemetry/ctrl syst, 10 chnls, wire line modems, manuals, works, $600/BO+s/h. R Kelly, KLOO, 1221 SW 15th, Carvallis OR 97333. 503-933-2217.

Comrex TCB 2-A auto answer, telco coupler, send & receive w/book & pwr sply, BO; Kintronics 3-wire lighting choke, new, (3) AM sample loops, like new, DA array, BO. C Gennaro, WJMS, 222 S Lawrence, Ironwood MI 49938. 906-932-2411.

Gentner SPH-3 phone patch, perf cond, $275; Catel FM modulator for cable syst, $75. J Swett, 602-526-1975.

Sci Atl 7300/7325 dig rcvr w/(2) 15 kHz, (1) 7.5 kHz, (1) 3 kHz cue cards, crystal switch assembly, fact manuals, $5500; LAUX analog rcvr, SMN-country w/DNR option, $600. E Stolz, KWOD, 1425 River Pk Dr, Sacramento CA 95815.

Moseley MRC 1600, Applied Dig dat syst term w/mon & modems, $1995. D McIver, KBHL, Box 247, Osakis MN 56360. 612-859-3000.

Moseley PCL-505/C comp stereo STL system w/stripline on-freq PA w/factor upgrades, Andrew P6-9C 6' grid dishes, GC category A w/ 7/8" feed, exc cond, $6000; (2) Moseley/ADDS viewpoint CRT displays & keybds, $300 ea. E Stolz, KWOD, 1425 River Park Dr, Sacramento CA 95815.

Burk Tech TC-8 8-chnl rem ctrl w/IP-8 interface panel, clean, $1050/BO. S Morse, KWOS, 3109 S 10 Mile Dr, Jefferson City MO 65109. 314-893-7857.

Gentner ANA dig hybrid, new, $500. B Brintzer, WINC, 1000 Park Forty, Durham NC 27713. 919-361-1429.

Moseley MRC-1600 16-chnl microproc, perf cond. D Siddall, 219-362-5290.

Marti RPT-15 161.76, new, 200', 1/2 65', 7/8" feedline, 3.5 element, 450 MHz. J Phillips, WZOM, 414 Washington Ave, Defiance OH 43512. 419-782-8591.

Harris 9100 facilities ctrl, $5500. B Murdoch, WVAZ, 800 S Wells, Chicago IL 60607. 312-360-8183.

Moseley DRS-1AR 20-chnl dig display w/manuals, SCA, gd cond, $500/BO; RCA BTR-15BW 15-chnl w/Hallikainen dig display w/manuals, gd cond, $500/BO. R Bauer, Price Bdctg, 35 Century Park Way, SLC UT 84115.

McMartin AM EBS, $250. K Jones, KTLR, 105 W Moore, Terrell TX 75160. 214-563-1071.

Moseley MRC-1620 studio & xmtr units w/modem, manuals & TM20 software, $3000/BO. J Ryan, KIQY, 743 Main St, Lebanon OR 97355.

Marti STL-8, exc cond. B Lacy, 95.7 KAR, 3611 Soncy #6A, Amarillo TX 79121. 806-359-4000.

Marti, $250. K Jones, KTLR, 105 W Moore, Terrell TX 75160. 214-563-1071.

Want to Buy

ATS equip. J Bumgardner, KQRO, POB 864, Cuero TX 77954. 512-275-3430.

Marti STL-8 & STL-10 equipment. Will buy or trade for new equipment. Jon Hall, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

SATELLITE EQUIPMENT

Want to Sell

Wegener 1601-50, (2), 1 down converter, 2 sets of cards, 1684-04, 1610, 1610-01, 1644-02, 2046-07, 1605-03, BO. W Long, LM Comms, 1300 Greendale Rd, Lexington KY 40511.

Sci Atl 7300 wideband BPSK rec, 7325 dig proc unit, SEDAT card, 2 DATS cards, voice cue decoder card, $5250/BO. T Green, North Star, Hwy 35 E, Bay City TX 77404. 409-245-4642.

Harris 6550 rcvr, $500/BO; Wegener 1601 rcvr card w/down converter, $125/BO. M Guidotti, 408-946-9466.

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Want to Buy

Fairchild Dart 384 15 kHz, stereo, DATS, audio card. T McGinley, WPGC, POB 10239, Washington DC 20018. 301-441-3332.

Wegener 1601 mainframe & pwr sply w/1608-22, 1689, 1610 & 1630 Panda II cards. B Moore, 213-463-3800.

Sci Atl 7.5 MHz card to rcv talknet. 316-251-3800.

Ku-band exciter, working cond. 212-969-0240.

SOFTWARE & DATABASES

Want to Sell

STATIONS

Want to Sell

6 kW CP, gd suburban mkt, all/part. R Myers, Tidewater Bdctg, POB 282, California MD 20619. 301-373-8429.

AM/FM combo in oper 40 yrs, northern MI. POB 190, Manistee MI 49660.

Class A FM & daytime AM in small mkt. 512-575-8613.

Class C FM, 10 kW AM in Miles City, MT, exc signals, mint equip, $595K. Paul, 612-222-5555.

West Texas AM/FM combo. AM-West Texas mainstay 1 kW. C-3 FM, new equipment. Studios located at tower site. Studios, tower and land included in sale. Inquiries to: Radio World, POB 1214, Falls Church VA 22041. Attn: 93-01-1RW.

50 kW AM in Capital City, clear chnl, mid/low dial pos, unltd time non dir, days dir, nights, sale/lease. 501-470-1525.

Want to Buy

FM or combo, Western states. Other areas considered if price is right. Cash plus Terms, depending on market size. Fax info to: D. Crepps/IBS, 805-294-9441.

STEREO GENERATORS

Want to Sell

Rood/Marcom 203 stereo gen/test set, $300; Moseley SCG-2 185 kHz subcarrier gener, $100. P Wells, KJQY, 625 Broadway #1200, San Diego CA 92101. 619-238-1037.

Moseley SCG 4T 67 kHz, $150. M Everhart, KXYQ, 111 SW 5 #1550, Portland OR 97204. 503-226-6731.

Dorrough 80-B, works, $100. A Russell, WNLC, 90 Foster Rd, Waterford CT 06385. 203-442-5328.

SWITCHERS (VIDEO)

Want to Sell

Pana WV-600P spec effects gener, splits, supers, wipes, $100+s/h. G Kirby, Gray Fox, 13613 US 36, Marysville OH 43040.

TAPES/CARTS & REELS

Want to Sell

260 10 1/2" reels beautiful music, Cent 21 format w/1984 lists, gd shape, low passes, $1500/all, will part. T O'Brien, WTYS, POB 777, Marianna, FL 32447. 904-482-2131.

Fidelipac Mdl 3000 (1000) carts, $500. 702-386-2844.

Pams Jingles ref tapes, 1951-1976, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625.

C-90s, $.20 ea/1000, $.25 ea/500; 3M & Ampex, 7" x 1/4", 1800', one pass ea, $2 ea/100; 10 1/2" x 1/2", plastic, empty, gd cond, $1 ea/50. L Wagner, 407-299-1299.

Bonneville Lite AC library, pristine cond, 101+ disks, $2500. T Backer, WXHC, Box 386, Homer NY 13077. 607-749-9942.

Fidelipac Mastercart II, (100), new, 70" length, $2.50 ea. M Guidotti, 408-946-9366.

CHR-A/C thousands, 3.5, 5.5 & 7.5 min lengths, $3 ea. M Seeber, KXGO, 215 4th St #A, Eureka CA 95501. 707-445-8104.

Want to Buy

Cash for Orr radio, Irish band A/V tapes & boxes, 3, 5, 7 & 10" reels; Orrtronic Car Mate; Aeromate tape plyrs. H Norman, 205-825-0390.

Disc recs, needles, blanks, rec xcriptions. B Davies, Virgo Prods, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

TAX DEDUCT EQUIP

Studio equip, working, educ radio, rcpt & s/h; low pwr AM/FM/carrier current xmtrs. Dr Newcomb, Grand River Radio, 19130 Nelson-Parkman Rd, Garrettsville OH 44231. 210-548-2053.

Educ FM, 1 kW, nds bdct equip, will pay s/h. C Hicks, WEAX, W Park Ave, Angola IN 46703. 219-665-7310.

Eng student desiring donation of old bdct equip (anything)in repairable cond, will pay all shipping charges, EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Circle (76) On Reader Service Card

Monte Vista Christian School, would appreciate any donations of used radio equipment along with used TV broadcast equipment. T Quinn, 408-475-0423.

TEST EQUIPMENT

Want to Sell

HP 206A audio osc, working w/manual, $100. E Konwinski, WSOY, 1100 E Pershing, Decatur IL 62524.

B&W 200 audio gener, mdl 400 dist analyzer, tube-type gd cond w/manuals, $60/pair/BO+s/h; BSR real-time audio analyzer, 10-band flourescent display w/calibrated rem mic, built-in pink noise gener, little use, $120/BO+s/h. R Kelly, KLOO, 1221 SW 15th, Carvallis OR 97333. 503-933-2217.

HP audio test set, gener, AC voltmeter, patch panel, $250; URM-26B RF signal gener, $100/BO. K O'Malley, 804-446-2731.

Tek FG507/TM515 func gen w/roadcase, $750; Sounder phase check set, $60; Pulse Dynamics pulse gener, $40. P Wells, KJQY, 625 Broadway #1200, San Diego CA 92101. 619-238-1037.

HP 333A dist analyzer, top cond, svc manual, $450. D Harris, Harris Csltg, POB 254, Woodacre CA 94973. 415-488-1137.

Philips PM6507 curve tracer, $1475/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Want to Buy

Crown RTA2 real-time analyzer; Tek 570 tube curve tracer; Lambda & HP pwr splys. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

TRANSMITTERS

Want to Sell

CCA AM50,000D 1972, operating w/tubes, sockets, coils, relays, xfrmrs, rectifiers, resistors, capacitors & spare parts. Mr. Gilbert, 809-469-5425.

Harris 2.5 Hz 1978 2.5 kW FM w/TE3 exciter tuned to 95.9 MHz, exc cond, $7500. D Rose, KAAA, 2534 Hualapai Mtn Rd, Kingman AZ 86401. 602-753-2537.

McMartin BF 3.5 K FM, just reworked, tune to your freq, $12K. 614-286-3023.

RCA BTA-563 5 kW AM, gd cond, gd tubes, $7000. P Patton, WAPO, 29 W Main St, Jasper TN 37347. 615-942-5611.

Circle (147) On Reader Service Card

TRANSMITTERS...WTS

TDD-5 25 W AM tuned to 530 kHz, perf cond, $500. F Smith, 615-624-7126.

RCA BTA-5U/100, runs, nds work, $5000. A Russell, WNLC, 90 Foster Rd, Waterford CT 06385. 203-442-5328.

Used & New Transmission Line, many sizes & lengths, many like new. 816-635-5959.

BE FX-30 exciter, very gd cond, hurry. 816-635-5959.

Gates FM1H 1000 W, on air; Bauer 607 1500 W FM, very clean, exc cond. S Bock, WQEQ, RD 1 & Walnut St, Freeland PA 18224.

Gates BC-1G 1 kW AM, $2000. M Everhart, KXYQ, 111 SW 5 #1550, Portland OR 97204. 503-226-6731.

Harris FM-10G, gd cond, priced to sell. 816-635-5959.

Gates BC-1G 1 kW AM, $2000. M Everhart, KXYQ, 111 SW 5 #1550, Portland OR 97204. 503-226-6731.

Harris FM-10G, gd cond, priced to sell. 816-635-5959.

Continental 816R-3/831G-2B xformers, rebuildable, T1, T2, T3, $300; Collins 785E-1 STL interface card, unused, $300; Moseley LPE-10 exciter PS/metering/audio panel, GC, $75; Collins TV-36 pwr amp, single 4CX250B, self-contained, rackmount, solid state, GC, $250. E Stolz, KWOD, 1425 River Pk Dr, Sacramento CA 95815.

McMartin/Harris 10-20 kW FM, gd cond. G Gilbert, CSRG, POB 50539, Denton TX 76206.

Harris 2.5 H3 FM, 2.5 kW w/TE3 exciter on 95.9 MHz, $7500. D Rose, KAAA, 2534 Hualapai Mtn Rd, Kingman AZ 86401. 602-753-2537.

Harris FM-2.5K with MS-15 exciter, excel cond. 816-635-5959.

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250-300 AM solid state tuned to 530 kHz. F Smith, 615-624-7126.

Visual Electronics medium wave, 1 kW output w/4-400 A type PA valve, manual & circuit diagram. A Gallagher, KISS, Harmony Hghts, Mayo Ireland. 011-094-23576.

BE/Continental exciters. B Lacy, 95.7 KAR, 3611 Soncy #6A, Amarillo TX 79121. 806-359-4000.

McMartin AM/FM xmtr, any model, exciter or stereo modules. Goodrich Enterprises, 11435 Manderson, Omaha NE 68164. 402-493-1886.

TUBES

Want to Sell

WE 300Bs, unused, BO. S Krams, Intl Cinema Equip Co, 100 NE 39th St, Miami FL 33137. 305-573-7339.

Penta prem output KT88, $35; KT99B, $55; EL34HD, $15; 12AX7B, 6072M. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Elmac 4CX250B, new, $100/BO. C Hicks, WEAX, W Park Ave, Angola IN 46703. 219-665-7310.

4-400A, (2), $75 ea/BO; (5) 6146A, $10 ea/BO; 7984, $10/BO. M Guidotti, 408-946-9466.

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Gold Lion KT-88/British/USA KT-88s, new/used. R Gleen, WJGR, 1718 Shannandona, Wimauma FL 33598. 813-634-1940.

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Harris-Gates CB-77, (2), new $350 ea; (2) Micro Trak 303 ea; (2) Shure M-121 stereo, new, $125 ea. V Mlyneis, 8211 Essen Ave, Parma OH 44129. 216-884-3705.

Russco Studio-Pro (2) 12", gd cond, $100 ea. J Swett, 602-526-1975.

Russco Cue-Master (2) w/arm, $100 ea; Studio-Pro w/arm, $100/BO. M Guidotti, 408-946-9466.

Shure SS39B (8) stylus, new, $10 ea. M Reichard, 219-482-9288.

Technics SL1200 MK2, new, $525; (2) Ramko XCLSCM preamps, new, $150 ea. T Green, North Star, Hwy 35 E, Bay City TX 77404. 409-245-4642.

Want to Buy

Disc cutting recs, needles & blanks. W Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Studio disc rcdg gear by Fairchild, Westrex, Neumann, Gotham, Rek-O-Kut, cutting lathes, amps, Fairchild 670 lmtr, mics, 45/78 recs. K Gutke, Custom Rcdg, 7134 15t Ave. S, Minneapolis MN 55423. 612-866-6183

VIDEO PROD EQUIP

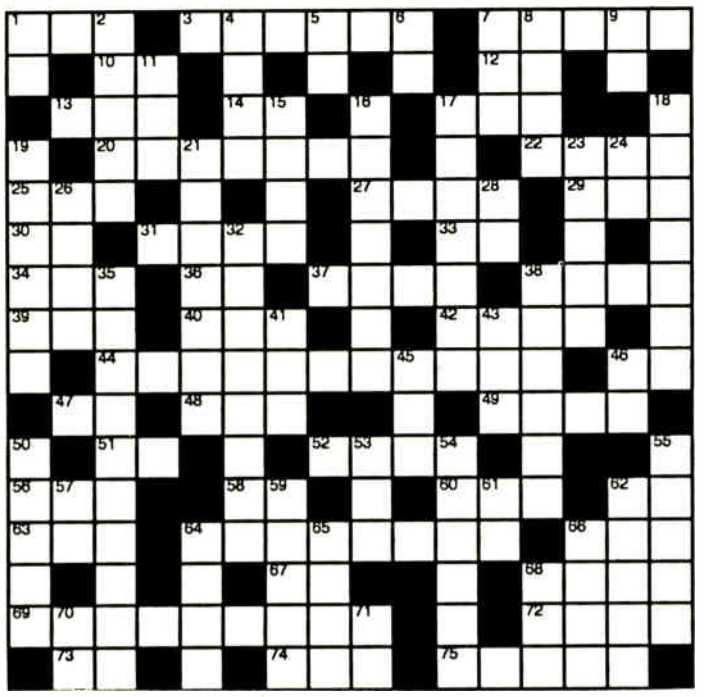
Want to Sell

Sony VO-5850 U-Matic edlers, gd cond, ctrlers avail, $2000 ea. 212-969-0240.

Channelmaster tape encoder unit w/kybd & mon, great shape, BO. M Reichard, 219-482-9288.

Sony BVE-3000, cables & manuals, $500. C Burke, Chnl 19, Atlantic Ave, Aberdeen NJ 07747. 908-290-2840.

This Month's Crossword



by Steve Walker **solution in next issue of RW**

Across

1. Something unexplained in the sky
3. Enflame
7. "The first name in digital audio"
10. Latin *you*
12. Having entered, you are ___
13. Regulates the air
14. Does not apply
17. "Research for the Benefit of Broadcasting"
20. To pick up a signal
22. Long ago; days of ____
25. Builds "Live Assistant"
27. What a clock does
29. Stimpy's friend
30. Part of a certain medical title
31. Wile E. Coyote's supplier
33. Not down
34. Direct
36. Oklahoma school
37. Turnkey tower systems
38. Precipitation
39. Baseball term
40. Ancient
42. Black
44. "Good Company Keeps Good Company"
46. Room of a house, abbr.
47. Logical thinker
48. Drink
49. Tear gas
51. Has a wizard and a yellow brick road
52. "If you're in a hurry, we understand"
56. *in medias* ___
58. Record album on vinyl
60. Logical connective
62. Current
63. Prefix meaning equal
64. Send a ___ package
66. Snake
67. Polynesian personification of light
68. Tag used after purchase
69. "A Great Deal More than Phasors"
72. Taxis
73. Football score
74. To cause to cease

Down

1. Pronoun
2. "Radio's Top Ten"
4. Hereditary factor
5. Conditional
6. Latin *and*
7. Cease to live
8. Covet
9. Beast of burden
11. Renowned MS *Windows* 3.0 error
15. Helper
16. 4-legged tube
17. AT&T Switched Digital Service
18. "Building higher ratings from the ground up"
19. What you have in a studio (2 wds)
21. Where butterflies come from
23. Piano-like musical instrument
24. Subject
26. Seventh Jewish ancient month
28. Kitchen duty
32. Divisible by
35. 38 virtual audio tracks on an AT
38. DM-80 multitrack disk recorder
41. Chip type
43. Bang
45. Veto
46. Spotmaster
50. What you do when you're thirsty
53. PC key often used for CANCEL
54. 110% 25 hrs/day. 366 days/yr.
55. Lots
57. Electrical unit
59. Air vehicle
61. New *Windows* version due soon
62. Model DSTL digital STL
64. "No hassle remotes"
65. Cut of meat
66. Male pig in original condition
68. Electronic switch
70. Pronoun
71. Digital music format

ACTION-GRAM

Equipment Listings

Radio World's Broadcast Equipment Exchange provides a FREE listing service for all broadcast and pro-sound end users. 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:

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Company/Station _____

Address _____

City/State _____

Zip Code _____—_____

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C. Educational FM station
E. Network/group owner
F. Recording studio
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
E. News operations
F. Other (specify)_____

WTS ❑ WTB ❑ Category: _____

Make: _____ Model: _____

Brief Description: _____

_____

Price: _____

*Closing for listings is the first and third Fridays for the next month's issue.
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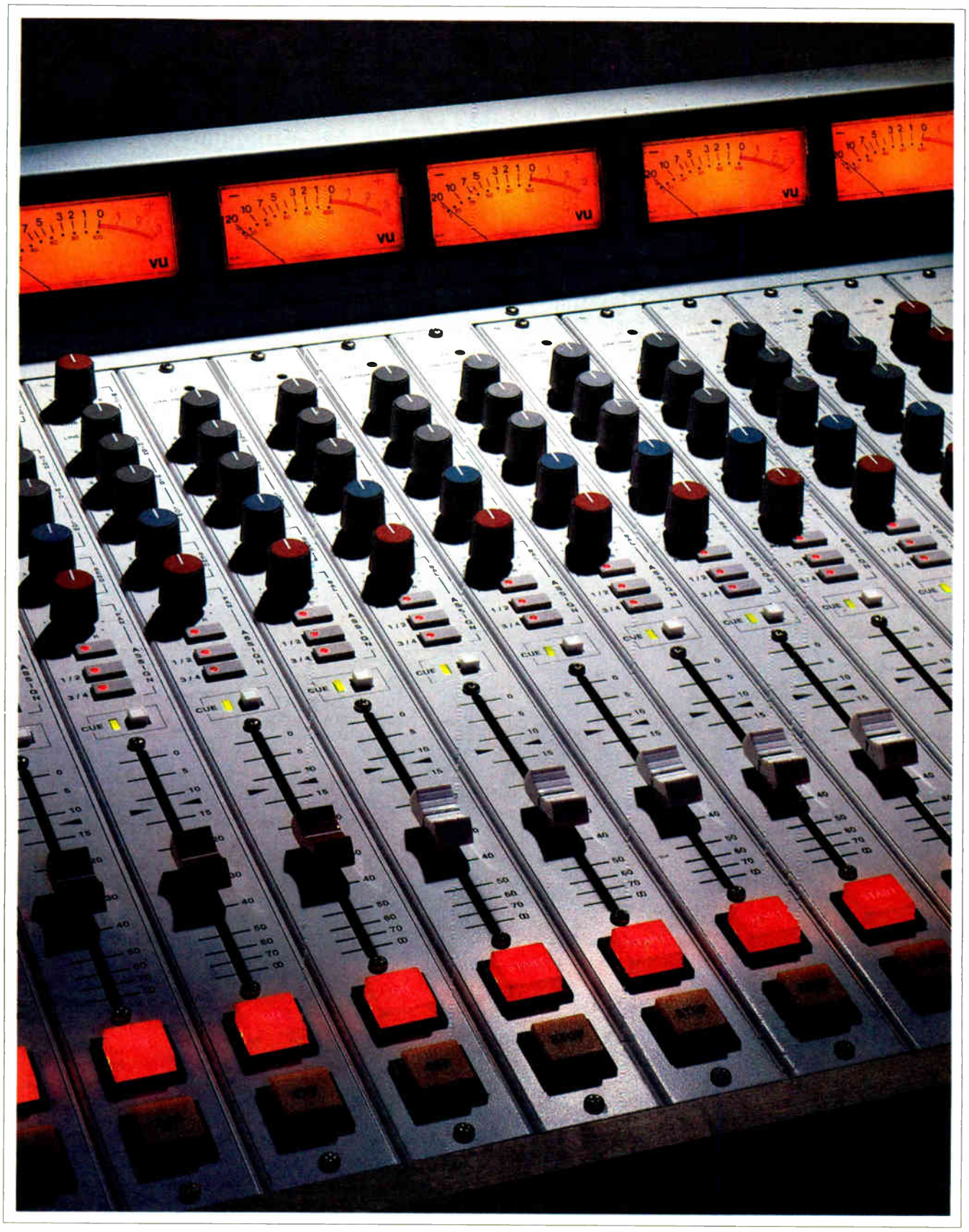
Just RIGHT!



MR-40

MULTI-TRACK PRODUCTION doesn't have to be complicated. The MR-40 has just the features most stations are looking for: 4-track bus assign for your tape recorder; program assign so you can transfer direct to your 2-track—or go right on-air! It has machine Start/Stops just below the fader like an on-air console, but also includes a 3-band equalizer section so you can have the tone control that a normal radio console couldn't provide. It even has a stereo send bus that follows stereo channel balance controls—ever so important for today's stereo effects devices.

Mono modules have both mic and line inputs: mic for recording and line for track playbacks. Subgroup channels provide fader control for record levels and also have a second track playback path for really quick sessions. And of course the MR-40 has an on-air type monitor section, complete with control room, headphone and studio outputs, plus all the necessary muting and tally functions you'd want. It even has a built-in cue speaker and power amplifier.

Small format doesn't mean we've cut corners either: all audio switches are gold contact; assign buttons are LED illuminated; all ICs are double burned-in, and all circuits are double-tested—we don't take any chances with reliability! The **MR-40** is a perfect blend of excellence in engineering and sensible size. It's just right for 4-track analog and digital work stations—it can even back up your on-air console! So contact Audioarts.

305 Performance Drive, Syracuse, NY. 13212 (315-455-7740/fax 315-454-8104)

AUDIOARTS® ENGINEERING

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Wheatstone's Finest

We've taken all that we know, all that you've asked for, and the very best of today's technology and components to bring you our finest radio console: the A-6000.

The A-6000 has all the features you could need (or even MIGHT need) but with a family of over 125 input module combinations, you're free to choose the features you DO need: like a built-in routing switcher with individual alpha channel displays, so you can configure your console to suit changing program requirements; Wheatstone's exclusive Bus-Minus™ system, the ultimate tool for news and sports events; four mix-minus busses, bringing real power to talk formats; logic controlled program and mix-minus buses, giving you complex function from simple switch commands; a full array of stereo and mono send controls for studio or effect mixes; and of course, an equalizer option for your production suite. You can even add features later; you can relocate any module anywhere in the mainframe at any time, preventing obsolescence as format needs change.

And while Wheatstone is well known for superior technical performance, the A-6000 surpasses even our own previous consoles in virtually every measurement category.

The A-6000 has the appearance, features and power to excite the most demanding program and production staff; its engineering, performance and thoughtful design will help your technical staff achieve excellence. So contact Wheatstone, the people with knowledge, experience and a committment to excellence.

Wheatstone® Corporation
6720 V.I.P. Parkway, Syracuse, NY. 13211 (tel 315-455-7740/fax 315-454-8104)

A-6000

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