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Buyer's Guide:
**STL, Remote &
 Telco Equipment.**
 See pp. 41-68

Vol 17, No 20

Radio's Best Read Newspaper

October 27, 1993

Radio Show Reveals Increasing Optimism

by Randy Sukow

DALLAS Business news and technology events at the National Association of Broadcasters (NAB) 1993 Radio Show in Dallas, served as good indicators of the upward continuum in the economic health of the industry. Digital technology has progressed from a high-tech novelty to an indispensable radio broadcast tool.

Several broadcasters and equipment dealers at the show (attended by 6,417, with 12 percent of the registration from outside the U.S.) observed that it is now less expensive to build an audio studio from scratch with digital equipment than to stock an all-analog studio. The question now is whether or not to buy digital devices employing data compression (or data reduction, as many prefer) schemes.

Looking ahead

The number of attendees seems to support NAB's decision to merge next year's Radio Show equipment exhibition in Los Angeles, Oct. 12-15, with the Radio-Television News Directors, Society of Broadcast Engineers and Society of Motion Picture and Television Engineers exhibitions. Registration for each conference will be separate, while access to the equipment exhibition will be open to attendees of all four conferences.

The task of making sure that the Radio Show's sessions conference retains its all-radio character will fall on Bill Stakelin, president, Apollo Radio Ltd., New York, who was named 1994 Radio Show chairman shortly after the 1993 show closed. Stakelin has ample experience with associations and their conventions as a past chairman of the NAB joint board and a former president of the

Radio Advertising Bureau.

Some exhibitors were grumbling about next year's combined show, but most appeared to support the idea or at least accept it as inevitable. "This is kind of the wave of the 1990s—get together and let everyone do what they do best," said John Abel, NAB executive vice president, operations.

Radio/Audio Pavilion

During an exhibitor meeting with NAB staff in Dallas, the main concern was over the placement of booths next year. In response to the early reaction to the merger announcement, Rick Dobson, senior vice president, conventions and exhibitions, said NAB (which is organizing the combined show) is considering a "Radio/Audio Pavilion" for traditional Radio Show exhibitors.

Some exhibitors, however, said they did not want to be placed in a "ghetto" of radio booths, because they would have products appealing to all media.

A final decision on a booth placement system is far from settled, Dobson said, and "nothing we do will

continued on page 12 ▶

THE INAB RADIO SHOW

Digital Broadcast Associates and Air Corp. joined forces to introduce compressionless digital technology to attendees of the Radio Show. For complete coverage, see pp. 14-24

The image shows two pieces of equipment: a rack-mounted unit labeled 'dB-CART' and 'DIGITAL OPTICAL' with a digital display showing '03 15 0110.0', and another rack-mounted unit with a digital display showing '03 15 0110.0'. Both units have various buttons and knobs on their front panels.

RBDS Emergence Expected

WASHINGTON Described as a bridge from analog to digital audio radio, the Radio Broadcast Data System (RBDS) technology appears to be catching on in the U.S., based on the number of stations that have purchased encoders and the various companies offering equipment and services.

As a response to inquiries about the status of RBDS in the U.S., beginning in this issue, RW will publish RBDS Roll-Call (page 8), a complete listing of stations, manufacturers and service pro-

viders. The section will be published three times in 1994 to keep readers up to date on the progress of RBDS.

Counting station translators, the RBDS station total is nearly 100, and interest continues to increase, according to encoder companies RE America and Modulation Sciences.

RBDS is based on the European Radio Data System (RDS), a 57 kHz subcarrier capable of sending various kinds of data to equipped receivers. Basic RBDS can provide text display of station call letters, and artist/song and other information with receivers that have scrolling text capability.

Another feature now widely promoted in the U.S. is the ability to select stations by format. Receivers can lock onto signals, based on format if the station is transmitting the format code.

Other RBDS uses include traffic alerting, EBS alerting, communications between studios and transmitters, and automatic translator/booster switching to provide interruptionless transitions between frequencies.

More innovative RBDS uses are already in the marketplace including CouponRadio's card encoder/reader system that would allow car radios to be used as devices for encoding promotion and discount retail information on cards that could be used at participating retail locations.

Specialized Communications is offering its Musicboard service that allows stations to promote themselves by actually displaying artist and song on a roadside billboard.

Paging companies, such as Axxess, are offering a new twist to an existing service by using the RBDS subcarrier. Global positioning is yet another use.

Look for a complete editorial analysis of RBDS in the Nov. 10 issue of Radio World.

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The image shows a large, rack-mounted broadcast transmitter with a complex control panel featuring numerous knobs, switches, and meters. The unit is labeled 'CCA BROADCAST TRANSMITTER' at the top.

Studio Sessions

Equipment and Applications for Radio Production and Recording, pp. 25-40

The image shows a piece of audio equipment, possibly a mixer or recorder, with two large circular components on top, possibly tape reels or speakers. The equipment is labeled 'RW'.

Circle (81) On Reader Service Card

World Radio History

NEWSWATCH

Eureka Specs To be Released

SOPIA-ANTIOPOLIS, France Eureka-147 DAB system specifications were set to be released following action by a joint technical committee of the European Broadcasting Union (EBU) and the European Technical Standards Union (ETSU), according to sources close to the committee.

This move contradicts action of Eureka-147 developers, who voted last summer not to release

the specifications, instead expanding membership of the consortium. The Eureka developers sought to maintain control of the specifications after the federation of German public broadcasters (ARD) dropped consideration of the system until 1997, citing cost restraints.

Meeting in Sophia-Antipolis, France, near Nice at ETSU headquarters, the ETSU said it controlled the specifications because of funding contributions, and decided to comply with committee member wishes

that the specs be released for standardization.

Some organizations opposed the Eureka consortium action, fearing delays in standardization would delay implementation. Many European broadcasters want DAB on the air by 1995.

The move to open consortium membership while delaying release of the specifications confused many, but the action led to interest from manufacturers such as Pioneer, Sony, Kenwood, Sharp, Motorola and Delco.

One of the main complaints from broadcasters testing Eureka-147 is the lack of receivers, which can cost up to \$20,000.

The specifications were to be

released October 5, following a Eureka-147 consortium meeting. Technical committee members then would vote by mid-November on whether to put the specifications out for public comment as part of the standardization process.

Harman Acquires Majority of AKG

NORTHRIDGE, Calif. U.S.-based audio equipment manufacturer Harman International recently purchased a 76 percent interest in AKG Acoustics, the Austria-based manufacturer of microphones, headphones and other professional audio products.

AKG was established in 1947 and over time, has been awarded more than 1,400 patents. It had representatives in 102 countries, as well as subsidiaries and affiliated companies.

In 1984, the company went public, and majority ownership changed several times.

With the buyout, AKG will maintain its own identity, according to representatives of Harman.

In the U.S., the only organizational change is that the company now will report directly to Harman.

Index

NAB COVERAGE

Session Delves Into Age of Digital	
by Dennis J. Martin and Randy Sukow	15
Seminar Shows Latest in Antennas	
by W.C. Alexander	16
Timetable Explained For AM Expanded Band	
by W.C. Alexander	17
Host of New Products Seen at Radio Show	
by Dennis J. Martin	21

STUDIO SESSIONS

Radio Documentary Requires Planning	
by Steve Rowland	25
Tips For a Better Sounding Condenser	
by Ty Ford	28
Radio Dramas to Make Orson Proud	
by Frank Beacham	29
Exploring Hard Drives, Removables	
by Mel Lambert	30
Hum Remedies: Bring It All Together	
by Bruce & Jenny Bartlett	37

BUYERS GUIDE

USER REPORTS

CCS Codec Cleans Up ABC Radio Act	
by William Holder	41
Dolby DSTL Makes the Grade at KMPS	
by George Bisso	42
Comrex Brings Cabo San Lucas Home	
by George Zema	44
CATLINK and T-1 Connect Michigan Stations	
by Walter Sisson	47
RE 533 Delivers to 'Smart' Radio	
by Mark Humphrey	48
EBSCentral Helps Solve WKBM FCC Worries	
by Ralph Sherman	49
Bext Bests KKIQ(FM) STL Situation	
by John Buckham	50
Henry Simplifies Station Information Lines	
by Tom Koza	51
Moseley Clears Jammed STL Channel for MPR	
by Kim Knocker	53
MSI: Setting a RBDS Standard at WYPL	
by Steve Terry	54
KXKL Remote Needs Met With Burke ARC-16	
by Ted Nahil	55

TECHNOLOGY UPDATES

Radio Systems, Inc.	56
AEO	56
Gentner	56
TFT	58
Hallikainen	58
Gentner	58
Avocet	59
Telos	59
T-Tech	59
Intraplex Inc.	59
Transtream Inc.	59
Fiber Options Inc.	59

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IEEE Examines DAR, RF Guidelines

WASHINGTON The annual IEEE Broadcast Symposium was held in Washington, D.C., on Wednesday, Sept. 22, and Thursday, Sept. 23. Subjects included advanced radio and other broadcasting topics.

The presentations on digital radio and digital TV made it clear that, fundamentally, the broadcasting of data bits is really the same for both media. Presenters also made it clear that broadcasters will have digital pipelines to consumers, and they need to start thinking about other valuable services that can be transmitted besides the traditional audio and video. These new applications may be the greatest challenge for the industry in the future.

The Wednesday morning session began with Consultant Steven Crowley's overview of various transmission systems proposed for digital audio radio (DAR) service. He covered the satellite, out-of-band, in-band on-channel (IBOC), and in-band adjacent channel (IBAC) systems that have been proposed, with a discussion of the technical issues each system faces.

Among other things, Crowley pointed out that systems using large amounts of time diversity in their channel coding require relatively long acquisition times before they lock on to a station. Listeners might find that annoying, he said.

A stationary benefit

Also, he noted adaptive equalization systems, so far, seem to have more benefit for stationary receivers in a fixed environment than mobile receivers in a rapidly changing environment.

No discussion of digital radio would be complete without a review of the policy issues involved. Crowley discussed the FCC's pioneer preference, rulemaking procedures, and the concerns about localism, economic disruption, allocation of new channels, and public use of the new services.

Because so little is known about the performance of data broadcast systems at VHF frequencies, research is being done by the EIA Digital Audio Radio Subcommittee.

Presenter Bob Culver, who is working on the project with Brian Warren of Delco Electronics, said an actual transmitter is broadcasting a data signal on TV channel 6 in Salt Lake City. A van, outfitted with calibrated antennas and receivers, is scheduled to take field readings every foot or so while driving around the city.

The data should provide information

Broadcasters, who will have digital pipelines to consumers, need to start thinking about the valuable services that can be transmitted.

about the detail and statistical distribution of multipath effects on urban and suburban VHF propagation, according to Culver. This may help the proponents of digital VHF radio systems adapt their channel coding schemes to minimize or eliminate multipath effects.

Consultant Tom Keller reported on the development of the test procedure for the digital audio radio laboratory tests. The results will be reported to the NRSC (National Radio Systems Committee) and EIA (Electronic Industries Association) working groups. The lab tests are well defined, and Keller listed the objective and subjective tests to be performed.

The test procedure is complicated by the fact that the DAR systems are designed for different purposes, i.e. satellite, IBOC-FM, IBOC-AM, IBAC (adjacent), and new band systems. The tests have to account for the different problems each system faces.

Keller noted a special concern; once you've learned to hear the artifacts on a

digital compression system, you know what to listen for; you'll always hear them, and "they become very annoying."

Judicious ears

He hopes that careful evaluation by trained expert listeners will enable selection of an audio coding scheme that will be able to stand the test of time.

Consultant Skip Pizzi reviewed the problems of degradation caused by repeated layers of digital compression. He played some tapes showing clear degradation after eight encode/decode cycles. He noted that the problem seems

to be more severe when the same encoding scheme is used, rather than different schemes. Pizzi believes that's because the same coding algorithm will make the exact same error each time, it reinforces

the problem until it's clearly audible.

The greatest effect seemed to be on time-domain sensitive material (transients). Pizzi noted that the effects seemed to be less severe if the audio was transferred between coders as analog; he believes that the slight gain errors inevitable in an analog transfer make the generations of digital coding behave

slightly differently each time, improving the result.

Consultant Jules Cohen presented an update on the new (radio frequency radiation (RFR) standards and their impact on broadcasting. He said the new limits have two protection levels, for controlled and uncontrolled exposure. They are tighter in the microwave bands and looser at low frequencies. There is a discontinuity at 100 MHz, which has been a concern for the broadcasters and regulators; logically and administratively, it would make sense to treat all FM stations the same, critics contend.

Mike Martin of the Potomac Electric Power Co. (PEPCO, Washington, D.C. area) talked about power line RFI (radio frequency interference). PEPCO handles about 500 RFI complaints a year, 20 percent of them turn out to be real. Martin explained that poor metal to metal contacts in the conductors and insulators can cause the arcs that generate RFI, and that some of them only occur under certain weather conditions.

Wet telephone poles have enough conductivity (in a 20 kV field) to contribute to the problems, Martin said. Wooden poles also shrink as they age, loosening bolts and other hardware. The RFI problems can travel miles down a line, making it difficult to pinpoint the source.

According to Martin, furnace and doorbell transformers, and aquarium heaters as common household sources of noise that are mistaken for power line RFI.

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EARWAVES

Fall Shows Over, Groups Look to 1994

WASHINGTON This is RW's radio convention wrap-up issue, and you will find it spilling over with new product information and coverage of the big issues that were discussed at the convention. Digital compression continued to hold the limelight, much as it did at the spring show, but the discussion is more balanced now.



Proponents of digital technology have made their voices better heard in the melee. Yes, sonic degradation will occur when compressed audio is stacked and restacked, but a judicious use of digital technology can make you sound better than you might now. Anyone who has abused analog audio knows what distortion will occur. You can look to the experts for their continuing thoughts on the issue, and you can find many of them in our pages.

★ ★ ★

Time moves on, however, and since NAB gathered its radio fold in Dallas, business has continued to happen. The Society of Broadcast Engineers (SBE) held its national convention (in combination with the RTNDA national gathering) in Miami Beach, Fla. RW will have an SBE wrap-up in the next issue, but I did want to share some thoughts on that show.

Attendance was up from last year's at the SBE gathering, but the association lost money on the show—the exhibit floor to be exact—to the tune of \$25,000 or so. The good news is that the association won't be handling the exhibit floor for the

"Super Show," thus it won't stand to lose money on that again.

As you know by now, the NAB has teamed up with SBE, SMPTE and RTNDA for next year's gathering. NAB will handle the exhibit floor sales for all the groups. The remaining good news is that SBE assured me it will not be increasing dues or decreasing member services to make up for the loss. According to the SBE, the money will come out of the national office budget.

The Super Show should be good for the SBE as the combination crowd of managers, programmers and engineers will all be exposed to the issues of technical significance.

Based on the dazzling display of new technology for radio at the Fall Radio Show, I think it is safe to say that manufacturers are confident of the medium's future health. Technological developments seem to outpace even the most cutting-edge of broadcasters.

U.S. broadcasters are just now climbing on the RDS/RBDS bandwagon, and to give you an idea of who they are and how widespread the technology is, we will be providing you with quarterly updates of broadcasters using the technology (see our initial RBDS Roll Call on page 8).

But, as you will read in our NAB coverage, already there are high-speed data systems of 16-20 kbps in development (versus the 1.2 kbps of RDS). In Japan, 16 kbps systems are being sold to consumers.

It almost can be overwhelming. When so many stations are just struggling to survive, it seems frivolous to be writing about futuristic datacasting technologies. But the truth is that those technologies will help define the radio industry's position in the envisioned digital communications "superhighway" of the future. So stay tuned and we'll keep you posted on the latest gadgets.

★ ★ ★

And speaking of broadcasters on the edge of tomorrow, Mel Karmazin is steering Infinity Broadcasting into the forefront of the industry. Through a com-

plicated deal, Karmazin's Infinity Broadcasting will become a majority player in Westwood One. At the same time, Westwood is purchasing Unistar Radio Networks (an entity which Infinity has been managing since earlier this year). So Infinity will end up with both Unistar and Westwood, and Mel Karmazin will become Westwood's new CEO.

We'll have the complete story on the deal in our next issue.

★ ★ ★

Our heartfelt condolences to Beverly Butler for the death of her husband, Thomas Sheridan Butler. Mr. Butler was

well known in the industry for more than 30 years—he both sold broadcast equipment and managed and owned radio stations. Thomas, 63, passed away at his home in Limestone, Ark., on Wednesday, Sept. 29. He spent his professional life in the businesses of broadcasting and pharmaceuticals. He was the cofounder of Eureka Springs' KTCN(FM) in 1985 and was involved in its operation through 1991.

He traveled the international circuit for broadcast equipment manufacturers Collins Radio/Rockwell International, Continental Electronics and McMartin Industries.

Akira Saito was named president of Denon America Inc. Concurrently, Hideo Kushida was named vice president of sales administration and product planning.

Saito will retain his previous responsibilities as Denon America's treasurer and chief operating officer. A 30-year veteran of Nippon Columbia, Denon's parent company, Saito joined Denon America in 1987.

Kushida had been serving as Denon's director of service and quality control. He has been with the company for 13 years. Both executives will be based in Denon America's Parsippany, N.J., headquarters.

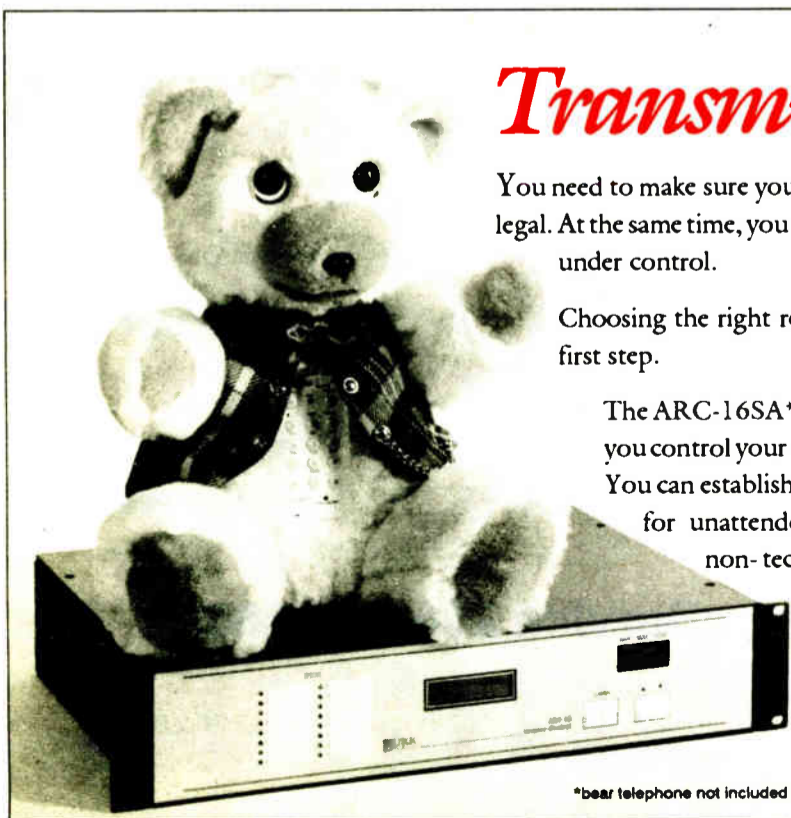
Tom Haga was named president of Pioneer New Media Technologies Inc. Haga joined Pioneer Electronic Corp. in 1970, and has worked in the company in various capacities, including: acoustic and sales engineer; production control and material manager; president, Pioneer Industrial Components, as well as responsibility for car electronics manufacturing and OEM sales;

general sales manager, International Business Group, Pioneer Electronic Corp., and executive vice president, Pioneer New Media Technologies.

The Radio Advertising Bureau (RAB) reports that radio revenue (combined national and spot) for August 1993 was up 8 percent compared to August 1992. Combined revenue year-to-date through August was up 9 percent. The figures are based on the RAB radio revenue index of more than 100 markets.

Local revenue was once again the top performer with a 9 percent gain for the month of August, a repeat of its July 1993 showing. Revenue on the national front was down slightly to 7 percent from its July 1993 increase of 9 percent.

Regional breakouts posted strong local revenue growth across all regions. On the national revenue side, the Southeast took the biggest dip when compared to the July 1993 numbers, while the Midwest posted gains of 4 percent.



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World Radio History

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Overeager editing

Dear RW,
I appreciate the publication of my article on transmission line measurements in the July 14 issue. However, I feel that you left some important information on the "cutting room floor."

I pointed out that short circuit measurements could be made with the sample loops connected, the information following this statement which was omitted was:

"Be aware, however, when measuring a line with the sample loop connected (short circuit) the measured phase lag will be something other than the phase lag of the line itself, due to the inductance of the loop. For this reason, if it is at all possible, measurements should be made with the loop disconnected as well as with the loop connected. If you have this information when trouble develops, you can easily isolate the problem either to the loop and/or its connections or to the line itself.

It is also wise, if the line has natural breakpoints, such as isolation coils, etc., to break the line down to its individual sections and perform measurements on these sections as well as on the overall line."

Fred W. Greaves, Jr.
Assistant Director of Engineering
Susquehanna Radio Corp.
York, Pa.

Hurrah for Al

Dear RW,
What a refreshing sight to find someone in this industry with some scruples, backbone, morals and principle of character! I'm referring to *From the Trenches*, by Al Peterson, in the Sept. 22 issue of RW.

Why is it that we think we have to use shock treatment to get an audience? My hope for you, and your Keymarket Station, is that you will blow the competition away and show a new level of

ratings for WNNK that has never been achieved.

In today's environment, we have no absolutes; there is no right or wrong, no black or white and no good or bad, so it's refreshing to see someone take a stand of good judgment against the temptations to cave in because it's "good money." Money is not the final designation of success.

In the referenced article, I question one statement. "Let me say, I don't intend to be the first to do so." I trust you would withstand the otherwise normal tendency to yield, cave and give in all together. It's a great feeling of achievement to look back and, with pride, be able to show your kind of courage and strength, swimming against the polluted stream.

Alan, thanks for being there, and thanks for keeping your reputation and for showing the rest of us the way!

Walt Rice
RF Specialties
Rockwall, Tex.

Dear RW,

Here at WINS(AM) New York we don't get a great deal of advertising for jeans, but I can assure you we would not carry any spot that used this approach. I'm surprised the spot ran on any station.

I'm a big believer in freedom of speech and that the listener can always turn the dial, but I wouldn't want to fight that battle over an advertiser's right to use a truly questionable spot to promote a product.

I agree with everything Al Peterson said and I appreciate his taking the time to say it.

Warren Maurer
Group W
New York, N.Y.

Engineering standards

Dear RW,

Few engineers, many PEs included, are aware that licensing of engineers and surveyors began here in Wyoming, the nation's least populated state, almost 90 years ago. Licensing came about when the state solicited for engineering studies related to the construction of a series of dams on the North Platte River and received a number of very defective proposals from people claiming to be engineers. From what I have read, some were so blatant as to have water flowing up hill!

A few surveys prior to this licensing act by inept surveyors are causing problems to this day. Only a few years ago, it was discovered that a sparsely populated area of several hundred square miles in north-eastern Wyoming, surveyed before the turn of the century, had benchmarks misplaced by as much as a mile. Resulting disputes over property and mineral rights (the area contains a large number of oil wells) may keep lawyers and courts busy into the next century.

The Wyoming Legislature was rightfully outraged by the ineptitude of some and down-right fraudulent representations of others claiming to be engineers and surveyors and passed, in 1907, leg-

Datacast In Radio's Future

The NAB's Fall Radio Show convention in Dallas was decidedly positive. Although registration levels may not have increased dramatically, those present were there to conduct business and attend sessions. A number of products were introduced at the show, and many that were introduced at the spring show were refined and ready to

ship at Radio 1993.

There was quite a bit to be dazzled by at the Fall Radio Show. Technological developments are pacing far ahead of the industry's ability to implement them. U.S. broadcasters are just now climbing on the RDS/RBDS bandwagon (see our Roll Call on page 8) and already there are high-speed data systems of 16-20 kbps in development (versus the 1.2 kbps of RDS). In Japan, they are already being sold to consumers.

Now more than ever, managers and engineers both need to keep abreast of technical developments to make informed decisions when mapping out business plans and preparing budgets. New datacasting technologies will help define the radio industry's position in the envisioned digital communications "superhighway" of the future.

Programming and management are fundamental building blocks for success in radio. But there now is a whole new world of business possibilities and alternate sources of revenue opening up to broadcasters, and those with the knowledge and entrepreneurial drive will be the ones to benefit first and most from this new arena.

The NAB has teamed up with SBE, SMPTE and RTNDA for next year's gathering. The combined show will help steer radio members, both management and engineering, toward issues of technical significance that will ultimately have repercussions on every station's bottom line and survival. The combination of forces by the various associations mean that exhibitors and broadcasters will both be better served. You can look forward to even further developments in the future.

—RW

isolation that mandated examination and licensing of those individuals claiming to be professional engineers and surveyors. Wyoming's licensing standards have been adopted in whole, or in part, by virtually every other state in the nation.

Dan Roberts
Roberts Broadcast Equipment
Casper, Wyo.

Amp repair woes

Dear RW,

Last February, acting on a letter with this information in RW's Reader's Forum, we sent in our Versa-Count transmitter power amplifier to a former co-partner of Versa-Count, Mr. Al Williams. His partner had died, causing the demise of Versa-Count, but he, according to the letter, would still do recalibration and repair work on those units. On that basis, I called Mr. Williams at his home phone. He agreed to do our unit, and so I sent it to him at his present workplace, American Communications Control Engineering, 500 Harvester Court, Wheeling, IL60090, phone 708-541-1211, to have him do our repair.

When the amp did not come back right away, I called. Mr. Williams told me that it would be out soon, then weeks later that it was on its way, then even later that there had been an error and it would be out right away. It never showed up. Despite many further phone calls, and constant excuses of one sort or another, we have yet to receive that unit.

Finally, we have been working through the attorney general of Illinois, our attorney here, and some law officials in Illinois. If any other of your readers have had difficulty with Mr. Williams, I would like to hear about them at 913-243-1435, ext. 233. If anyone is contemplating having Mr. Williams work on their unit or have dealings with American Communications, I would urge them to think more than twice about it.

David Norlin
Broadcast Instructor,
KVCO-FM Station Mgr.
Cloud County Comm. College
Concordia, Kan.

Flood relief

Dear RW,

Just wanted to let you know in the Midwest Flood Relief effort, WTIM(AM) Taylorville, Ill., held a 12-hour telethon July 25 for the Christian County, Ill., chapter of the American Red Cross. The local Red Cross chapter chairman was our co-host, and we featured stories on what was happening just two hours away from us in Western Illinois.

Our listeners called in pledges, and local volunteers answered the WTIM phones. Almost \$3,000 was raised in one day for the Midwest Flood Relief, another attest to the power of local radio.

Randal J. Miller
President/General Manager
WTIM Newstalk 1410
Taylorville, Ill.



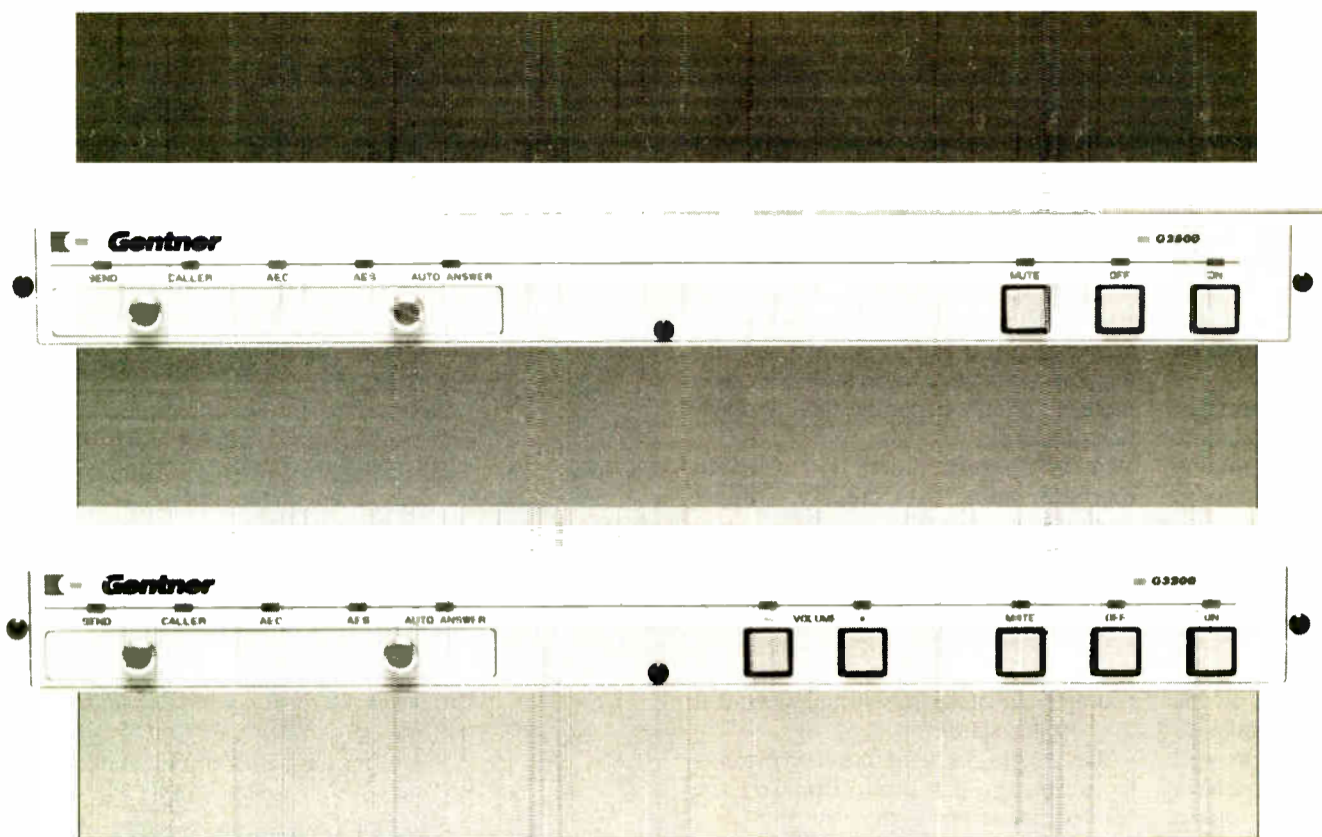
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Advanced 'Datacasting' Promoted

by Randy Sukow

DALLAS Data broadcasting over FM subcarriers (and possibly over AM carriers as well) is developing into a major source of revenue, experts at the National Association of Broadcasters (NAB) 1993 Radio Show in Dallas said.

Entrepreneurs demonstrated several ways to take advantage of the year-old NAB/Electronic Industries Association radio broadcast data system (RBDS) standard. RBDS, based on radio data system (RDS) technology that has been in operation in Europe for several years, delivers digital information to consumer receivers at a rate of 1.2 kilobits per second (kbps).

But RBDS is already obsolete, some say. High-speed data systems of 16 kbps to 20 kbps are in development and, in Japan, already being sold to consumers.

Regardless of the technology that ultimately catches on, broadcasters appear to be moving irreversibly to non-audio digital media.

Japanese consumers are already buying receivers for Data Radio Channel (DARC) transmission, based on level-controlled minimum shift keying (L-MSK) technology. The system, developed by Japan Broadcasting Corp. (NHK), Sanyo Electric Co. and other Japanese companies, transmits at 16 kbps over a 76 kHz FM subcarrier, over 13 times the rate of RDS.

"The system will create an entirely new dimension to radio," said Edward Sarkiss, senior engineer, databases systems integration for Digital DJ, San Jose, Calif., U.S. representative for L-MSK technology, a first-time exhibitor at this year's Radio Show.

L-MSK not only transmits substantially more information than RDS, but L-MSK receivers will store digital data for later recall. The receiver's six-inch liquid crystal display allows for more detailed data presentation, including graphics and, potentially, full-motion video. Weather and traffic information services are among the L-MSK applications already in operation in Japan.

Gordon Kaiser, president, CUE Network Corp., Irvine, Calif., which uses FM subcarriers for its paging system, went as far to say that L-MSK has already overtaken RDS. "I believe RDS is an outdated technology, and I say that when I am operating the largest network in the world operating at 57 kHz in 1,200 bits per second," Kaiser said during a Radio Show technical session.

RDS and L-MSK are compatible: anyone buying RDS today could convert smoothly to L-MSK in years to come. "We don't even like to compare the two

the Hayes modem of the air," Morgan said.

High-speed data transmission is an issue to be resolved in years to come. Some broadcasters believe they can and should make money with RBDS today.

At the same time, strong RBDS support could return significant revenue to the industry. Ron Haley, president, Differential Corrections Inc. (DCI), Cupertino, Calif., de-scribed his proposed service, which would use RBDS to build on the military's global positioning technology. The result is a positioning service that will let a driver know his position accurate to within 100 meters.

"RDS has some absolutely tremendous things going for it. The first thing is that it's going to be everywhere, with the possible exception of Japan. We're working to address that situation, but basically, in the world we're going to be able to have a common standard sys-

tem," Haley said.

"My feeling is that there is no chicken and egg situation here. There is just a lack of an organized plan," said David Alwadish, president, CouponRadio Inc., New York.



One use for enhanced radio technology

of them," said Lucie Allen, Digital DJ marketing manager.

An NHK representative in Dallas said L-MSK has already become a Japanese national standard and that it would be proposed to the International Radio Consultative Committee (CCIR) in October.

In the U.S., the National Radio Systems Committee (NRSC) is forming a high-speed data subgroup, which is expected to attract other data broadcasting developers who are currently testing systems for 19-kbps and 20-kbps operation.

"We're talking about a standardized, high-speed SCA. Whether its going to be NHK's 16 kilobits remains to be seen," said NRSC Chairman Charlie Morgan, vice president and director of engineering, Susquehanna Broadcasting, York, Pa. "I would like to see radio broadcasters become common carriers. You have an input and you have an output...We can be



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RBDS ROLL CALL

The following is **Radio World's** quarterly listing of RBDS stations, equipment and receiver manufacturers, and service providers.
If you would like to be included in the next listing, contact John Gatski at 703-998-7600.

RBDS Equipment Manufacturers

AEV

Via Saviolo I/E
40017 Le Budrie
Di S. G. Perisceto
Bologna, Italy
+39-51-95.02.01

CRL

2522 West Geneva Drive
Tempe, Arizona 85282
Contact: Bill Ammons
602-438-0888

Inovonics, Inc.

135 Fair Avenue
Santa Cruz, California 95060
Contact: Jim Wood
408-458-0554
Reader Service 165

Modulation Sciences

12A World's Fair Drive

Somerset, New Jersey 08873

Contact: Art Constantine
908-302-3090

Reader Service 80

modulation sciences, inc.

RDS Diagnostix

74 Hanover Road
Mountain Lakes, New Jersey 07046
Contact: Boyd Baker
201-344-7858

RE America, Inc.

21029 Center Ridge Road
Westlake, Ohio 44145
Contact: John Casey
216-871-7617

Reader Service 59

Rohde and Schwarz

4425 Nicole Drive
Lanham, MD 207406
Contact: Chris Porzky
301-459-2810

SCA Data Systems

225 Arizona Avenue
Santa Monica, California 90401
Contact: Corine Weber
310-576-0655

Teli AB

14980 Nunashamn
Sweden
Contact: Marc Roman
+46-8749-6600

Tectan

Box 27157
Concord, California 94572
Contact: William Leasey
510-796-2222

Reader Service 46

TECTAN
RBDS PRODUCTS

VG Electronics

Theaklen Drive Hastings
East Sussex TN34 1YQ

England

Contact: Bev Marks
+44-424-446888

RBDS Receiver Manufacturers (with current U.S. models)

Access (Paging)

6620 Riverside Drive
Suite 200
Metairie, Louisiana 70003
Contact: Bobby Adams
504-887-0950

DENON

Denon (Car/Home)

222 New Road
Parispany, New Jersey 070054
Contact: Stephen Baker
201-825-7950

Reader Service 73

Grundig (Portable)

3520 Haven Ave.
Unit L
Redwood City, California 94063
415-361-1611

Onkyo (Home)

200 Williams Drive
Ramsey, New Jersey 07446
Contact: Fred Maxix
201-825-7950

Terrapin (GPS)

11958 Monarch Street
Garden Grove, California 92641
Contact: David Kelley
714-898-8200

RBDS Service Providers

Access (Paging)

6620 Riverside Drive
Suite 200
Metairie, Louisiana 70003
Contact: Bobby Adams
504-889-0950

DCI (Global Positioning)

20045 Stevens Creek Boulevard
Suite 2A
Cupertino, California 95014
Contact: Ron Haley
408-446-8383

Reader Service 107



Coupon Radio (Information Services)

10 Rockefeller Plaza
New York, New York 10020
Contact: David Alwadish
212-956-7959

Reader Service 32

Sage Alerting (EBS)

700 Canal Street
Stamford, Connecticut
Contact: Gerry Lebow
203-357-1464

Reader Service 40

Specialized Communications

(Music Billboard)
1638 153rd St. SE
Bellevue, Washington 98007
Contact: Allen Hartle
206-641-9043

Reader Service 159

TDF Paging

6577 143rd Street N.
Palm Beach Garden, Florida 33418
Contact: John Canady
407-694-2510

RBDS Stations

Station	Frequency	City	Station	Frequency	City
CALIFORNIA			NEVADA (cont.)		
KLON-FM	88.1	Long Beach	KNPR-FM*	91.7	Beatty
KTWW-FM	94.7	Los Angeles	KNPR-FM*	88.7	Indian Springs
KNPR-FM*	88.1	Ridgecrest	KNPR-FM*	89.5	Laughlin
KSFM-FM	102.5	Sacramento	KNPR-FM*	88.7	Moapa Valley
KPBS-FM	89.5	San Diego	KNPR-FM*	88.7	Pahrump
KEAR-FM	106.9	San Francisco	KNPR-FM*	88.1	Scotty's Junction
KOME-FM	98.5	San Jose	KNPR-FM*	105.1	Searchlight
COLORADO			KLUC-FM*	98.5	Las Vegas
KMJI-FM	100.3	Denver	KFMS-FM	101.9	Las Vegas
DISTRICT OF COLUMBIA			KEYV-FM	93.1	Las Vegas
WGAY-FM	99.5	Washington	KRRI-FM	105.5	Las Vegas
GEORGIA			KOMP-FM	92.3	Las Vegas
WSTR-FM	94.1	Smyrna	KEDG-FM	103.5	Las Vegas
ILLINOIS			KFBI-FM	107.5	Las Vegas
WXRT-FM	93.1	Chicago	KYRK-FM	97.1	Las Vegas
WLS-FM	94.7	Chicago	KLNR-FM*	91.7	Panaca
WLIT-FM	93.9	Chicago	KTPH-FM*	91.7	Tonopah
WNUA-FM	95.5	Chicago	NEW YORK		
WVAZ-FM	102.7	Chicago	WHTZ-FM	100.1	New York
WCKG-FM	105.9	Chicago	OHIO		
WGCI-FM	107.5	Chicago	WOUN-FM	91.3	Athens
WLUP-FM	97.7	Chicago	WVXU-FM	91.7	Cincinnati
WUSN-FM	99.5	Chicago	WWNK-FM	94.1	Cincinnati
WBEZ-FM	91.5	Chicago	WGAR-FM	99.5	Cleveland
WKQX-FM	101.1	Chicago	WGTE-FM	91.3	Toledo
WFMT-FM	98.7	Chicago	WLTF-FM	106.5	Cleveland
INDIANA			WKKO-FM	99.9	Toledo
WSHW-FM	99.7	Frankfort	WOUZ-FM	90.1	Zanesville
WZPL-FM	99.5	Indianapolis	PENNSYLVANIA		
WZVZ-FM	92.7	Kokomo	WRTI-FM*	97.1	Allentown/Bethlehem
WWKI-FM	100.5	Kokomo	WNCE-FM	101.3	Lancaster
LOUISIANA			WRTI-FM	90.1	Philadelphia
WGGZ-FM	98.1	Baton Rouge	WPLY-FM	100.3	Philadelphia
KFXV-FM	96.7	Morgan City	WDOU-FM	90.5	Pittsburgh
WLMG-FM	101.9	New Orleans	WRTI-FM*	97.7	Reading
WMXZ-FM	95.7	New Orleans	TENNESSEE		
WTGE-FM	100.7	Baton Rouge	WYPL-FM	89.3	Memphis
KIPY-FM	99.9	Lafayette	TEXAS		
KCIL-FM	107.5	Houma	KNLE-FM	88.1	Austin
MASSACHUSETTS			KAYD-FM	97.5	Beaumont
WGBH-FM	89.7	Boston	KQXY-FM	94.1	Beaumont
MARYLAND			KKMY-FM	104.5	Orange
WHFS-FM	99.1	Annapolis	KYKR-FM	93.3	Port Arthur
WIYY-FM	97.9	Baltimore	UTAH		
MICHIGAN			KSOS-FM	106.9	Ogden
WIOG-FM	102.5	Bay City	KSOS-FM*	92.1	Salt Lake City
WLLZ-FM	98.7	Detroit	KSOS-FM*	96.7	Salt Lake City
WKQI-FM	95.5	Detroit	KSOS-FM*	98.3	Utah County
WJLB-FM	97.9	Detroit	VIRGINIA		
MINNESOTA			WLTY-FM	95.7	Norfolk
KBEM-FM	88.5	Minneapolis	WNVZ-FM	104.5	Norfolk
NEW MEXICO			WKOC-FM	93.7	Virginia Beach
KKOB-FM	93.3	Albuquerque	WCDX-FM	92.7	Richmond
NEVADA			WASHINGTON		
KKLZ-FM	96.3	Las Vegas	KUOW-FM	94.9	Seattle
KNPR-FM	89.5	Las Vegas	KMPS-FM	94.1	Seattle
KNPR-FM*	88.7	Boulder City	KRPM-FM	106.1	Tacoma

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32-to-48 CD-to-DAT
DAT-to-1630 44.1-to-48
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ProAudioVideo

KTWV Promotes Station Via 'Programercial'

by Pamela Watkins

LOS ANGELES *Programercial?* You read right. It is a unique marketing strategy KTWV(FM) (94.7 MHz) "The Wave" implemented in an effort to boost some of its ratings. Designed to take the infomercial idea one step further, a programercial is the KTWV version of this marketing tool aimed to familiarize potential listeners with The Wave's musical programming.

Forsaking the traditional six-week, 30-second television commercial, Los Angeles' eclectic contemporary adult music station The Wave embarked upon a

different method to get its sound and story to potential listeners. "The Wave is a different kind of product and the best way to explain it was through the various acts that appear on the station," said Vice President/General Manager Chris Claus. "Our sound just can't be pigeon-holed into a 30-second spot effectively."

A la carte

In late August, KTWV sponsored "L.A. A La Carte," an annual food festival with musical acts to help raise money for the homeless. "L.A. A La Carte" had been on the station's marketing and event schedule

since the 1993 budget was planned. However, the programercial idea didn't develop until weeks before the event.

While sitting around Claus' office discussing the logistics and dynamics of their sponsorship, the management team of Chris Brodie, program manager, Bonny Chick, marketing director, Susan Boyer, publicity, and Walter Sabo, consultant, came up with the brainstorm: "Why don't we tape the musical elements at A La Carte and create a half-hour television show instead of using the 30-second spot blitz for our fall campaign?" said one of the staffers. The idea was an immediate hit.

All the acts had been arranged. The Wave hired Panache Productions to produce the show with Shirin Azimadeh as producer. Azimadeh not only had no rehearsal time but also had a limited budget. However, she did have complete access to the musical acts and two days of shooting.

Claus, Brodie and Chick decided to intersperse the music of Dave Boz, Boney James, Kilauea and Peter White with talking head testimonials from the event participants. KTWV had been promoting the event for weeks so they were relatively sure they would garner enough positive responses to intersperse throughout the half-hour production.

Along with promoting the contemporary adult sound of the station, KTWV enlisted Michael Nouri (CBS's "Love & War") as host for the programercial and touted him as an avid listener—the soft sell strategy.

Logging the calls

The sell portion of the program happened when host Michael Nouri came on the stage, an 800 number appeared as he asked listeners to call if they like the music and if they wanted to receive KTWV's music newsletter. "Even though we didn't want to hard sell our sound, we wanted to be able to build our database of potential listeners," said Claus.

The 30-minute programercial, "The Wave on Stage," played Sept. 17-26, on local television stations said Brodie.

During the past year, like most radio stations in the Los Angeles area, KTWV's ratings had reached a plateau and remained flat for a year.

"Acts were not counted in the budget because they were always part of the 1993 operating plan," stated Claus. Production and post production costs, as well as buying station time, were new expenses and came out of the 30-second TV spot budget. Claus estimated his new costs were less: "Even though we didn't buy the 30-second spot," said Claus, "historically we've spent in the neighborhood of \$1 million to \$1.5 million a year on advertising. The production cost of \$65,000 to \$70,000 to produce, including talent, shooting and editing was less than filming a 30-second commercial."

The programercial had 27 different air plays over a two-week period and Claus felt the station had more exposure with the programercial than with the 30-second spot, a six week campaign. The programercial will cost KTWV a little over "half a million to do," stated Claus.

"While working around the house on September 18, I turned on the TV hoping to hear a bit of the programercial. I did and was favorably impressed by not only the smooth, intricate upbeat music on television but also the creative camera work."

At this writing, it's too early to tell whether the programercial did the job of increasing ratings. However, Claus believed the intensity of the television blitz and the length of the spot, along with the uniqueness of the commercial, might remove that flat line.

Claus, Brodie and the rest of KTWV's management team were upbeat about "The Wave on Stage." "I think the programercial idea would work for all the stations in Group W," stated Claus with enthusiasm. Maybe programercials are the wave of the future. Look out!

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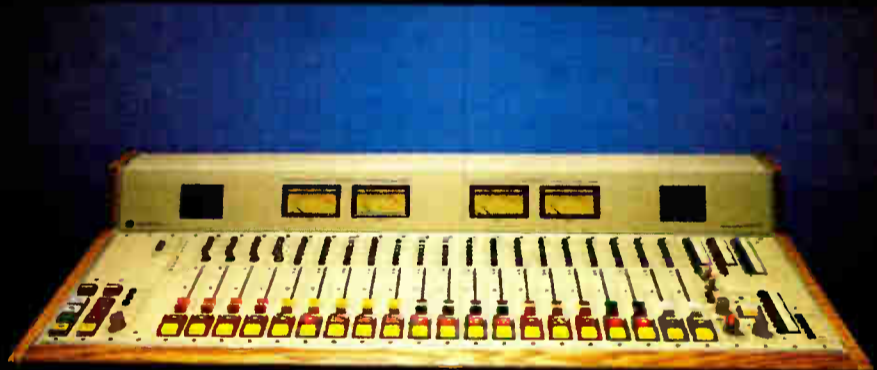
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Serious Business at Radio Show

► continued from page 1
be in the dead of night."

"Change is threatening to everyone," Abel said. But he predicted that by the time next year's show starts, everyone will be used to the idea and the joint exhibit announcement will seem like "a non-event."

Digital doings

Digital Broadcast Associates (DBA) and AIR Corp. have joined forces to come up with an alternative to digital data reduction: compressionless digital cart machines. The companies have jointly agreed to observe the ASPECT (Audio Standard Precision Exchange of Coordinated Technology). Manufacturers interested in the technology can produce equipment that records and plays re-recordable magneto-optical disks that are interchangeable, machine to machine, brand to brand.

The discs, manufactured by a number of companies are capable of handling 11 minutes of uncompressed audio, cost less than \$20 apiece, and come with a lifetime warranty.

The DBA Laser-CART is available now. AIR Corp. is putting the finishing touches on its version and expects to deliver product in the first quarter of 1994.

On the transmission side, broadcasters saw demonstrations of the two proposed in-band, on-channel (IBOC) digital audio broadcast (DAB) systems that U.S. broadcasters tend to favor by a wide margin over the new-band approach of the Eureka 147 system. Eureka, the IBOCs and two other proposed DAB systems are scheduled for several months of testing at NASA's Cleveland, Ohio, facility starting Dec. 31.

Consolidation through duopolies and local marketing agreements (LMAs) was a well-discussed topic at the show as well.

Many agree that it has been a positive development for the radio industry. But some individual deals have been disasters or, at least, disappointments.

A Radio Show panel advised broadcasters considering consolidation deals to base their decisions on conservative estimates; do not assume that revenues from the merged operation will be the sum of the preconsolidation revenues for each station.

"Sales don't equal what you think they will equal," said Alan Box, president, EZ Communications, Fairfax, Va. On the bright side, "in every case, expenses have been lower than we predicted."

Robert Gourley, general manager, KKCS-AM-FM Colorado Springs, said it has taken a year to work into a comfortable routine with LMA station, KIKX-FM Manitou Spring, Colo. KKCS would probably do it again if it had the LMA decision to do over, Gourley said, but it would take several additional factors into account before completing the deal. "LMAs are a totally separate business, which will certainly challenge your sense of humor," he said.

Gourley offered a number of things to look for before closing an LMA deal. Be sure that the LMA/duopoly station has an adequate, experienced sales staff and does not require a full-time manager. Do not enter the deal if sales for both stations must fall on the parent station's sales staff.

Finding and paying a full-time manager for the second station could cancel much, if not all of the added profitability of consolidation. Do not complete the deal unless the parent station's manager can handle both stations from one common studio location, Gourley said.

Advertising news

Not all the news at the radio show was technical. General managers, sales man-

agers and owners heard a dose of good news.

NAB and the Radio Advertising Bureau (RAB) reacted happily to the introduction of Senate legislation (filed on Sept. 10, during the Radio Show) to clear car-lease advertising on the radio.

If passed the legislation would give local broadcast associations a shot in the arm in their efforts to target a major category of advertising—the car dealership.

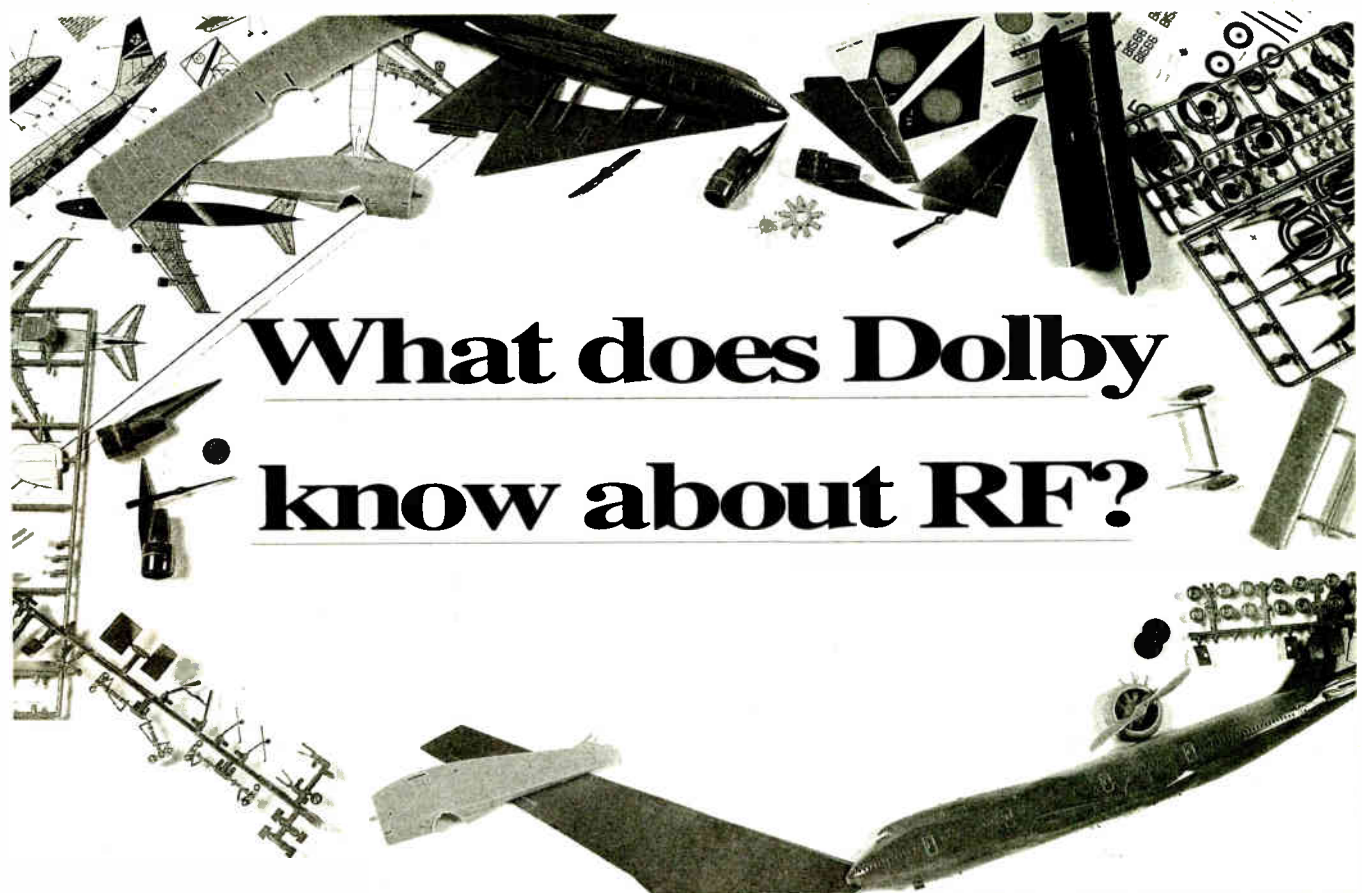
RAB estimates that the bill (S. 1447), introduced by Senators Richard Bryan (D-Nev.) and Alfonse D'Amato (R-N.Y.), if enacted, will attract \$20 million in additional radio advertising.

"I think (\$20 million) is a modest estimate," said Bill Burton of the Detroit Radio Advertising Group, which is also lobbying heavily for the bill. Leasing is a major trend in the auto industry and accounts for a growing percentage of TV and print automobile advertising, he said.

Under the current regulations, embedded in federal law by three 1960s-era banking and consumer protection acts, a radio announcer must read a long disclaimer at the end of the ad to outline consumers leasing rights. (TV and print ads can display the disclaimer in fine print.)

"The regulations have been on the books for a number of years, but they hadn't been a problem until recently," said NAB President Eddie Fritts. But their current effect "has taken radio completely out of the (car leasing) ballpark," RAB President Gary Fries said.

S. 1447 would replace the disclaimer with announcement of an 800 number consumers could call to hear leasing rights information.



What does Dolby know about RF?

Traffic Reports Go Airborne in Kansas City

by Bob Kirby

KANSAS CITY, Mo. When Johnny Rowlands goes to work, he experiences both his greatest joys—radio and flying. A little before 6 a.m., Rowlands adjusts a dual-mic headset, tests the two-way and Marti and gives the pilot a thumbs-up.

The Bell Jet Ranger rises off the Johnson County (Kan.) Executive Airport tarmac on a heading for downtown Kansas City, 18 miles northeast. Before long, commuters will tune-in Johnny's traffic reports on four Kansas City radio stations and the NBC-TV affiliate, expecting him to lead them the speediest way to work.

Rowlands has combined his love of flying with his broadcasting experience and in the process created Airborne Traffic Network.

The home-grown network reports morning and afternoon traffic information for 16 of Kansas City's 31 radio stations using eight reporters, three airplanes and a helicopter.

He started his career in 1972 at KEWI(AM) Topeka, Kan., as night DJ while completing college. He moved to Kansas City in 1975 to jock the overnight shift on KBEQ(FM), then a CHR station. He programmed a couple Kansas City stations in the early 1980s and began reporting traffic from above ten years ago this month while employed by KMBZ (AM) Kansas City, Mo. He started Airborne Traffic Network in 1988.

An early day

Rowlands' daily performance is tightly choreographed. He reports from the helicopter for WDAF-TV from 6:30 to 7 a.m., besides reporting for radio clients

KMBZ, KQRC-FM, KCFX(FM) Harrisonville, Mo., and KK CJ(FM) Liberty, Mo.

With his TV obligation over at 7, Rowlands moves from chopper to airplane for his other clients. Equipment is ripped from Velcro mounts, and there's a mad dash to a Cessna 152. From 7 a.m. through morning-drive, Rowlands continues his radio reports while flying the plane.

"If I'd walked into this and they handed me four stations immediately, I'd have been a basket case," he said. "I started with two stations and did that a couple years. We added a station, later another. What's the saying? Repetition is the mother of skill. I've done I don't know how many thousands of traffic reports. You develop the ability to quickly shift your concentration."

Listeners know Rowlands pilots the plane. Occasionally they overhear his communications with Downtown Airport's control tower. "I'll sometimes be in the middle of a report, and if the tower calls, traffic's gotta wait. I'll do a little tower talk, then jump back into the traffic report, picking up where I left off."

Eyes in the sky

While Rowlands reports from a Cessna 152, three Airborne reporters are servicing other stations from a Cessna 172, according to Airborne Program Director Chris Wilkinson. "Steve Parker, a.k.a. 'Major Miles,' reports for KCMO-AM-FM. Tony Scott reports for KYYS(FM), and I report KFKF-FM (Kansas City, Kan.) traffic while a pilot flies us," Wilkinson said.

A third Cessna carries Christy Russell aloft to report for WDAF(AM) mornings

and afternoons. Producers at Airborne's office in Mission, Kan., provide WDAF's traffic reports middays over a fixed Marti link.

Airborne reporters deal with a phenomenal amount of information provided by customized gear. "I have a Walkman earplug to take cues off-air from my station in my right ear," Wilkinson said. "The police scanner earplug is in my left ear. I have an airplane headset on over

Throwing the switch one direction keys a Marti RPT-15 RPU transmitter; toggling it in the opposite direction keys a 450-MHz two-way. A noise-cancelling mic and VOX circuitry enable squelched intercom communication only when the mic is very near the speaker's mouth.

Each reporter's equipment is extremely portable, according to reporter and technician Steve Parker. "We come off the Cessna's 28-volt system into a converter



Airborne's Johnny Rowlands uses the WDAF helicopter each day between 6 a.m.-7 a.m. to do traffic reports.

those. In the right headset, there's two-way communication with our producer on the ground, and in the left headset I have aircraft intercom. These headsets have two booms holding two mics. One is for broadcast. The other is the intercom and two-way mic," he said.

Airborne Traffic uses the model H10-40 headset made by David Clark Co. and models made by Aviall.

Each reporter holds a home brew talk box with a double-throw toggle switch.

stepping it down to 12 volts, then into a Radio Shack noise filter. From there, power goes to a bank of cigarette lighter jacks where we all get power for our equipment."

Each reporter uses a single or dual-channel Marti transmitter tuned to the client's RPU frequency.

Ground observations, too

When the Kansas City altitude ceiling is below FAA visual flight rule minimums, "the cigarette lighter plugs and mag-mount antennas make it easy for us to head out in our cars to predetermined (traffic) overlooks," Wilkinson said.

A great deal of traffic information is gathered by ground-based producers who monitor police scanners, make telephone beat checks and then radio information on accidents and construction bottlenecks to the reporters above.

"We also work with Southwestern Bell Mobile Systems and provide the information for their traffic tip line," said Shellie Nelson, Airborne's director of technical operations and morning producer. "People with cellular phones can call in accidents and tie-ups, and we promo that on each of our stations. It becomes another source of information for us," she said.

Airborne provides some stations a "rip-n-read" traffic service, and the ground-based producers type locations of traffic accidents, road construction and other bottlenecks into a computer. "We run word processing software," Nelson said. "But instead of printing to a printer, I'm printing to leased phone lines and ultimately to modems hooked to printers in the stations."

Airborne's service is strictly barter. A five-person sales staff sells the spot inventory that stations relinquish for Airborne's reports.

□ □ □

Bob Kirby is a former radio general manager and news director and is a freelance technical writer in Kansas City. He can be reached at 816-941-4356.

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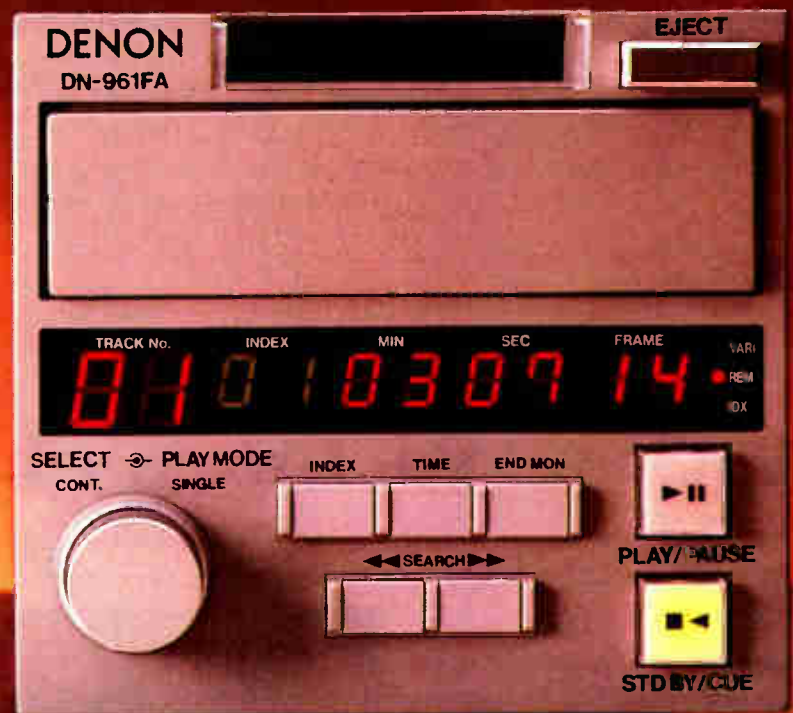


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World Radio History

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Its Eject-Lock during play adds another most-wanted feature to its list of attractions. Meanwhile, the new DN-951FA CD Cart™ Player dramatically improved functionality with its Auto Track Select (ATS) system, which reads bar-coded carts to *lock-in*, *lock-out* or *auto-cue* to a specific track.

That's not all; three-in-a-rack mounting, true instant start, and end-of-message signals with selectable time-to-end are just a few more key features of these cost-effective new players.

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NAB Radio Show Coverage

September 8-11, 1993 • Dallas Convention Center

Session Delves Into Age of Digital

by Dennis J. Martin
and Randy Sukow

DALLAS "Digital brings a very powerful tool, or group of tools, that can be used to dramatically extend what your radio station people can do," said Andy Butler of NAB's Office of Science and Technology, during The Radio Show's Digital Radio Seminar.

Despite digital's advantages, "more than one station has had a disastrous experience with trying to bring digital into the facility and either spending money for no results, spending far more money than they intended to spend to get the results, or simply giving up and having no results to show for their money," Butler said.

An eye for conflict

It is becoming apparent that one of the most important things to watch out for when installing digital devices is the probability of conflicting compression (or data reduction, as many prefer) systems. Seminar attendees heard how

such conflicts can lead to severe audio degradation.

There are definite business reasons for digital equipment purchases. A reduction in the cost of storage media is a primary incentive. But a full analysis of what you realistically hope to achieve must be part of the search process.

"We have to be able to buy solutions today, not just equipment," said Jim Hauptstueck, digital products manager for Harris Allied Broadcast Equipment, Quincy, Ill.

It may sound simple, but assembling an entire digital storage and routing system can be complex, Hauptstueck said. Digital has a lot to offer, but "if it's not going to help us increase our bottom line in one way or another; if it doesn't help us increase efficiency within our station, then what good is it to us?" he asked.

Hauptstueck advised broadcasters to first analyze their current facilities and create lists, room by room, of each piece of equipment and its function. Before moving to digital, assess and fully understand the

facilities' present technical capabilities.

"But don't stop there—that's only one small piece of the puzzle," Hauptstueck said. People are a valuable resource that should not be overlooked. Analyze whether the staff is fully utilized and look for ways to enhance their talents with new digital equipment.

"This new age of technology will allow us to increase our quality," Hauptstueck said.

"Finally, you'll want to look at the future," Hauptstueck said. Technology is quadrupling every two years; remain flexible. Otherwise, many will not be prepared to take advantage of technology as it develops over the next three to five years.

Ailing algorithms

Herb Squire, chief engineer, WQEW (AM)-WQXR-FM New York, who caused a stir at the spring NAB convention with the results of data-reduction equipment tests, appeared in Dallas to give an update on his findings.

Squire's tests suggest that digital systems with conflicting data-reduction algorithms

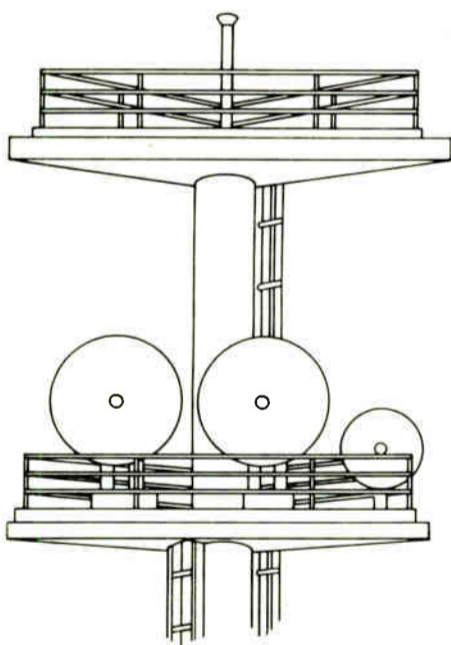
create damaged stereo separation, clicks, pops, chirps and other artifacts when operated together in the broadcast chain.

As he had in Las Vegas six months earlier, Squire played tapes of audio passed through 22 different data-reduction devices—much more algorithm mixing than would ever occur in a real broadcast scenario. The test, however, served to demonstrate how artifacts created early in the chain can be enhanced and embedded in the audio over and over with each data-reduction pass.

Another problem Squire recently recorded is what can happen when only two different algorithms are mixed. He played a tape of the final sustained high note from a Linda Ronstadt song that was noticeably damaged. "This is the scary part that I worry about. The whole song sounded good until this point," he said.

Squire says more study of conflicting algorithms is needed. "With compression before audio processing, what happens to audio that's been pushed through a regular AM or FM chain?" he asked. "What about postprocessing audio compression? Some manufacturers have recommended that you put all your processing in front of the

continued on page 18 ►



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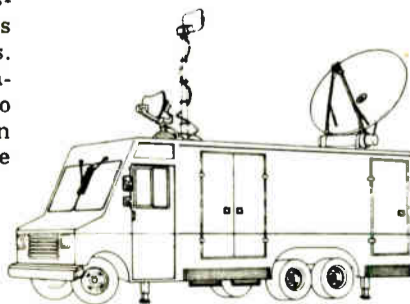


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World Radio History



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— Ron Crockett, SHOOK ELECTRONICS

Seminar Shows Latest in Antennas

by W.C. Alexander

DALLAS This year's two-day NAB AM antenna seminar featured a distinguished list of presenters. Among them were leading consulting engineers, manufacturers and station engineers.

The current directional antenna rules (now under review by the FCC) date back to 1939, said Ben Dawson, a Seattle consulting engineer. New technologies and changes in the business of AM broadcasting are prompting needed changes.

Antennas and LMAs

New station combinations created under the new duopoly and local marketing agreements (LMAs) are leading many AMs to look for ways to broadcast with a common antenna by diplexing, triplexing or multiplexing, said Jack Sellmeyer, a Dallas area consulting engineer.

Some advantages to common-antenna broadcasting include cost savings (only one tower or set of towers needed), personnel savings and capital gains (through sale of one transmitter site). The "all-eggs-in-one-basket" threat, a familiar problem to FM stations operating into combined master antennas, is the main disadvantage. The same calamities and maintenance complications affect all stations at the same time.

Stations also must be aware of the

FCC's technical and site requirements for combined operations and the limitations common to combined systems, Sellmeyer said. He suggested looking at pass/reject filter design and construction.

One interesting actual case is the WBOW(AM)-WBFX(AM) combined two-tower directional site in Terre Haute, Ind., Sellmeyer said. The owner of these stations solved serious coverage deficiencies as well as economized on real estate by combining the 1230 kHz non-directional operation with the 640 kHz directional-antenna and non-directional-antenna operation.

Digital age antennas

Methods to maximize bandwidth have been a hot topic in recent years. Washington consulting engineer Ron Rackley

bandwidth, Rackley's demonstration dispelled it. Essentially the same patterns can be achieved, but with different element spacing. Close-spaced arrays have very poor pattern bandwidth.

Rackley's discussion also included such important factors as RSS/RMS ratio and using vectors to show how the various factors affect array operation. Patterns with high RSS result in high base currents, usually having low base operating resistances, and such arrays tend to have poor impedance bandwidth.

Harris Allied's Daryl Buechting, gave an overview of digital audio radio terminology, and the many acronyms and antenna-related technologies involved with AM radio's proposed conversion to in-band, on-channel DAR broadcasting. The discussion included a look at digital modulation methods and a peek at the

The digital signal is 40 kHz wide and below the -25 dB "wings" of the NRSC-2 mask. The coverage area is predicted to be 5 mV/m minimum, and coverage out to the 1 mV/m contour is expected.

Reradiation remedies

Reradiation has long been the scourge of AM directional antenna systems. The problem is only getting worse in today's urbanized and developing environment, said Voice of America engineer Karl Lahm. He led a reradiation discussion including reradiation basics and ways to approximate reradiation by calculation and measurements.

The first step, Lahm said, is often to make calculations to see if a suspect structure has the potential to cause reradiation problems. He pointed out that such structures in the null areas or on the "back" side of the array are seldom the offenders. Trouble is more likely to originate from things like towers, power line supports, water tanks within a few miles of the transmitter site in the main lobe.

There is no cut-and-dried method to treat reradiators, Lahm said. Each situation is unique. There are, however, basic principles that can be used as a starting point from which to work toward the successful correction of a reradiation problem.

Among the other highlights of the seminar was a Sellmeyer presentation on DA adjustment and maintenance. He suggested establishing a starting point, calibrating the sampling system, understanding feed system phase shifts and using vector diagrams.

They say they aren't making any more land these days, so we've got to make the best use of the real estate we have. Rackley gave the ins and outs of sharing an AM site with other, non-radio uses.

One case study was of a California station sharing a five-tower DA site that evolved into Trammel Crow industrial park, with the buildings being literally built around the tower. Such uses of land really are possible, provided that the land is valuable enough to justify the significant expense of "cohabitation."

The problem of reradiation, long the scourge of AM DA systems, is worsening in today's crowded, urbanized and developing environment.

said the issue becomes even more important in the digital age. He demonstrated the effect of element spacing on DA operation, showing two 2-tower example arrays.

If there was any doubt that element spacing has a dramatic effect on pattern

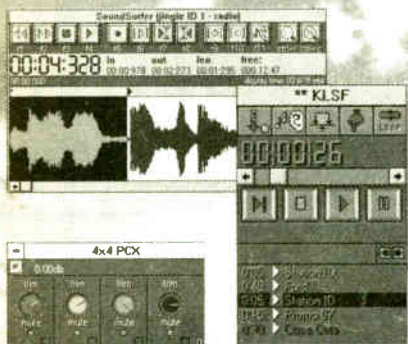
U.S.A. Digital IBOC AM DAR system.

While much of USA Digital's technology is a closely held secret by the consortium (CBS Radio, Group W and Gannett), the group gave a few details of how the system will work. A standard analog AM audio signal is combined with digital audio modulation. It will provide 15 kHz stereo audio within the NRSC-2 (now FCC-mandated) emission mask. In addition, a data channel is also provided for radio broadcast data system (RBDS) or other similar uses.

The system converts the analog audio to digital audio, compressing it with the MUSICAM algorithm, processing the compressed digital audio with a forward error correction scheme with interleaving, then transmitting the result in quadrature with its analog counterpart.

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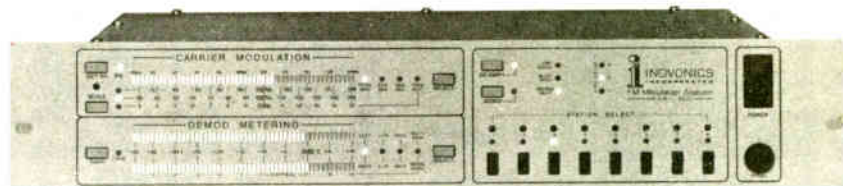
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Timetable Explained for AM Expanded Band

by W.C. Alexander

DALLAS The current effort to smoothly assign stations with slots in the expanded AM band (1605 kHz-1705 kHz) was the hot topic in a Radio Show session on broadcaster and FCC efforts to improve the technical quality of AM and FM radio.

The estimates were that the first construction permits for expanded band facilities could be granted by May 1994.

Close to 1,000 licensees on the conventional AM band have applied for possible relocation to the expanded band. The commission is now in the process of deciding which of the 880 applicants that have been designated as "eligible" for migration, will eventually move to the approximately 300 open expanded band slots.

The commission's next step, said FCC Audio Services Division Chief Larry Eads, is to determine the interference improvement factor on the conventional band following each applicant's proposed migration. Applicants that score improvement factors of zero, which the FCC estimates will amount 200-230, will be immediately set aside.

The remaining 650 applicants will then be ranked according to improvement factor. A list of the stations and their respective improvement factors is nearing completion, Eads said.

Eads said it will take the FCC's computers three to four months, working 24 hours per day, to work out an expanded band allotment plan. February 1, 1994, is the target for the plan's completion. There will then be a comment period, followed by the actual assignment process.

A five-year transition period, during which licensees will be allowed to simulcast programming on their regular and expanded-band stations, will follow after construction permits are awarded. Each licensee may choose to remain in the existing AM band and cease expanded-band operation at the end of that five years, or to cease existing-band operation and move all operation to the expanded band.

New AM technical standards

Among the most visible of the new technical rules the FCC has approved in recent years to cure myriad interference problems, are the adjacent-channel protection ratios that have created "paper" overlaps for many stations.

Before the change, stations were not allowed to permit their 0.5 mV/m groundwave contour to overlap the 0.5 mV/m groundwave contours of adjacent-channel stations. Now stations are restricted from overlapping their 0.25 mV/m contour with the 0.5 mV/m contours of adjacent-channel stations.

Many of these overlaps already existed before the rule change. Affected stations are grandfathered under the new rules. New facilities, however, must comply with the new rules.

The method for calculating nighttime interference was another big change. In the past, only co-channel stations were considered as contributors to other stations' RSS (root sum squared) night limits, and then only if they exceeded 50 percent of the previously calculated RSS limit. Now, first-adjacent channel stations are included in the calculations, and 25 per-

cent is the cut-off point for contributors.

A station that enters into another station's 25 percent RSS night limit is grandfathered under the new rules, but if any voluntary change is made to its nighttime facilities, it must reduce radiation toward that other station by an amount that will lower its contribution to less than 25 percent of the RSS or by 10 percent, whichever is less.

Stations forced to make facility changes because of factors beyond their control—losing a site lease, eminent domain, FAA problems—may be eligible for a waiver of this "rollback clause." Waiver requests

will be examined on a case-by-case basis, Eads said. He declined to comment on what might be specific go/no-go factors.

Another AM issue is the on-going FCC proceeding to rewrite the 60-year-old AM directional rules. In today's urbanized and developed environment, current proof-of-performance methods are very expensive, and monitor points are often hard to locate or inaccessible. Modern computer modeling and analysis make it possible to accurately predict the behavior of a directional array and the factors that influence its operation.

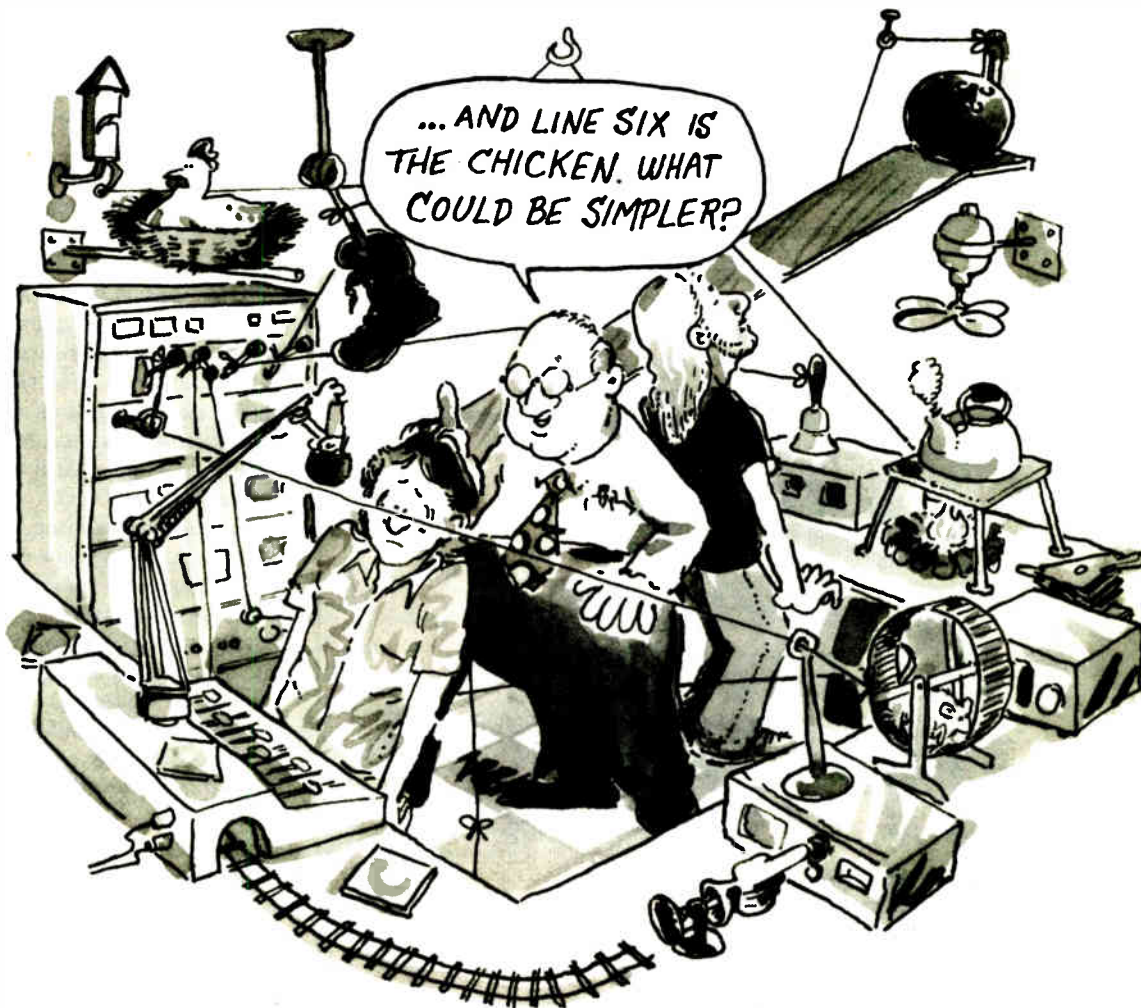
The FCC is currently asking for com-

ments on about 20 rules involved in the inquiry. Barry Umansky, NAB deputy general counsel, said that the association's comments, which have already been filed, stress that any rule changes must maintain the integrity of the AM band.

Going dark

Panelists held a lively discussion on stations that "go dark" and turn in their licenses after being compensated by another licensee seeking to reduce interference or increase coverage. Such arrangements are usually between co-

continued on page 18 ►



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Expanded Band Schedule Explained

► continued from page 17

adjacent-channel stations. Once a license is turned in, that allocation is unavailable for reassignment.

The FCC is encouraging such activity. In fact, the FCC is issuing tax certificates to those submitting their licenses. The certificates allow the recipient to defer capital gains taxes on the transaction for two years.

In a related discussion, Eads commented on the commission's concern that some stations have been remaining "dark" for extended periods of time. The FCC wants these stations to either resume operation or return their licenses and remain silent permanently.

Eads said that the FCC is going to "turn up the heat" on those stations that have been silent for more than 12 months. Licensees will be required to show adequate cause for remaining dark. If no adequate cause is demonstrated, the commission could start up a revocation hearing.

The FM one-step

Attorney Margaret Tobey of Akin, Gump, Strauss, Hauer & Feld, Washington, described the FCC's new "one-step" applications process for FM stations seeking upgrades to higher classes.

In the past, a licensee seeking a Class-A-to-Class-C1 upgrade, for example, would first have to petition for a rulemaking to

amend the table of allotments, deleting the Class A allotment and adding the Class C1 allotment. A filing for construction permit for a new, higher-class facility would then be required.

Both these steps are consolidated into one under the new policy.

Directional antennas may be used for contour protection from a short-spaced site, in order to upgrade under the new process, Tobey said. But a suitable "allocation reference site" must exist that meets all spacing and city of license coverage requirements.

Another benefit of the new process is that only one filing fee is now required rather than one for the rulemaking and one for the change application. Someone joked that the FCC can no longer be accused of double-billing.

Several panel members commented on how FM technical rules as they now read are conducive to local marketing agreements (LMAs) and duopoly ownership compared to many of the old rules.

The main studio rule, for instance, allows a station to locate its main studio anywhere within the city-grade contour (3.16 mV/m for FMs, 5 mV/m for AMs). In years past, the main studio had to be located in the actual community of license. Another example is the contour protection rules which allow much greater

flexibility in transmitter site selection.

New FM translator rules will go into effect in June 1994. Stations will no longer be allowed to offer funding to translators outside their primary service areas (i.e. other than "booster" stations that operate within the 1 mV/m contour). Those requesting waivers of this rule will have a "high hurdle" to clear, Eads said.

Another on-going FM issue is the tension and territorial conflict between the

FCC and Federal Aviation Administration over potential FM interference to FAA communications/navigation facilities.

The FAA's computer interference model, long held by the broadcast engineers to be unrealistic and overprotective of FAA interests, has been improved somewhat, Eads said. Progress is slow, but the rift between the agencies is not as wide as it once was, he said, because broadcasters are "working around the FAA," and finding sites that are agreeable to both agencies.

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Cris Alexander is director of engineering for Crawford Broadcasting, Dallas.

Session Highlights Digital Technology

► continued from page 15

coding because this may change the relationship of the audio to the noise floor."

Greg Urbiel, director of technical operations, Midwest, for CBS Radio, who is active in the CCIR, summarized the results of tests that group has performed since 1990 with results similar to Squire's.

CCIR was scheduled to meet in October to agree on a draft data reduction standard, which was expected to recommend the ISO (International Standards Organization) layer II standard for transmission (at 256 kbps), contribution and distribution (both at 180 kbps), Urbiel said.

Many experts advised simply avoiding data reduction when ever possible.

"We shouldn't, however, forget why we're moving into the digital age. There is no affordable alternative," said Bob Donnelly, general manager, satellite systems, ABC Radio Networks. "It's a half-full, half-empty situation. We're exploiting technology today that we absolutely have to have to survive."

The inevitable is approaching

"It's inevitable that (digital) is where technology is going, and this is what stations will be using in the future," said Laura Tyson of Broadcast Supply

Worldwide. But the obvious question is: What's the best way to get into digital?

In 2003, Tyson said, most stations will be using computer-based hard disk storage systems that are networked and automated. "With digital, we have the opportunity to rethink how we do things in our studio," she said.

Until then, broadcasters can choose from at least five different formats to replace their analog cart machines.

Tape formats include DAT and DCC (Digital Compact Cassette). Recordable optical disc choices are MD (MiniDisc) and recordable CD. The traditional "feel" of carts can be retained by using a floppy disk based cart machine. Computer hard disk formats offer mass storage options, and a "hybrid" device is a cart machine that includes an internal hard disk.

When reviewing analog cart machine alternatives, Tyson suggests carefully investigating: user friendliness; cost of hardware and storage media; sound quality; ease of backup; editing provisions; random access features; compatibility with air studio operations; automation capability, whether it is "handled" (such as floppy disks) or is based on hard disk technology; reliability; sampling frequency and data compression flexibility; network expansion; system speed; and the strength and stability of the manufacturer.

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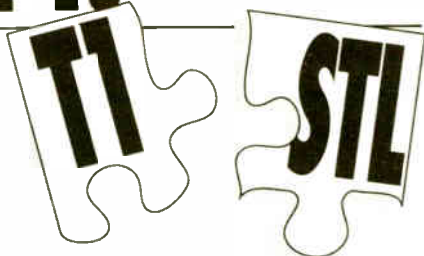
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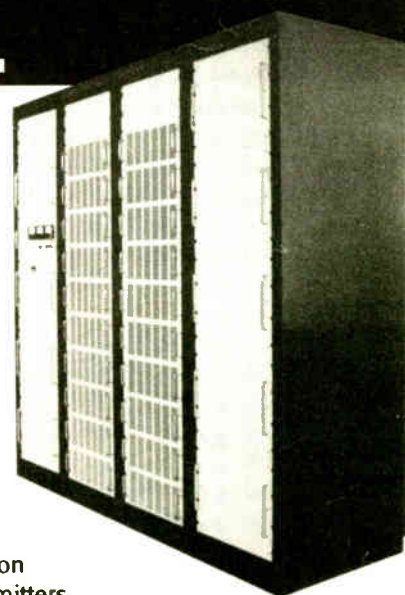
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Host of New Products Seen at Convention

by Dennis J. Martin

DALLAS The Radio Show, the second big radio equipment exhibition of the year following the annual spring NAB convention in Las Vegas, proved itself to be a vital forum for new product introductions. The Dallas show included new hardware and software, from audio to RF.

AEQ-America introduced the MAR (Management of Audio Resources) System. A common server is used to store all audio and data and to service all workstations in real-time. User-friendliness and ease-of-operation are key features. A touch screen is used; a mouse or keyboard are not needed. Automated recording of field reporters in normal or frequency-extended modes, quick editing of audio, and an on-air screen that sorts events by category are other MAR System highlights.

AKG demonstrated software version 3.5 for its DSE-7000 Digital Sound Editor. Some of the new features are: varispeed, double/half speed listening, automatic punch in/out, cuing flexibility, automatically saved console settings and new "move" and "swap" functions.

The CK94 is a new figure-eight capsule from AKG that complements its Blue Line series of modular microphones. It is suggested for mono bi-directional and MS stereo mic'ing of orchestras, choruses, interviews and dialog.

The C5600 and C5900 are two new AKG condenser microphones. The C5600 is a voice/instrument mic designed for extremely high sound pressure levels and offers three different bass contours. The AKG C5900 is a hand-held vocal mic with a hypercardioid pick-up pattern and selectable bass contours.

Cutting Edge Technologies unveiled the new Unity 2000i FM Processor, with advanced digital signal processing to maintain sonic integrity. Unity 2000i features include a linear response algorithm to provide intelligent high-frequency control before pre-emphasis, selectable broadband

AGC and phase rotator, adjustable bass enhancer, phase linear four-way adjustable crossover networks, four band processor/leveler and limiter, and a high-quality stereo generator.

Dawn Satellite introduced Coversat, a satellite antenna cover designed to inhibit the accumulation of snow and debris that can prevent the signal from properly focusing on the feed horn. Snow build-up can also change the alignment of the dish. Snow slides off the vertical surface of the cover (constructed of a slick vinyl material), while the signal passes unobstructed.

Digital Broadcast Associates presented Laser-CART, a new 16-bit linear player/recorder. Laser-CART stores 11 minutes of stereo audio, sampled at 48 kHz, on removable 3.5-inch magneto optical (MO) disks. MO disks do not suffer from signal degradation as a result of repeated plays like audio tapes and floppies. The projected MTBF of MO disks is more than a million record cycles, and the disks are guaranteed for life.

Dolby Laboratories highlighted the new 740 Spectral Processor. The 740, billed as a new kind of dynamic equalizer, permits low-level signals in three frequency bands to be increased by as much as 20 dB while high-level signals remain unchanged.

Fidelipac was exhibiting the Air Marshal, a new digital audio hard disk system. The easy-to-use, intuitive user interface was designed by broadcasters. Configuration of the Air Marshal is flexible, expandable at low cost, will support up to eight audio outputs per unit and uses APT compression.

International Tapetronics (ITC) was showing the new DPR-612 Digital Program Repeater. The device, designed for repetitive announcements like IDs, liners, and stingers, has six MB of battery-backed internal D-RAM, offers selectable sampling rates of 16 and 32 kHz, starts in ≤ 25 ms, and has active balanced inputs and outputs.

ITC's new Digi-Center News software

collects news wire audio and text on hard disk. The software allows the user to write newscasts and edit audio on the same system. Copy can be read directly from a monitor in the news booth, and audio news clips are started by pressing the space bar on a keyboard. Category and keyword search, print urgent, all-caps editing and custom programming for all news wires are just a few of its functions.

Intraplex introduced the Intralink STL+ and two new codec modules. The Intralink STL+ is an integrated package that transmits 16-bit, 64-times oversampled, uncompressed linear stereo audio over T1 lines with dynamic range greater than 90 dB. Error mitigation, based on digital signal processors, eliminates transmission line induced noise, clicks and pops.

The new Intraplex PT-355 and PR-355 modules are based on telephone company standard 14-to-11-bit digital encoding technology. Using moderate compression, 15 kHz discrete stereo can be transmitted over one half of a T1 circuit.

The Management was exhibiting AXS, a new cart machine replacement system with total "access" to internally-stored audio. AXS also displays logs, music playlists, live copy, tags, and other on-air materials. It operates with standard 486-type networked computers, and can be controlled via a keyboard, mouse or trackball, or optional touch screen or remote button box.

The new DMX-4 is a four channel stereo VCA-controlled audio switcher that installs in a standard 16-bit PC slot. The DMX-4 performs audio mixing and digital level control, processes eight logic functions and provides balanced audio outputs.

Marti featured the new STL-15C composite STL transmitter and R-15C receiver. In a single 300 kHz channel, the system can deliver a response of ± 0.3 dB, 50 Hz to 53 kHz; $< 0.2\%$ THD+N. Sixty dB receiver quieting is achieved with a signal level of just 9 μ V. Ultimate SNR is > 75 dB and channel separation is typically better than 60 dB.

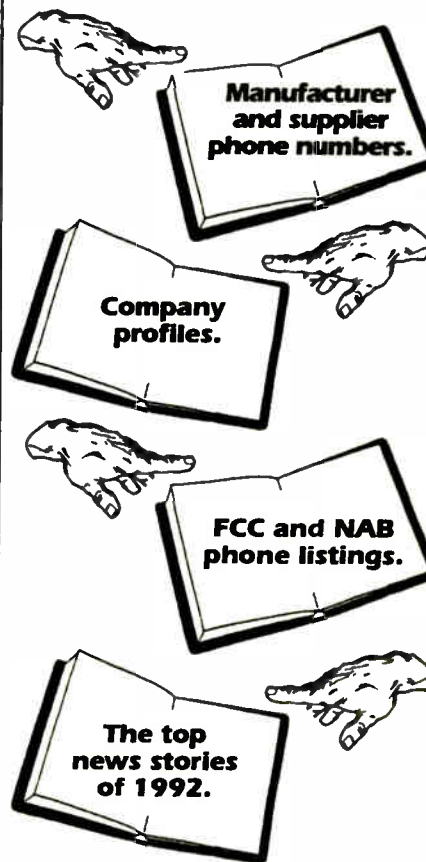
The transmitter has a precision peak-hold modulation meter and an accurate forward-reflected power wattmeter. The receiver is designed to provide a high degree of interference rejection and uses a Ga As FET low-noise amplifier to achieve high sensitivity.

Modulation Sciences showed the new DSCA-1 Data SCA Receiver covering the FM broadcast band. The DSCA-1 offers a transmission speed of 4800 bits per second, an RS-232C output, and can be jumper-selected for 67 or 92 kHz operation. Typical applications include data transfer, roadside or mobile radio sign dis-

continued on page 22 ▶

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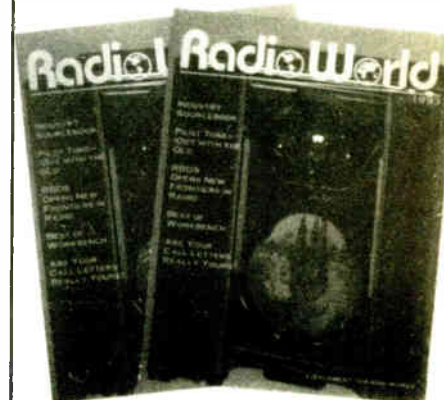
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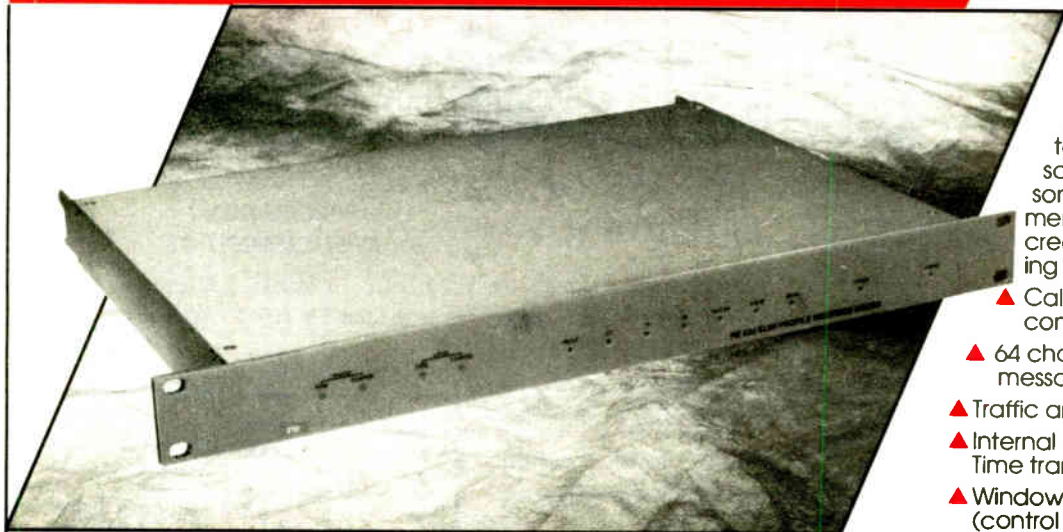
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New Products Showcased at Radio Show

► continued from page 21
plays, telemetry as a TSL and animated billboards.

Omnitronix Inc. introduced a solid state 50 kW AM transmitter. It is a fully digital model, without intermediate power amplifiers. Four 700-watt modules are contained on each of the transmitter's 20 power amplifier panels to achieve the power output.

Orban/AMG displayed its new 8200ST OPTIMOD Studio Chassis, intended to complement both the OPTIMOD 8200 FM and AM Digital Audio Processors. The unit will protect a dual-channel STL system from overmodulation when the OPTIMOD 8200 is located at the transmitter site. Proprietary Class-A VCA circuitry minimizes distortion and provides AGC, high-frequency limiting and final peak control functions. A variable density control, stereo couple/uncouple switch and modulation calibrator tone are included.

Orban also announced that multiple-rate digital I/O ports are now available for the OPTIMOD-FM 8200. The 8200D/SRC kit adapts the OPTIMOD to send and receive standard AES/EBU digital audio signals at rates of 32, 44.1, or 48 kHz, while the analog I/O ports remain fully operational. The 8200D/32 is a new 32 kHz fixed rate digital I/O option.

Prophet Systems showed its new software, Wizard for Windows™, a digital audio production and control system. Central storage of audio, database capabilities,

and a user-friendly interface are key features.

RE America unveiled the new RE 532 RDS/RBDS Encoder, a third-generation product. The RE 532 has the capability to manage emerging ancillary data services such as paging (Group 7A) and differential global positioning (DGPS, Group 3A) through its five data ports.

RE also showed its new 662/663 ISDN Musicam Codecs. The 662 encoder and the 663 decoder can multiplex up to three basic rate interface ISDN lines with on-demand bandwidths between 56 kilobits per second and 384 kbps. AES/EBU or S/P DIF digital audio I/Os are available with sample rate converters.

Scientific Atlanta showed the new Encore™ DSR-3610 Digital Satellite Receiver, combining a high-performance receiver and a SEDAT-compatible digital audio decoder in a single, rack-mountable package.

Smarts Broadcast Systems presented the new Smarts Automation Controller. The device updates popular technology with a computerized version of a thumb-wheel controller that includes real-time event capability.

Sony demonstrated the new PMD-C1 card recorder and the PMD-C1P player, based on Sony's recently-developed MiniDisc (MD) technology. Unlike analog cart machines, the MD system allows for quick random access, high-quality digital sound, as well as memory start and

cueing functions for swift playback. A front-panel display indicates such things as track title, end cue, commercial run dates and emulates a peak level meter. A



Denon's prototype MD CART™ recorder

random music sensor programs tracks to play in any order, and an audio search function prevents accidental erasure of existing tracks.

Sony also introduced the PCM-E7700, a dual-deck DATStation transportable digital audio editing system. Compared to an analog reel-to-reel recorder, a few of the benefits are non-destructive editing, elimination of multiple-generation degradation and digital audio with wide dynamic range.

Sony's DMX-B4000 digital broadcast console, intended to function as the nucleus of an all-digital broadcast suite, was also introduced. Multiple inputs allowing flexible routing, a graphical user interface, and a 3.5-inch floppy disk drive for storing console settings are a few of its features.

Spar/ComStream exhibited its new ABR75/75B Audio Receiver. The ABR75 is designed for radio broadcasting, and the ABR75B for business music. Full 20 kHz stereo audio is possible at 128 kbps using ISO/MPEG compression. The receiver includes an RS-232 data port that operates at 300 to 4800 bps. It can be configured from the uplink. Eight contact closures are provided on a relay control port.

Svetlana of St. Petersburg, Russia,

exhibited its growing line of new power grid tubes. The company is one of the largest power grid tube manufacturers in the world, and employs more than 24,000 engineers, technicians and assembly workers. Its product line includes the 4X150A, 4CX250B, 4CX250BC, 4CX350A, 4CX350AC, 4CX15000A, 4CX15000J, 5CX1500A, and 5CX1500B.

Tapscan was offering demonstrations of Prospector, new software that helps to identify prospective advertisers. Using a Dun & Bradstreet® select marketing information database for your market, Prospector allows searches by category, geography and type of business. It will then prepare a complete report for each prospect.

Telos displayed the new Zephyr Digital Network Audio Trans-

ceiver, capable of transmitting 15 kHz stereo audio on a single dial-up ISDN line. Zephyr uses ISO/MPEG Layer-III technology to compress the digital audio signal to 64 kbps or less per channel. The device transmits three data streams on a single ISDN line: 15 kHz stereo audio plus an auxiliary data channel.

The Telos ONE-x-Six is a new "instant" talk show system. In a single rack-mount unit, the ONE-x-Six combines a proven digital hybrid with a six-line broadcast phone system. A desktop switch console is included at no additional cost.

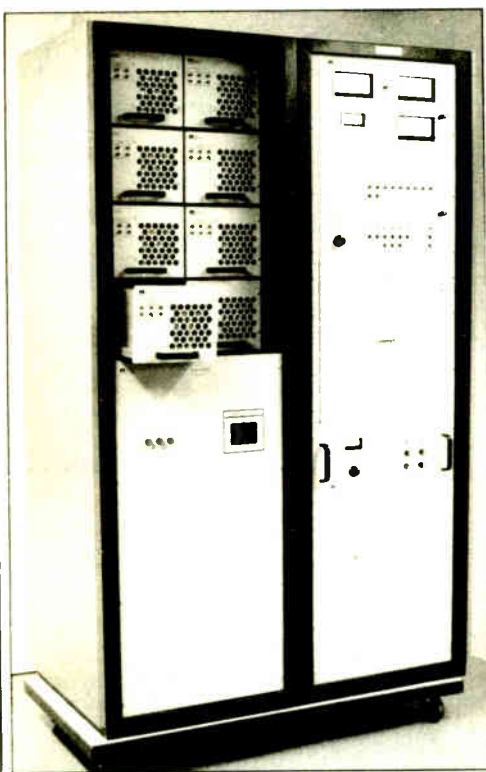
TFT introduced the new DMM92, a spectrally-efficient digital STL. Up to six audio channels can be transmitted on a 250 kHz channel, and STL paths can often be extended because of improved fade margins. The DMM92 is designed to complement the TFT 9100A/9107A composite STL system.

The TFT 923 is a new AM Modulation Monitor that features phase-linear filtering that does not overshoot, a highly-accurate peak flasher, a voltmeter mode for proof-of-performance measurements and a modulation calibrator. It is NRSC compliant.

□ □ □

Dennis J. Martin is chief engineer for KBIG(FM) Los Angeles.

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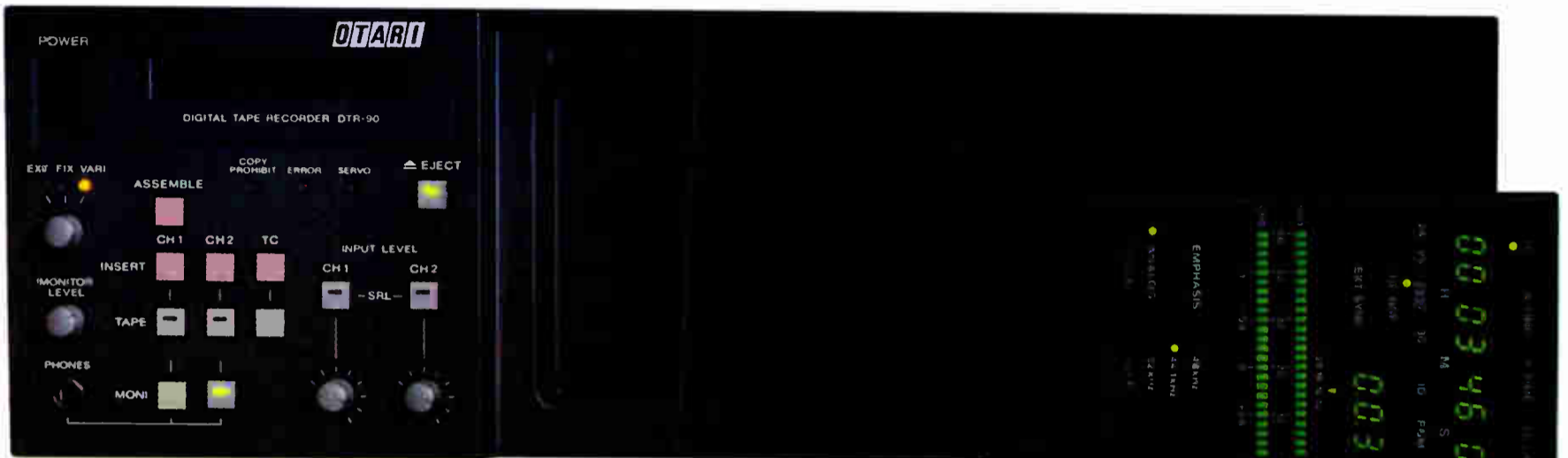


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Studio Sessions

New product information in **Product Guide**, see pp. 27, 33.

Equipment and Applications for Radio Production and Recording

Radio Documentary Requires Planning

Editor's Note: This installment is the first in a five part series entitled, "Producing A Radio Documentary" by Steve Rowland. Steve produced the 1991 Peabody Award-winning Miles Davis documentary and most recently, he produced a documentary profiling Carlos Santana.

by Steve Rowland

NEW YORK Radio documentaries are an increasingly important part of the contemporary radio landscape. They are also an important, but often overlooked, part of the overall documentary tradition.

The development of the genre has been hindered by a number of things, including: lack of air time offered on commercial radio, lack of funding for public radio, and of course the overshadowing by television documentaries. Despite these continuing problems, there

are a number of superb producers working throughout the country, who are responsible for the form's evolution.

There are only a few outlets for radio documentaries, but searching them out is certainly worth the effort. There are currently

two weekly documentary series on public radio, "Soundprint" and "Horizons," both distributed by National Public Radio. Each is a weekly 30-minute program. Together they present some of the best work done in the field. In addition, both NPR, and its counterpart, American Public Radio distribute longer form documentary specials on an occasional basis.

I have been producing long-form radio documentaries for public radio for six years. I have tried to combine the standard public radio feature concept with styles based on the best of film and TV docu-

mentaries. In general, there are two basic styles of documentary production—the historical overview and the verité approach (derived from the European "cinema verité" movement of the 1960s).

My work, which has concentrated on the work of contemporary musicians, leans towards the over-

view, but I include as much verité recording as possible.

Tools of the trade

In this series of articles on the technical aspects of audio documentary production,



Steve Rowland

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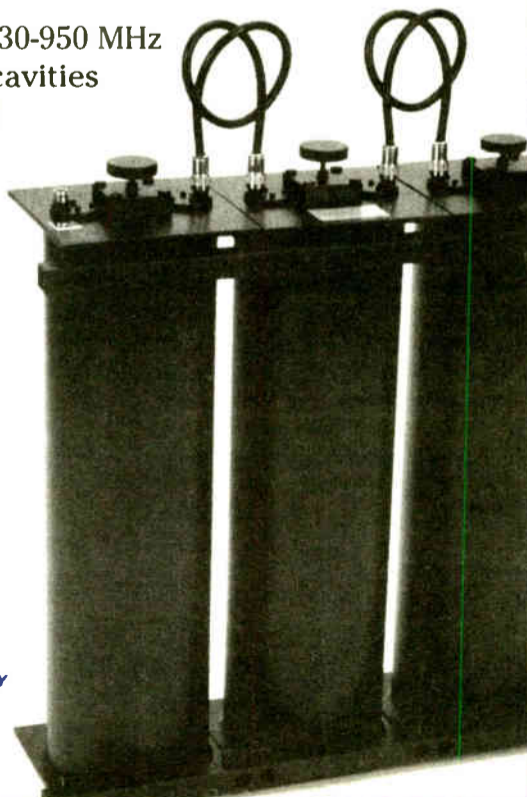
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I'll focus mainly on the tools used in creating quality work—what equipment to use, and how to use it. I'm going to start with a basic description of the various phases, and then break each one down with more detail.

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continued on page 38 ►

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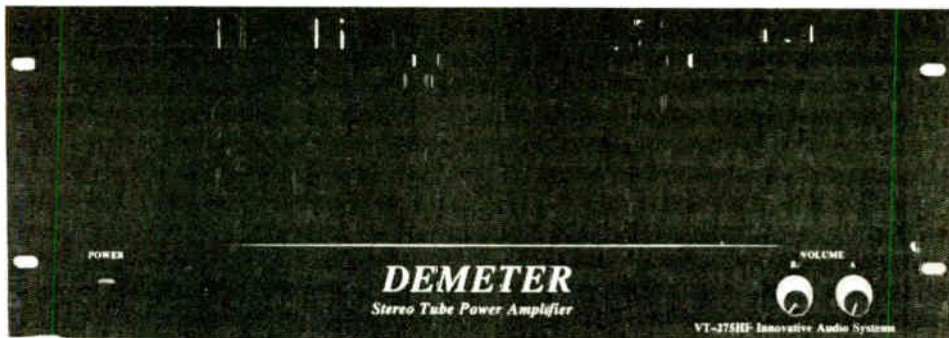
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PRODUCT GUIDE

Companies with new product announcements for Studio Sessions Product Guide should send them to Radio World, c/o Studio Sessions Editor, 5827 Columbia Pike, Suite 310, Falls Church, Va. 22041



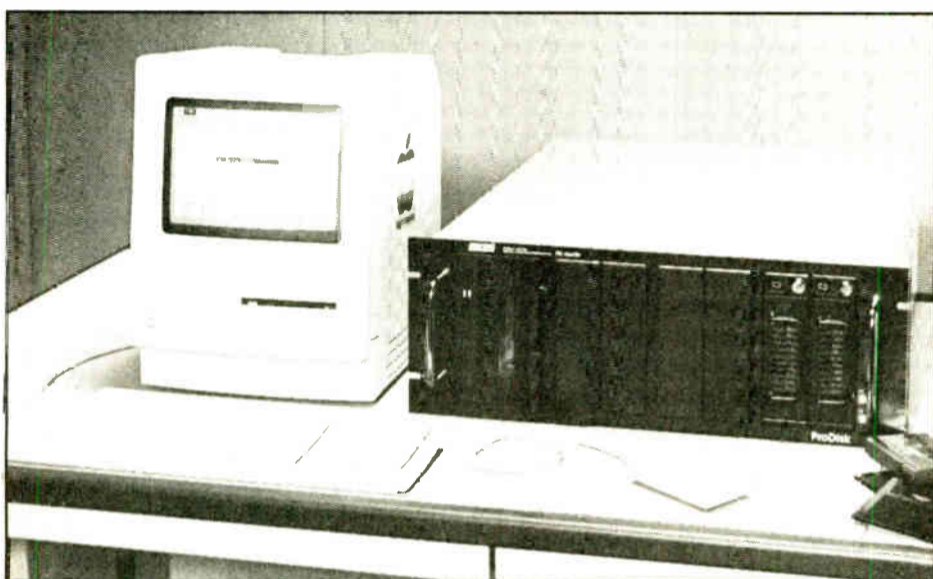
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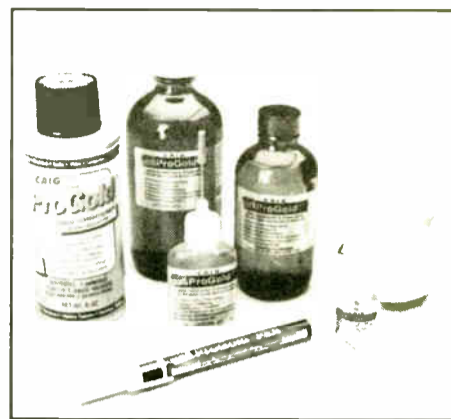
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PRODUCER'S FILE

Tips for a Better Sounding Condenser

by Ty Ford

BALTIMORE Last month, as I was writing about the new Neumann TLM 193 condenser mic, it occurred to me that I've heard from a number of radio production people who have tried various condenser mics and disliked them. In most cases, condensers have better specs than dynamic and ribbon mics, I started asking questions in an attempt to isolate the reasons for the negative reactions.

As a result, I thought it might be helpful to make public some of the "little known secrets" of using condenser mics, in hopes of improving their reputation.

Before you begin making changes, set any EQ you may be using to the flat position, or disengage it from the mic circuit. Condenser mics usually have relatively high outputs. If your mic preamp is not prepared to take the increased level, it will distort.

While it would seem logical to use the mic preamp input pad on your console to knock the signal down, be forewarned, pads can create their own negative consequences. Most input pads consist of one or more resistors that keep the input stage of the mic preamp from being overloaded. The problem is, dumping in a

bunch of resistance changes the impedance relationship between the mic output, the mic cable and the mic preamp.

Beware the pads

This change in impedance may also change the frequency response of the mic, usually not for the better. If your mic preamp can't handle the input, your first move should be to use the pad on the mic itself, if it has one. Since most pads on mics are placed between the capsule and the output stage of the mic, they don't change the impedance relationship between the mic, cable and preamp input. If you are using the pad on the mic and are still overdriving the mic pre-amp, you may have to go with an outboard mic pre-amp that can take the higher output.

You'll notice I mentioned mic cables. Recent experiments I've done have proven that some mic preamps are very sensitive to the type of mic cable and/or connection scheme used while some are relatively oblivious. In the most remarkable case, when Belden 8412, Gotham GAC-3 and EMT2202 were compared, each cable audibly changed the frequency response of each of three different mics. For the record, both ends of the Gotham and EMT shields were connected to the

XLR shells, but the shield of the Belden cable was not connected to the XLR connectors.

Relative to the Belden 8412, the Gotham GAC-3 caused a bump of several decibels in the 800Hz-1200Hz range, while the EMT2202 produced a bump of several decibels in the 6kHz-9kHz range. The results of similar experiments with other mic pre-amps were much less dramatic. Incidentally, don't try to make any critical

sible without causing any nasty sounding artifacts.

Moderation is key

Use a similarly moderate approach to adjust the limiter. Most limiters offer ratios from 10:1 to 20:1. Pick the one you like best and use it to catch the peaks that passed through the compressor. Faster attack times will dull the sound. Faster release times may result in more artifacts. Usually, using any more than 4-to-6 dB of limiting, in conjunction with the previously described amount of compression, will put you at or near the point of diminishing return. Remember, gain reduction

Some mic preamps are sensitive to the type of cable or connection scheme used, while some are relatively oblivious.

listening decisions at the end of a long working day. When the body and ears are fatigued, they won't be sensitive enough.

Gain reduction circuits in the mic chain also can cause problems. You disconnect the trusty RE-20, plug in the new condenser, expecting it to wail, and it sounds like mud. Before slitting your wrist, check for increased amounts of gain reduction. Chances are the increased output of the condenser mic is pushing the gain reduction circuits a lot harder than the RE-20 did. If you're using both compression and limiting (your compressor is in front of your limiter right?), readjust your compressor to a ratio of 2:1 to 4:1 with a total gain reduction of 4-to-6 dB. If you have an attack control adjust it so that during normal performances, it is as fast as it can be without taking the edge off. If your compressor has a release control, adjust it to operate as quickly as pos-

is not a "more is better" kind of thing.

Now that you've got the level and gain reduction under control, consider the EQ. First establish the average working distance most people will use; will they eat the mic? Will they give it four inches or maybe a foot? The mic you have been using may exhibit more or less of a proximity effect than the condenser. (Proximity effect is the term used to describe the phenomenon of increased bass response as the sound source gets closer to the mic.)

If everybody is eating the mic, you might have to roll off a bit of the bottom to prevent the sound from being too bass heavy. If the mic itself has a low frequency roll-off switch, try it before using console or outboard EQ.

Condenser mics may be more prone to popping. To avoid this, talk across it at a

continued on page 33 ▶

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SIGNAL-TO-NOISE

Radio Dramas to Make Orson Proud

by Frank Beacham

NEW YORK Film and video move over. When it comes to the medium of choice for powerful storytelling, radio wins hands down. That's why, in its golden age, radio was called the theater of the imagination.

Because radio provides no more than sound, it allows us to fill in the missing pieces of information with our own imagination. What we conjure up in our mind is usually scarier, funnier and more vivid than the super realistic, information-packed images of video or film.

In the 1920s and 30s, while sound equipment was technically primitive, radio storytelling reached its peak. It was in that era that young talents like Orson Welles elevated the radio story to an art form.

How Welles did it

I was privileged to have known and worked with Welles late in his life and from him I learned the infinite possibilities of the radio medium. Even though Orson was a master choreographer of sound effects and music, he always considered radio a narrative medium. "When a fellow leans back in his chair and begins: 'Now, this is how it happened'—the listener feels that the narrator is taking him into his confidence; he begins to take a personal interest in the

outcome," Welles once said.

Tragically, radio storytelling has been displaced in our time by the visual media. Welles' producer during his radio days, the late John Houseman, lamented the loss of radio drama a few years ago. "I think it is one of the cultural tragedies of our time that, through nobody's fault, simply because of the changing state of the art and the habits of American people, radio drama virtually came to an end," Houseman said. "It was a great art and would have been capable of infinite development."

The good news is radio storytelling is back and actually thriving in some pockets where determined producers continue to make innovative drama programming against difficult financial odds. A good example is Tom Lopez of the ZBS Foundation in Fort Edward, N.Y. Lopez and company have been producing radio dramas since 1974. Among his popular audio series, which have appeared on hundreds of stations in the U.S. and 23 foreign countries, are "Ruby" and "The Fourth Tower of Inverness."

Drama on radio lives

The most recent Lopez radio show is "Dreams of Sumatra," the latest of his popular "Travels with Jack" adventures. (Jack Flanders, a magnet for mysterious women with metaphysical dilemmas, usually finds himself traveling to exotic

locales and unraveling psychic riddles in the series.) The latest adventure recently aired on National Public Radio and is now being sold on cassette and compact disc.

One of the things that makes "Dreams of Sumatra" unique is the way Lopez created the story. Without a script or any real idea of what the story would be about, he boarded an airplane to Sumatra

Determined producers continue to make innovative drama programming against difficult financial odds.

with a small rucksack containing two portable DAT recorders (Sony TCD-D3 DAT Walkman and Sony TCD-D10) and several microphones (Sennheiser MKH 20 omni and MKH 40 cardioid, Trams and a Sony ECM-959 M/S stereo).

Arriving on the last day of Ramadan, the Moslem holy month of fasting, Lopez, favoring the D-3 Walkman for portability, simply began recording the sounds he heard as he moved throughout the country. It was from these recorded sounds he discovered and created the script for the program.

"I call it sound scripting," Lopez said. "I

record the sounds first and then write the script to fit the sounds. A good sound should have character, like a character in the story. It's not just something you take off the shelf." As he recorded the native sounds of Sumatra on DAT, Lopez also gathered information about the country and its people to work into the story.

Back in New York, Lopez wrote a script that incorporated the sounds he found most compelling. The voices of his actors, also recorded in New York, were mixed with the location soundscapes using his 16-track Otari MX-70 multi-track recorder.

The results are stunning. The rich sounds of daily life in Sumatra permeate the program and help drive the story. There are chickens, rickshaws, insects, and exotic birds interacting with the human characters at every turn. As the city celebrates, we hear crowds, music and the call to prayer that sounds from mosques across the city and surrounding hills.

In his next project, to begin late this year, Lopez will use his Neumann "Fritz" binaural dummy head microphone and his new Digidesign Pro Tools editing system to create a jazz opera in 3-D sound.

"It will be a film noir detective story in audio," Lopez said.

Orson Welles, one who understood so well that the pictures are always better on radio, would no doubt approve.

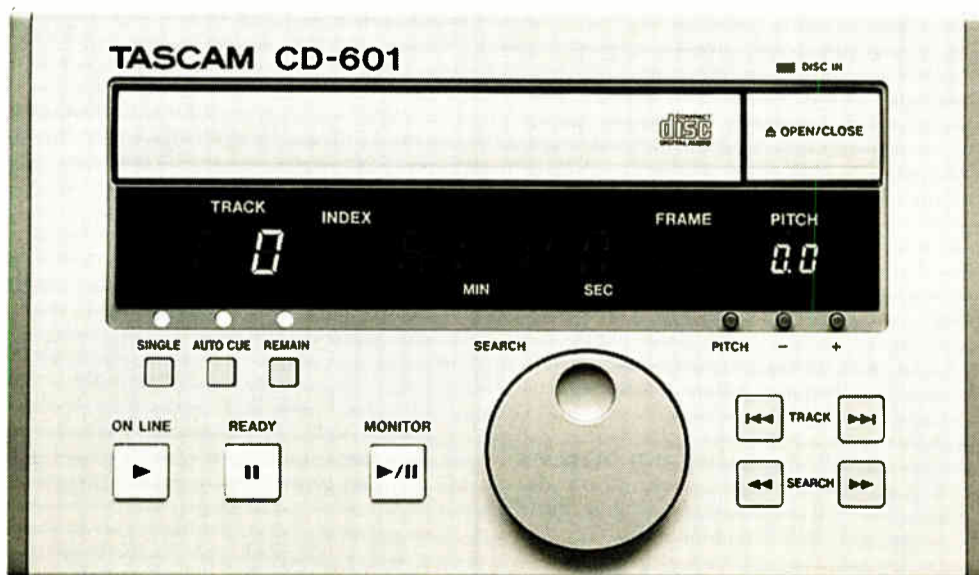
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Frank Beacham is a writer, director, producer and consultant. His address is 163 Amsterdam Ave. #361, New York, NY 10023.

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DIGITAL DOMAIN

Exploring Hard Drives, Removables

by Mel Lambert

LOS ANGELES For me, the key to ready acceptance of any technical innovation is the realization that the device will enhance rather than hinder a function with which I'm already familiar. If you have ever tried to teach somebody who doesn't type how to use a word processor, you'll understand how hard it is to overcome the fundamental reason for needing to know about the program's user functions. The same principle applies to station automation systems.

For many years now, the advent of reliable hard-disk storage systems—with and without data compression—has meant that we can store virtually limitless amounts of audio data for instant replay at the press of a button. And the recent availability of floppy, "floptical" and MO-based playback units has added the capability of removable playback that matches the convenience (and familiarity) of conventional NAB cartridge machines.

There is no denying, however, that neither technology offers a truly universal solution for automating audio playback.

Hard-disk systems, while providing multiple hours of playback capacity, require some means of inloading the various music, jingles and station IDs, as well as cataloging and displaying the current content.

Decisions, decisions

Removable media often suffer from restricted storage capacity which, in some cases, might limit their applicability for certain long-form or unattended configurations. In either case, it is virtually impossible to guarantee that either technology would be appropriate for every application.

There are obvious exceptions, of course. Totally automated formats might run perfectly well on several interlinked or networked hard drives, used in conjunction with a separate inload and/or programming workstations. In this way, multiple drives would extend the system's reliability and even allow simultaneous replay/inload functions. And to simplify the transition from analog to digital playback—and offer the same degree of tactile satisfaction we currently enjoy with NAB carts—the new generation of removable-media systems are without comparison.

But for many stations, these two technologies will need to coexist in one or more duties. Maybe the bulk of a music library will be held on hard disk and programmed via a standard automation package. For short-form commercials and stings, as well as material that is pre-recorded specifically for replay once and then deleted (a phone-in contest winner, for example, or a time-shifted news bulletin) floppy/MOs would offer additional flexibility.

Removable advantages

In either case, there are many examples where large-scale permanent and removable storage offers distinct advantages.

One of the problems I envision, however, is that these two complementary technologies offer different user convenience. What I am looking for is a way of combining the best of both worlds.

For a hard-drive system being used in operator-assist mode, I'd like to see some way in which information could be downloaded to a relatively simple alphanumeric readout above (or close to) the "Next" button that will actually trigger the event. Now we have visual confirmation that the next sound we will hear will be a music cue (with an abbreviated title), a commercial (a simple tag) or some other event.

While this information also is available on a master monitor screen, are we entirely sure that the next event really will be the one currently highlighted or otherwise indicated in a color display?

In turn, the alphanumeric display currently available on the front-panel readouts of floppy/MO players could be extracted via a simple serial link to a similar display located close to the normal start/stop button. Again, we would have visual confirmation that the correct cue is now loaded and ready for playback. (And if the floppy or MO disk contains several cues—as will almost certainly be the case for larger capacities—we might also add a pair of nudge up/down buttons that allow the operator to scroll through the disk's contents, and select the appropriate audio segment.)

Multiple devices

If we also add the ability to control additional replay devices from a master sequence via a simple serial protocol (a growing number of manufacturers are considering MIDI Machine Control for such applications), we might be able to enjoy the advantages of both forms of playback technology, while minimizing their inherent limitations.

Finally, I have a couple of lines in which to tell you about a useful new test product, and a very handy addition to any chief or production engineer's bookshelf.

The Prism DSA-1 Hand-held AES/EBU Analyzer, now available in North America through Sprocket Digital (818-566-7700), quickly measures electrical and electronic performance of professional and consumer digital I/Os. The battery-powered unit handles sample rates between 28 and 52 kHz, displays channel status values, data or sample jitter, and features a built-in monitor speaker. Beyond routine spot checks of digital I/Os, the unit can be used to establish a template of acceptable test limits.

"The Digital Interface Handbook," by Francis Rumsey and John Watkinson (Focal Press, 1993, ISBN 0 240 51333 9) is a great source of useful, practical information on how to interconnect digital audio and video systems. The 220-page paperback book covers format and electrical performance of current digital I/O formats; how they perform in day-to-day applications; what remedies to turn to when the digital audio/video data doesn't produce expected results; how to establish reliable synchronization schemes; plus measurement of interface and cable performance. Highly recommended!

□ □ □

Mel Lambert is a principal of Media&Marketing, a Los Angeles-based consulting service for the professional audio industry, he can be reached at 818-753-9510.

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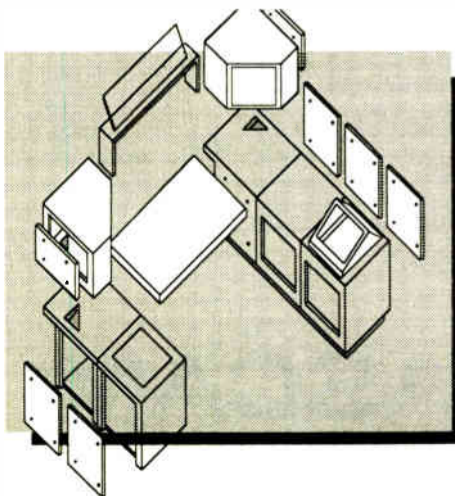
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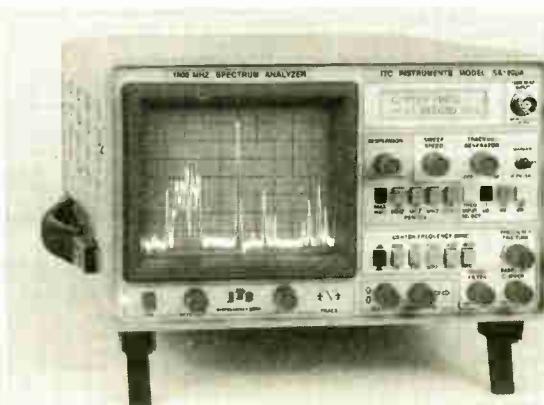
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PRODUCT GUIDE

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HHB CD-R Indexer

HHB Communications has developed a CD recorder indexer that is compatible with the Philips-based CD recorders, including the latest generation of



less-expensive professional Marantz machines.

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flags, and provides a "delay" function that advances the position track flags to compensate for "late" ID markers on the source DAT. Other functions include manipulation of consumer, professional, emphasis, channel usage and category code status bits.

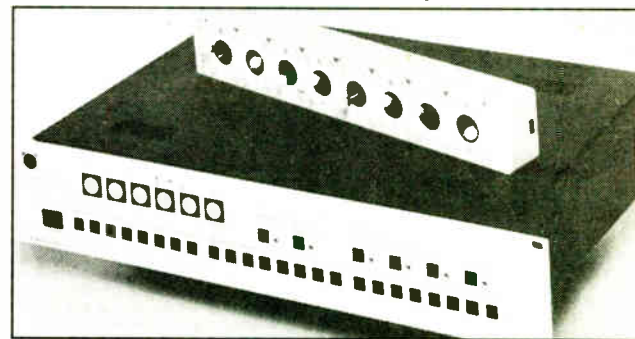
The CD-R Indexer is available in the U.S. through Independent Audio in Portland, Maine. For more information, contact Fraiser Jones at 207-773-2424; or circle Reader Service 54.

The Spatializer, by Desper Products

The Spatializer is a real time, three-dimensional studio processor that is said to allow placement, movement and scaling of individual tracks in space from two loud speakers.

The unit features multi-track joy stick operation, modular design for expandability and is mono compatible.

For more information, contact distributor Audio Intervisual Design, 213-845-1155, or circle Reader Service 201.



Tech Tips to Enhance Your Condenser Mic

► continued from page 28

forty five degree angle or use a foam pop filter designed for the mic. Good foam pop filters, while they may screen out some highs are worth the investment, especially if you're using condenser mics with charged capsules like the Neumann U87 series and the Gefell UM 70S, UM 70 and M71.

Because the charged element of the capsule is exposed to the air, it attracts minute particles of pollution; dust, smoke, and other human effluvia. Use of a foam pop filter may reduce the number of capsule cleanings these mics need to keep their sound. Also know that, as the foam ages, it may become less transparent. As the foam particles dry out they may increasingly block the sound from getting to the capsule, especially the high frequencies. Mesh screens pop filters can be used if you're not worried about airborne pollution and if you can find a way to mount them so that they don't become cumbersome in a crowded console area.

Like I said earlier, condenser mics are very sensitive. If you crank up the headphones and hear the air conditioner, cart machine bearings and truck traffic from half a block away, make sure the condenser mic you're using is either a fixed cardioid (unidirectional) or a multipatterned mic that's switched to the cardioid position. Try repositioning the mic with its back to the sound source. Move the news wire machine to the other side of the room, change the ducting on the air handlers.

If the sound is mostly low frequency room resonance and HVAC noise, try rolling off a bit of the bottom with EQ. If these approaches don't work, use a noise gate to "turn down" the mic between your words.

Finally, when trying out different mics, do a voice-over-music test. If you don't, you'll probably end up choosing the brightest sounding big with the biggest bottom, which won't necessarily be the best one for voice-over work.

□ □ □

Ty Ford's new book, "Advanced Audio Production Techniques," is available from Focal Press. Call 800-366-2665 for more information.

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Hum Remedies: Bring It All Together

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

Last in a series

ELKHART, Ind. In this final installment on preventing hum in an audio production system, we'll briefly sum up the entire series of articles.

Grounding provides three benefits:

1. It eliminates voltage differences between equipment chassis by connecting them all solidly to earth ground. Then, when you interconnect components, there is no voltage between them to cause hum.
2. It protects people from AC shorts to chassis (via the power ground or safety ground).
3. It provides a drain path for the oscillating electrostatic charges built up on shields and chassis. These oscillating charges are induced by hum fields from power wiring and transformers, and by RFI fields from transmitters.

For unbalanced equipment in a small studio that uses short connecting cables, these are the most important points to remember about hum prevention:

- Plug all equipment into outlet strips powered by the same breaker.
- Put unbalanced equipment in a single rack, isolated from the rack and each other (say, by using a wooden rack).
- Use balanced mic cables if possible.

If you have a small studio with fewer than 20 power cords in use, you can use

the wall-outlet power ground to ground your audio equipment. Plug your equipment into three-wire grounded outlet strips powered by the same circuit breaker. If your equipment has two-prong power cords, you probably won't have any

A system ground is a single common ground point for the whole studio.

ground-related problems if you connect the equipment as described in previous columns. In particular, review the column on preventing ground loops.

For balanced equipment in a large installation:

- Put audio equipment on a separate power feed.
- Use AC isolation transformers or AC line filtering if necessary.
- In each balanced line-level cable, connect the shield to pin 1 in the female XLR; disconnect the shield from pin 1 in the male XLR. Then plug your recording equipment into local three-hole grounded outlets and connect audio cables.
- If hum is still a problem, establish a system ground. This is a single common ground point for the whole studio: the ground bus bar in the circuit-breaker box, or the console ground bus terminal. This system ground is connected by a heavy

wire or strap to a solid earth ground (a rod, pipe, or rod system).

Connect all the equipment chassis individually to the single system ground—not to each other.

• If you're installing a system in a building with existing power wiring, connect a separate insulated low-resistance wire from each chassis to the single ground point. Be sure to follow local electrical code.

Connect each chassis of rack equipment separately to rack ground, and connect the rack ground to your system ground. Put electrical three-to-two adapters on the power-cord plugs.

• If you're installing a recording system

and new power wiring:

Use isolated-ground outlets. Connect an insulated low-resistance wire from each outlet's ground receptacle to your system ground.

Plug all the rack equipment into the same AC outlet strip in the rack. Plug all the power cords into three-hole outlets.

By following all these tips, you should be able to connect audio equipment without introducing any hum. Good luck!

Portions of this article were excerpted from the authors' book, "Practical Recording Techniques," published by Howard W. Sams.

□ □ □

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.

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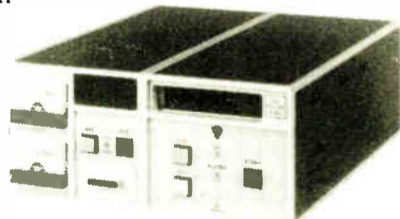
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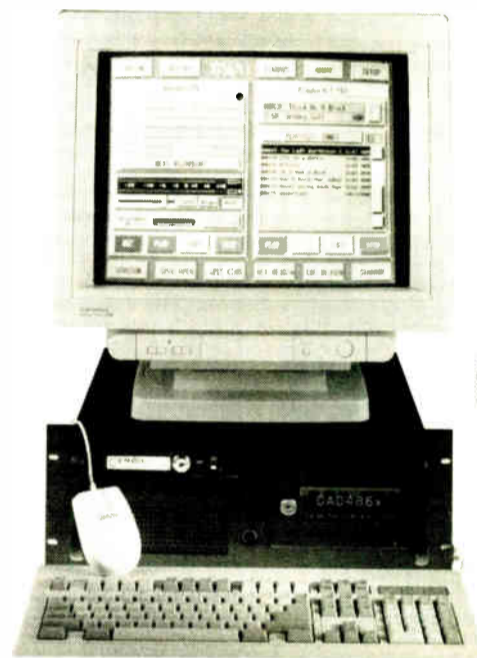


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Documentary Requires Preplanning

► continued from page 25

the likelihood of actually getting the funding at your desired level, and who is going to distribute or air the piece.

Sometimes it is necessary to shift one's focus, in order to make sure that a project gets completed and aired. Then again, sometimes settling for less than what you dreamed of spells disaster. A good piece must have quality, but it also must have heart. Without heart, a program won't go far, but with it, you will be able to overcome many more obstacles than you first think.

An important part of this planning is what could be called production design. Here you will decide what the piece will sound like—both technically and aesthetically. You will decide what equipment to use, and where the recordings will be done.

Have a plan

The next task is to develop a written treatment which addresses all of the above. This is used primarily for fund-raising and securing a distributor. However, putting the project details down on paper always helps clarify things for the producer and all others involved in the production. The more you can write about the project, the better prepared you will be, and when changes are necessary (and you can count on it), you will be able to make decisions without wasting too much time.

Production

The production phase includes doing the research, setting up all of your recording sessions, including interviews, going out and doing the recordings, collecting any archival material, or any material which you will not personally record, and logging everything you end up with.

Post-Production

This phase includes writing your scripts, editing the tape, recording the narration (if there will be one), preparing for your mix, and doing the mix.

Distribution

Finally, you will get your work on the air. For a local broadcast you will probably deliver on either on 2-track tape or on DAT. If you are distributing nationally, you will still master on tape or DAT, but the master will probably be distributed via satellite (for public radio). Some people in commercial radio are distributing via CD. Then, hopefully, your program will be promoted locally by your station, or nationally by your distributor.

Because the focus here is on the technical aspects, we'll concentrate primarily on production and post production, and leave the discussion of concept development, approach to telling the story, and distribution issues for another time.

What should you use as your field

recorder? DAT? DCC? MiniDisc? Cassette? Reel-to-reel?

The format of choice is DAT. High end cassette decks and open reel-to-reel decks are suitable, but becoming less and less likely choices. I think that it is fair to say that Sony and Panasonic are two key players in the field, with most of the other manufacturers close behind.

Consumer to pro

Sony has introduced some professional applications for its new consumer format the MiniDisc, while Panasonic is likely to introduce some lower end professional uses for DCC. In speaking to representatives, each company clearly acknowledges the limitations of these new formats because each of them use not only compression, but data elimination, which for many keeps the linear DAT as a viable format. Both Sony and Panasonic have made a strong commitment to keeping DAT the professional format for the foreseeable future.

In considering the features of a field tape recorder, it must be battery operated, durable, have good mic pre-amps, and good sound quality. There are a number of good location DAT recorders on the market which range in price from about \$1000-3000. The first two DAT portables to be widely used were the Sony D-10 Pro and the Panasonic 250/255. (The Panasonic has recently been discontinued, and many are around at bargain prices. Panasonic promises to service these machines for at least five years. Panasonic is now working on the SV-450, which will be a very robust, full function, time-code unit modeled after the Nagra, but has not announced any release dates.)

Many of the newer DAT machines from Marantz, Aiwa, Casio, and JVC have interesting features and are less expensive than previous generations. There also is a class of higher-end machines, intended for film production. StellaDat and Fostex PD-2 each make a very expensive location recorder. The StellaDat and the Fostex each have many features, including the ability to write SMPTE time-code on the tape and a four-head design, which allows for off-the-tape monitoring.

This can be especially useful in the digital world, because of drop outs and other problems that should be caught in the field. Unfortunately, they each cost around \$10,000.

If you are looking for an inexpensive machine, carefully consider the features, and the construction. If a machine will be used by more than one person, the more durable and easy to use, the better. Weak areas in recorders can be flimsy construction, small and confusing controls, small

input and output jacks (mini-jacks), bad mic pre-amps, cheap A/D - D/A converters, hard to read meters, lack of digital in and out, no limiter, or no mic attenuation pad.

A good way to find out about the merits of a field recorder is to talk to someone who has used it. One place to check these things might be on a bulletin board service. Compuserve, America On-Line and the WELL each have conferences on audio equipment. The WELL has an interesting one specifically for radio producers which I use regularly.

Important good features include writing absolute time (different than time code), XLR connectors, easy to read and backlit meters, controls accessible while carrying, good mic pre-amps, decent A/D - D/A converters.

Most of these machines run off NiCad batteries, so that if you are doing a lot of field work, you will have to have a number of fully charged back-up batteries with you. Some of the newer machines will run on regular household batteries which can be an advantage.

Portable tools

The machine I use, and am very happy with, is the Sony D-10 Pro. Sony has just introduced the D-10 Pro II, which adds A-time (absolute time, a very useful address track, but one not compatible with SMPTE time-code) capability and a few other nice features. (The original machines can be upgraded). It costs about \$3300. The D-10 Pro has balanced, XLR mic in-puts, a large and very easy-to-read back-lit display, good peak-hold meters, a built in speaker (very handy). It has a great limiter which has helped me often. The machine is well laid out and simple to use.

For some stations and independents, the cost of going digital is still high. And there are still lots of great analog machines around. Using a good portable cassette recorder like the Sony TCD-5M or one of the Marantz pro portables is a viable option. However, I wouldn't suggest using anything less than either of these. These cassette recorders are extremely reliable, easy to use and they sound good.

Of course using one of the great portable reel to reel decks like the Nagra, Uher or Stellavox would provide great sounding tape. But they are just very expensive and rather cumbersome to carry and use.

In Part II of "Producing a Radio Documentary," we'll discuss choosing and using microphones for interviews.

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Steve Rowland is a principal in the production company, *The Music Makers*, in Philadelphia. He can be reached at 215-843-4388.

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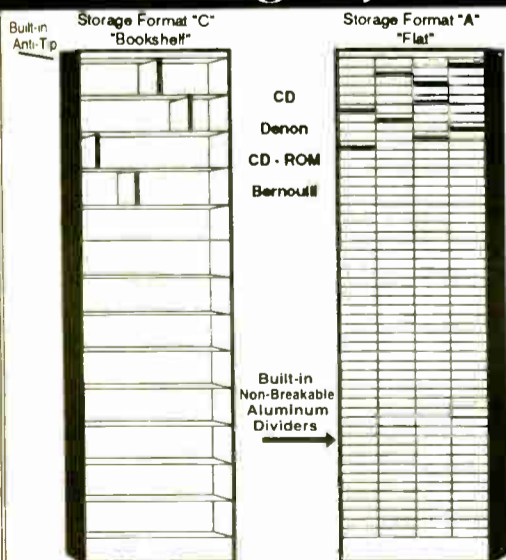


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READER SERVICE NO. 133

STL, Remote & Telco Equipment

USER REPORT

CCS Codec Cleans Up ABC Radio Act

by William Holder
 Technical Operations Manager
 ABC Radio Networks

NEW YORK Switched 56 and ISDN digital telephone facilities are the terrestrial telecommunications services of choice for audio backhaul from remote locations for many broadcast and production studios.

digital telephone facilities.

The next generation

The CDQ1000 Digital Audio Codec from CCS Audio Products, a division of Corporate Computer Systems Inc., Holmdel, N.J., delivers audio with a bandwidth of up to 10 kHz on a single 56 or 64 kilobit (kb) digital circuit, and offers the next generation of audio quali-

any of three different digital audio compression algorithms.

In the CCITT G.722 mode at 7.5 kHz bandwidth, the unit is compatible with existing codecs offered by CCS (Micro 56/64 and 66i), Comrex and other manufacturers.

In the second algorithm, the ISO/MPEG Layer II MUSICAM mode with a sampling rate of 48 kHz, the unit offers compatibility with the CCS CDQ2000 and other MUSICAM codecs, with an audio bandwidth of 8.2 kHz.

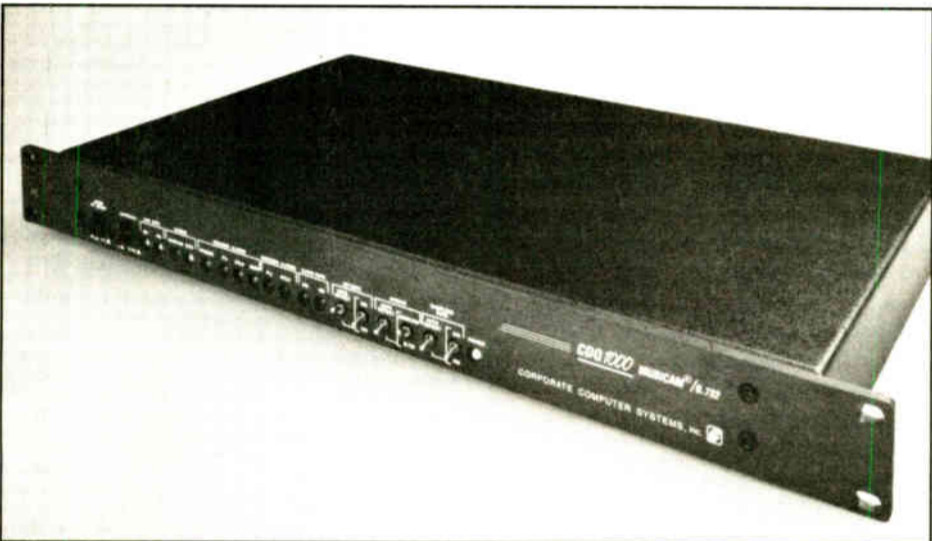
The third, the CDQ1000, also offers an "enhanced MUSICAM" algorithm. This algorithm uses a 24 kHz sampling rate and maximizes audio bandwidth out to 10 kHz. It also yields 10 dB to 15 dB improvement in dynamic signal-to-noise over the G.722 algorithm (80 dB below maximum output versus 66 dB).

This enhanced audio coding scheme sets the CDQ1000 apart from the rest of the pack, but it's currently only compatible with other CDQ1000 units. CCS is working to have this algorithm adopted into the ISO MPEG2 standard.

The CDQ1000 can be set to automatically sense the algorithm the far-end unit is using, and adjust itself to synchronize with the received data. Alternately, front-panel switches manually select the compression mode, data rate and sampling rate desired.

Front features

The front panel also offers LED indicators to show data and sampling rates, audio coding scheme and framing status.



The CCS CDQ1000 Digital Audio Codec

High quality bidirectional audio using either dedicated or dial-up circuits is delivered at a reasonable cost from almost anywhere in the world. As a result, the single most important method used by the ABC Radio Networks to receive program audio feeds from outside sources for our news, sports and satellite services divisions is

ty for use with single-line ISDN and switched digital facilities.

The CDQ1000 also maintains full compatibility with existing equipment at the station or studio for use with 56 or 64 kb digital or ISDN telephone services.

The CDQ1000 codec can operate at either a 56 kb or 64 kb data rate, using

Internal jumpers select reference audio input/output levels of 0 dBm or +8 dBm, and audio input impedance of 600 ohms or 30,000 ohms. XLR connections for audio input and output are on the rear of the unit.

The CDQ1000 offers a DB-25 connector for the V.35 data interface, and a DB-15 connector for X.21 and RS422 digital
 continued on page 45 ▶



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USER REPORT

Dolby DSTL Makes the Grade at KMPS

by **George Bisso**
Director of Engineering
KMPS-AM-FM

SEATTLE When I first started thinking about writing this report, I told myself I wouldn't begin by saying this product is great, wonderful, etc. But the **Dolby DSTL** system is great and wonderful, so I guess I can end the report right here.

who came along with that tank?

It was Dolby, and as far as we're concerned, the people at Dolby are the audio people of the world. When the company hired people to enter the RF world, the company came up with a state-of-the-art RF, digital audio and digital stereo generator package that's better than anything we've ever seen.

Making comparisons

With my chief assistant engineer, Arne Skoog, we matched this DSTL system up against our good-sounding (we thought) composite radio system. The first part of the system has a transmitter at the studios, a receiver and transmitter at the relay point, and a receiver at the main

The relay site just passes the original digital signal through, with no degradation of the bits. We tested the entire system on the bench with the first link set at 949.5 MHz and the second link at 945.000 MHz. We looked at it from 40 Hz to 15 kHz. Left and right inputs to the transmitter were kept at 0 dB (see chart).

Frequency response was measured to be an average of ± 0.24 dB at the receiver's analog output. (The test results of the digital stereo generator come later.) Test of the AUX SCA channel was flat from 47 Hz to 7150 kHz, ± 0.25 dB.

The voice/modem channel was flat from 300 Hz to 3.0 kHz, ± 0.45 dB. The main channel's distortion measured 0.075 percent at 1 kHz. The dynamic

ing left at the studios.

The Dolby Digital Stereo Generator allows us to do just that. Readings were taken at Tiger Mountain through the whole system, with the audio generator at the studio.

The signal-to-noise ratio was greater than 89 dB de-emphasized. Frequency response tested 20 Hz to 53 kHz with flat ± 0.05 dB. Stereo separation measured off-air at 52.5 dB, 50 Hz to 12 kHz and 52 dB at 13.5 kHz.

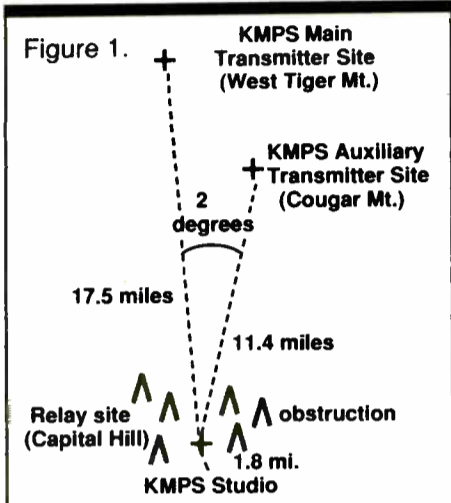
Many, many more tests were run, all of them showing factory specs or better. The DSP system Dolby uses is a very acceptable system, delivering to our transmitter the way audio should sound.

Crowded frequencies

STL frequencies are crowded in Seattle, as in most major markets. I am frequency coordinator (below 1 GHz) for the WWFCC, and another station recently sought my advice when it needed an STL frequency.

I looked at the spectrum and concluded the Dolby DSTL system would probably work. There was a user on 947.000 MHz vertically polarized and a user on 947.5 MHz vertically polarized. We put the station that needed an STL frequency on 947.25 MHz horizontally polarized, and the system worked fine for all parties. Using only 250 kHz of spectrum, the Dolby system works many times when other systems just won't operate.

The transmitter operates at 1 W, so RF interference won't be a problem around town. But you don't have to worry if 1 W is enough power. That's because you don't need to think in terms of analog receivers any more, which require much more power to operate. If you read a spec manual, I think you'll be surprised at how the Dolby works with very little signal.



All kidding aside, our station recently completed the full testing of the Dolby system, and I want to relate the nuts and bolts of our testing.

Our situation here in Seattle is a very unique one. Our studios are located close to the Space Needle in the northwest part of the city. We have one AM and two FM transmitter sites. The first hop of the DSTL system was designed with the future audio installation of the AM station in mind.

For years, we used the so-called greatest, most solid and bullet-proof composite STL system, and it did a good job for a composite radio. We used add-on digital systems from two other companies that worked well for our purposes, but what we really needed was a tank. Guess

FM transmitter site on west Tiger Mountain (Figure 1).

We put the whole system together on the bench and ran it through some very rigid testing. We looked for the amount of degradation received from one piece of equipment through the next. I might add that the original digital signal starting at the studio is the same one that ends up at the receiver at the FM transmitter sites.

range measured an average of 92 dB. Channel crosstalk was measured with many different frequencies, with an average of -90 dB.

Final selections

I think the built-in Digital Stereo Generator is one of the greatest inventions since sliced bread. We were at a loss, because there were no telco lines

KMPS DSTL® Path: Capital Hill to West Tiger Mountain				
Path Length (Statute Miles) = 17.50				
		(dB)	(dBm)	Description
Transmitter Output Power	1W		30.0	
Transmitter Line Loss		-3.5	26.5	175 feet of 7/8 inch coax
Transmitter Connector Loss		-1.0	25.5	
Transmitter Antenna Gain		+22.0	47.5	6 foot parabolic grid antenna
Free Air Path Loss		-121.0	-73.5	17.5 Miles
Receiver Antenna Gain		+24.8	-48.7	8 foot parabolic solid with radome
Receiver Connector Loss		-1.0	-49.7	
Receiver Line Loss		-2.8	-52.5	140 feet of 7/8 inch coax
Receiver Input Power	529µV		-52.5	
Signal Required for BER=10 ⁻⁴	2µV		-100	
Fade Margin for BER=10 ⁻⁴		47.5		Estimated Outage Time =0.06 min/yr

Circle (94) On Reader Service Card

Dolby came up with a state-of-the-art RF, digital audio and digital stereo generator package that's better than anything we've ever seen.

for modem control of the processor at the Tiger Mountain site. We didn't want to put just any stereo generator up there, and we really wanted all of our process-

You can feed either pre- or de-emphasized audio into the system, user selectable. Dolby also has a hot standby system to configure a full backup system using either another Dolby system or your old composite STL system.

When John Schneider of RF Specialties of Washington dropped off the units for us to test, he said he would return in a week to pick up the gear. But the equipment never left the station. We even ordered another receiver for our backup site.

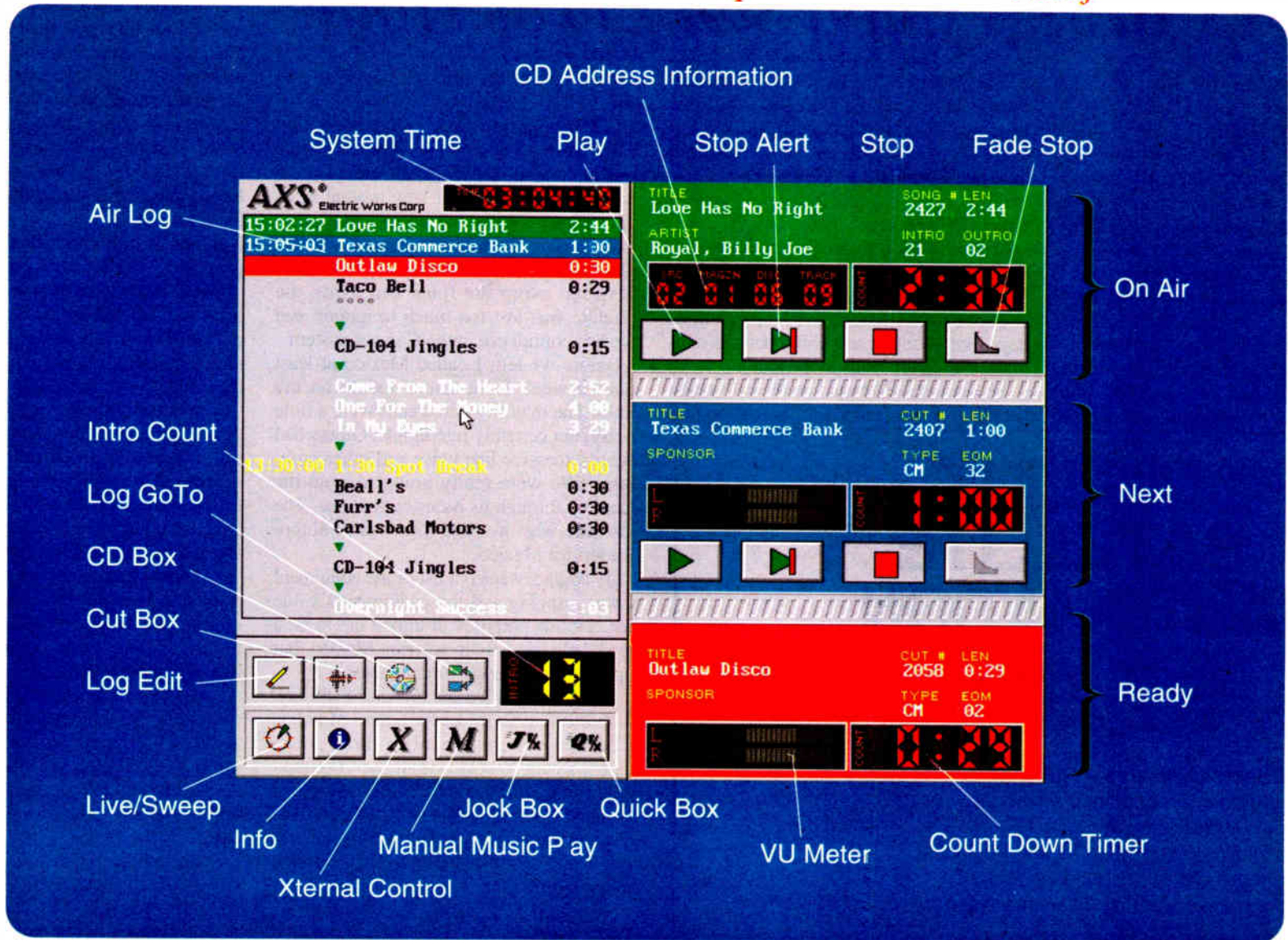
Based on our experience, we feel confident saying that if you use a Dolby DSTL system on the air, your program director, staff and listeners will never let you use a composite system as the main audio source to your transmitter ever again.

□□□

For information on the Dolby DSTL system, contact Tom Daily in California at 415-558-0200; fax: 415-863-1373; or circle Reader Service 192.

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USER REPORT

Comrex Brings Cabo San Lucas Home

by George Zema
Chief Engineer
KSFO(AM)-KYA(FM)

SAN FRANCISCO Our promotion director, Susan Reynolds, came in the office one morning with details on our latest contest. We were sending morningman Gene Nelson, News Director Dave Henderson, Susan, and 24 contest winners (each with a guest) to Cabo San Lucas, at the southern-most tip of Baja California.

Ted Levin, director of engineering, and I began discussing how to send the audio back home. Satellite estimates were in the

\$30,000 range for a three-day broadcast. So the idea was put on hold while we investigated dial-up phone lines. We felt that we could get decent audio from our dual-line Comrex.

Cost difference

I called AT&T to receive a rough estimate of line charges. We'd be off-hook on four lines (two for the Comrex, one for IFB, one for COM) for five hours all three days (not counting test calls, post-air calls to the station and calls to the kids).

The estimate was based on the calls originating from San Francisco, even though it

wasn't the true scenario. The estimate was around \$1,400 per day.

Our contact in Mexico advised us that calls from Mexico to the United States would cost 40 to 60 percent more. There was no real convenient way around it, as all the equipment at the studio end is auto-answer. We decided to go ahead with the phone lines, because the cost difference between using the lines and using the satellite was just too much to ignore, and we had confidence in the Comrex system.

Before we left, I called Mexico at least once a week for a status update on the lines. The majority of the calls were a little noisy, but certainly intelligible. Others had echo, excessive line noise and other problems. We were really going to send the Comrex through its paces on this one. The last line was installed a few days before we left for Mexico.

My contact wanted a list of the equipment I was bringing and the equipment's value for customs purposes. It turned out to be a great help not only in entering Mexico, but upon returning to the United States.

The plan included me arriving Saturday, with our first show set for 6 a.m. Monday. I packed the equipment in three Anvil cases, trying to stay within the 70-pound maximum per case the airlines impose. I kept the Comrex with a mic and cable and a spare Shure M267 mixer as carry-on luggage just in case the Anvil cases got rerouted to Guam.

First steps

We finally reached Mexico, and I was taken to the room with the phone lines and where the equipment would be stored between shows. The power to the room was on a breaker around the corner, down some steps, and into another room. I asked if I could put a note over the breaker so it would not get turned off. I was assured it would not happen.

I opened the cases to look for obvious ship-

ping damages. The main Shure mixer slipping partly out of its rackmount and a couple of broken wires on the IFB panel were the worst of it. I was able to draw a dial-tone on the four lines and hear sufficient side-tone in the earpiece. In addition, I'd scheduled a test with the station for Sunday.

Everything was set up Sunday morning as if we were doing the remote that day. I called the Comrex lines and then the COM line. Switching the phone from pulse to tone, I punched in the intercom code to listen to the output of the Comrex receive unit. Nothing. It turned out that the line I was using for COM had a transmit problem.

I could make local calls and be heard, but once the call left the area, the audio was only one-way. The hotel summoned the phone company, but after a couple hours, the problem was not going away.

A private line was substituted from one of the hotel's offices, and we completed the switchover 15 minutes before the scheduled test time. While I was waiting for the phone problem to be corrected, I gave the equipment another once-over and found a couple more ready-to-break wires.

A quick word about the AC source. The pool was the only place with grounded outlets, and the closest one too far away to be useful. The inside outlet I used was a two-prong polarized type.

I measured the hot side to ground and received 125V; neutral to ground was about 30V. The equipment didn't seem to mind the voltage, so I didn't change it. And after a couple times, I learned where not to rest my bare arm on the equipment cases.

Console mix-minus was fed to the IFB line, and the COM line to the studio worked perfectly. The COMREX lined up on the first call. The noise level was in excess of -50 dB; the audio level and EQ were right on.

Live surprises

At 3 a.m. Monday morning equipment setup went very smoothly. The broadcast kicked off at 6 a.m. sharp, with a live newscast from Cabo San Lucas.

But about 20 minutes into the show, a hotel groundskeeper turned off our breaker. Gene Nelson's producer, Don Rea, slipped right into spots without missing a beat while I scurried to reset the breaker. This time I slapped duct tape over the switch and wrote a big "NO!" on it. We finished the broadcast without a hitch.

Reports after the first day's show were very encouraging. People at the station said if they had not known better, they would have thought that the show was coming from the studio, not another country. In fact, someone said they could hear the birds chirping. Not too bad, I'd say.

While all the equipment worked fine considering the movement on the trip down, I give a big tip of the sombrero to the Comrex, which worked flawlessly under less-than-ideal phone conditions.

While a three-line unit provides better frequency response, a two-line unit is much more forgiving in countries where the CCITT standard for network switching is less than standard. Comrex suggests this when broadcasting from foreign countries.

Things move a little slower in Mexico, so we haven't received a phone bill as of this writing. My guess is it's going to be around \$8,000 or so. Whatever it is, it'll be less than a \$30,000 satellite bill.

□ □ □

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Circle (95) On Reader Service Card

CDQ1000 Gives 'Clean' Broadcast

► continued from page 41

interfaces to terminal equipment. Rear-panel dip switches are used to select the data interface type.

The CDQ1000 also allows transmission of asynchronous data at 300 or 1200 baud via an RS-232 interface when operating in either of the MUSICAM modes. This feature can be useful in sending "tally" signals between the station and remote site.

Shortly after the CDQ1000 was introduced at this year's NAB convention, David Lin of CCS contacted us about using the product during our 1993 Triple Crown horse race broadcasts. Knowing that the unit offered an improvement in frequency response and signal-to-noise over the 7.5 kHz audio quality with the Micro 56 unit, we agreed to evaluate and test the unit at the Preakness and Belmont Stakes.

The CDQ1000 offers the next generation of audio quality for use with single-line ISDN and switched digital facilities.

In-house testing of the new CDQ1000 24 kHz algorithm prior to its use at the Pimlico Racetrack in Baltimore confirmed the improved extended frequency response out to 10 kHz, and greater signal-to-noise ratio over the older unit.

A workspace-sharing arrangement with ESPN Radio allowed ABC Radio the luxury of two complete Switched 56 circuits in each of the race venues. We fed a pair of CDQ-1000s on one circuit, and a pair of Micro 56 units on the other circuit for direct A/B comparison.

At the Preakness remote site, ABC Washington engineer Tom Marchitto and I set the CDQ1000 to sample the audio in the 24 kHz MUSICAM/10 kHz bandwidth mode. The unit at our New York Technical Operations Center was set to "auto-detect" the incoming signal and synchronize itself to it.

Cleaner audio

Subjective listening tests of both feeds revealed the CDQ1000 had a clarity and presence with both voice and music material, easily making the unit our choice as the main program feed, with the Micro 56 feed as a "hot standby."

As good as the 7.5 kHz audio from the Micro 56 series always sounded, the CDQ1000 feed sounded cleaner, quieter and brighter than the feed of the G.722 unit, and close to the sound of a 15 kHz audio circuit. Staff feedback following the Preakness confirmed that the broadcast sounded "cleaner" and "brighter" than in previous years.

The subsequent broadcast of the Belmont Stakes in June using the CDQ1000 was also flawless and equally "clean."

Compatibility tests were later performed with SMS Studios in London,

verifying the ability of the CDQ1000 using the 48 kHz MUSICAM algorithm to communicate with the CDQ2000 operating in single-line 56 kb mode (the CDQ2000 is normally used with two 56 or 64 kb circuits to produce a 15 to 20 kHz stereo feed).

We also used the CDQ1000 to provide Radio Clyde in Glasgow, Scotland, a feed of its morning drive show when it originated from our New York studios. Radio Clyde obtained a CDQ1000 from CCS Europe hours before the broadcast began.

Our backup plan was to use the CDQ1000 to feed a single 56 kb circuit

into a CDQ2000 unit already installed at the station. But the arrival of the CDQ1000 with its improved audio quality again made it the unit of choice for the feed. The broadcast went smoothly and the quality of the audio heard on both sides of the Atlantic was great.

One small caveat for stations interested in the CDQ1000: the unit's manipulation of audio to squeeze 10 kHz of bandwidth into a single digital circuit causes a processing delay of about 180 milliseconds, which is slightly less than that of a typical satellite path.

This path delay means that stations need

to consider using "mix-minus" practices for cue and IFB return to the remote location. This way, announcers avoid hearing themselves delayed (for those who have not done remotes via satellite, it's an experience not unlike talking into a microphone while listening to the output of a reel-to-reel tape machine).

Because of its almost "universal" compatibility with the variety of digital codecs currently available, and the promise of improved audio quality from pairing CDQ1000 units together, the CCS CDQ1000 codec offers a versatility unique in the marketplace today.

□□□

For information, contact David Lin in New Jersey at 908-946-3800; fax: 908-946-7167; or circle Reader Service 109.

THE D-MUX 500 SERIES DIGITAL MULTIPLEXER CAN TAKE YOU TO SPACE AND BACK! USING OUR LINEAR CONVERSION SYSTEM (LCS)

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Circle (103) On Reader Service Card

World Radio History

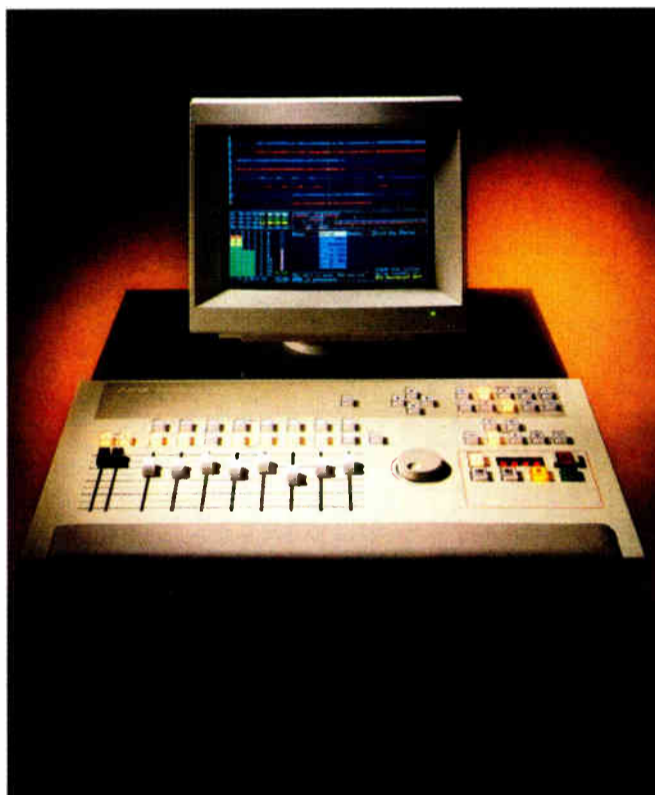
To Make Money in Radio Advertising, You've Got to Push the Right Buttons.

Since 1990, radio stations in every music market have been more creative, more efficient and more profitable with the DSE 7000. In order to increase profits in the competitive radio environment of the '90s, general managers have been asking more from their production directors, who in turn have had to do things faster and cheaper. Clearly, the trusty 8-track recorder wasn't going to lead radio stations through this new era.

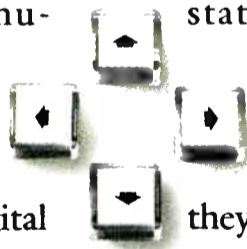
Since it was impossible to become more efficient at tape splicing, astute production types contemplated digital technology. They found out



DSE 7000. In order to increase profits in the competitive



about a company with over 40 years experience manufacturing professional audio products, who was already shipping a digital sound editor for radio production. Not coincidentally, this system had many of the same controls and functions they were used to.



They tried a demo of the DSE 7000 and realized they could produce spots in one-third the time. Which meant they had time for a certain luxury called creativity. The DSE's UNDO button gave them room to experiment. And its audio quality raised their standards to an entirely new level.

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called creativity. The DSE's UNDO button gave them



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World Radio History

USER REPORT

CAT-LINK and T-1 Connect Michigan Stations

by Walker Sisson
President
Communications Resources

BRIDGMAN, Mich. As the licensee of a new FM station, Dunes Broadcasting knew the station had to be innovative even before its construction permit arrived.

There were various reasons for this, including the fact that four years passed since filing for the license and competition for advertiser dollars increased, while radio profitability decreased. Dunes needed high local presence, while sharing staff expense with another station.

The Lake Michigan shoreline community closely matched the market of South Haven, 40 miles up the lake shore, home to a highly successful Class A operation, WCSY-FM. The light adult favorites format of the station resembled the Dunes market of Bridgman/Benton Harbor/St. Joseph.

The licensees agreed to operate together, with a goal to retain local identity for both. The call sign WCSE(FM) was chosen for the Bridgman facility.

Definite requirements

WCSE programming outlined definite requirements: simulcasting the popular WCSY-FM morning program, while keeping news and commercial content independent.

Control of this portion would be the responsibility of the news staff in each community. Both stations were to operate independently the remainder of the time. Formats would be similar, originating from separate CD/hard disk systems in South Haven.

The news staff in Bridgman needed

**By using
QEI's CAT-LINK
configuration, we
accomplished all
of the needs of
programming.**

fulltime modem control of its programming computer in South Haven. Conversely, South Haven needed control of Bridgman's transmitter site for unmanned overnights. Additionally, we wanted South Haven's satellite reception capability at Bridgman, shuttling RPU audio between studios.

Production and news actualities needed to be transferred immediately for news, sales and programming. In addition, an "inter-city" intercom was needed so sales and news could conveniently chat.

After researching our requirements, traditional 950 MHz link use was evaluated. We needed three program-grade and three voice/data-grade channels each way, and three hops to get there. With analog 950 MHz gear, it amounted to 18 transmitters, 18 receivers, 18 subcarrier generators and 18 subcarrier receivers.

We also looked at new digital 950 MHz systems and found we needed fewer pieces of equipment, while final costs remained essentially the same (\$80,000

to \$110,000) using existing towers. Cost and complexity were not a factor with programming, because a capable system was required.

Although setting up 950 MHz inter-city relay (ICR) received the green-light from management, we were concerned about the path along the Lake Michigan shoreline, making 950 MHz propagation

The quantity of plug-in modules required us to use two CAT-LINK rack mount chassis at each studio.

QEI neatly configured the modules so one chassis holds all the send modules and the other chassis holds all the receive modules at each studio. Connection to the telephone company circuit is as simple as plugging a modular connector into

a wall jack. Total equipment cost was under \$14,000.

CAT-LINK provided the advantages of digital-interconnect without the complications of using radio equipment. Although known by trade names such as DS-1, Digi-Link and Mega-Link, T-1 is the universal building block of intercity and long-haul telephony.

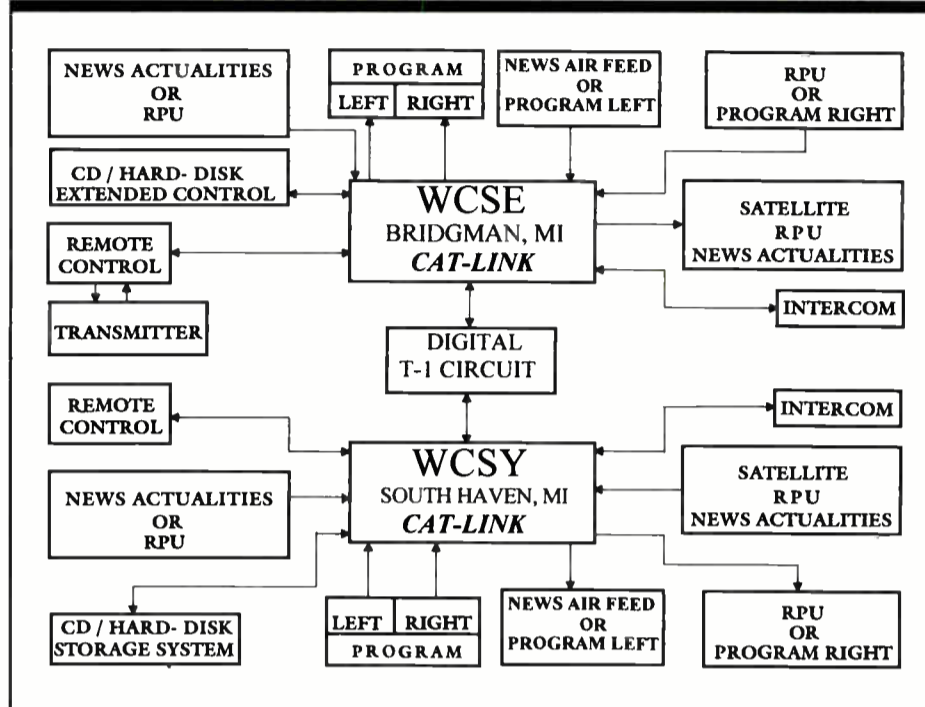
All T-1 channels run at the industry standard 1.588 Mb/sec, which gives them wider bandwidth than 950 MHz radio. No data compression is used within the telco's T-1 so it has no "sound" of its own. CAT-LINK also doesn't need or use compression schemes. From input to output, the transmission is linear-digital.

In the past, telephone lines received a bad rap in the industry, so initial skepticism is understandable. We credit WCSE management for supporting us on the CAT-LINK application.

The end result is a staff effective in serving both stations, essentially unrestricted in creating the local-identity they desire. By using CAT-LINK and leased terrestrial digital service, we saved in our equipment purchase, installation and maintenance, while keeping the sonic quality of digital interconnection.

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For information, contact Jeff Detweiler in New Jersey at 800-334-9154; fax: 609-629-1751; or circle Reader Service 20.



unstable. Considering the lightning threat to tower-related equipment, it seemed too complex to insure reliability. So we continued to look for a better way.

The better way

Our experience outside broadcasting offered insight into the use of leased telco digital circuits to interconnect the studios. Our telephone company could supply a T-1 channel across the 40 miles between the studios for about \$1,300 per month.

Calls to traditional telephone equipment companies revealed they didn't understand our application or didn't care about our small and special request. We searched on, knowing we had a huge advantage in terms of initial cost, maintenance and reliability by using terrestrial digital interconnection.

While talking with QEI about transmitter and monitoring equipment for the same project, we began discussing the CAT-LINK digital STL/TSL system. Although CAT-LINK was designed primarily to transport composite stereo over a T-1 line, it was also advertised with provisions for discrete channels.

Figuring QEI would at least understand our needs, we began exploring our non-composite application. Not only did QEI understand, but the company configured a system from stock. Management was reluctant to use telephone lines at first. However, QEI remained open minded and realized we wanted a whole new telephone concept.

By using QEI's CAT-LINK configuration, we accomplished all of the needs of programming (see figure) and reduced our construction costs by about \$90,000. There were no surprises or disappointments.

Dune's CAT-LINK system is one of the largest QEI has configured, with six discrete channels running each direction.

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USER REPORT

RE 533 Delivers to 'Smart' Radio

by Mark Humphrey
Director of Engineering
WPLY-FM

PHILADELPHIA Since first going on the air in 1982, WPLY-FM, like most radio stations, has gone through a number of changes. Its original broadcasts were from a couple of former apartments above a veterinary hospital and bartending school in Media, Pa., a suburb of Philadelphia. It has since grown to a full Class B FM station and the expanded facilities take the entire building.

We changed our format from adult contemporary to Top 40 in March, when the

market's only other mainstream CHR station switched to "smooth jazz." Because there were four AC and no Top 40 stations at the time, we seized the opportunity and have since doubled our market share.

Certainly not the least of our changes was the installation of an RE America 533 "Slim Profile" RDS/RBDS encoder. The RE unit allows the station to transmit a continuous data service to "smart radios."

We believe this technology will create a significant source of future revenue for radio stations. The RBDS radiotext feature offers our advertisers the extra bene-

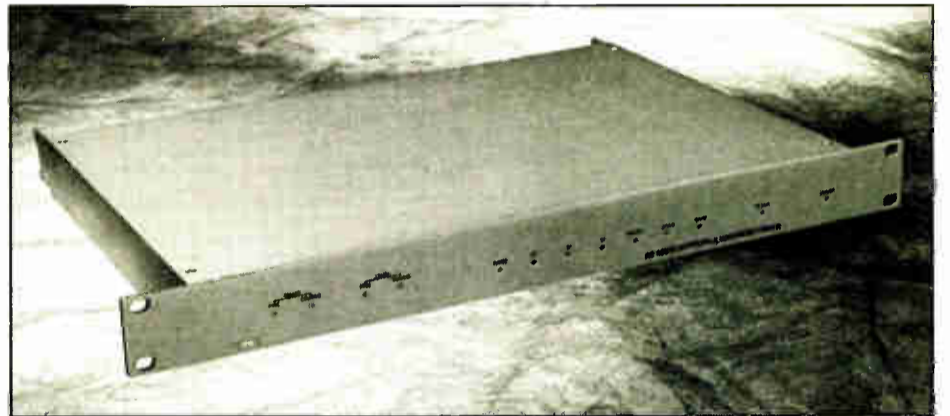
fit of a visual image during commercials. In the past, television always had the unique ability of displaying a phone number or slogan during an advertisement. Now, radio can do the same.

To obtain the best possible crosstalk performance, I installed the RE 533 at our transmitter site, downstream from the composite audio processing. Connected to its RS-232 serial port is a standard auto-answer modem, which users dial into from a modem-equipped PC at the studio or a remote broadcast site.

ilar arrangement could link the traffic computer to the RBDS equipment.

The RE 533 encoder is enclosed in an attractive, well-shielded, compact single-rack-unit chassis, operating completely independent of a computer once the desired RBDS messages are programmed into its non-volatile memory.

The unit is also designed to function reliably in the high-RF environment typically found at transmitter sites. And our experience this past summer didn't reveal any lightning-related problems. In our situation, I feel that RE's approach would prove the most reliable of the configurations offered by some other manufacturers.



RE America's 533 "slim profile" RDS/RBDS encoder allows stations to transmit a continuous data service to "smart radios."

FROM MOSCOW TO NEW YORK MORE STATIONS BUY ARRAKIS

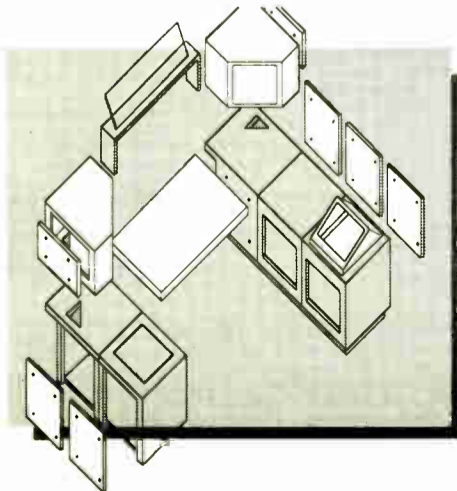
Arrakis Systems is a world leader in radio studio technology. In Japan, Digilink is a brand name for hard disk audio for radio. For use around the world, the United States Air Force chose the 10,000 series console from among all competitors as its console of choice. When the United Nations needed 6 entire studios with consoles and furniture for a rush shipment to Cambodia early this year, they chose Arrakis 10,000 consoles and Modulux furniture. In Jamaica, Tahiti, and elsewhere, entire factory assembled and tested Arrakis studios are on the air. Around the world and of course in the United States... more stations buy Arrakis for their digital audio, console, and furniture needs !!!!!

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Using the menu-driven software RE provides, we can quickly change the "live" radiotext message or revise one of the 16 messages stored in its internal memory. Currently, we're displaying our slogan (Y-100), format type, time of day and some radiotext, including a promo for our new "Barsky in the Morning" show and the phone number for our request line.

As American broadcasters embrace this new technology, I expect new software updates will permit the RE 533 to be linked with the station's music scheduling computer. This allows title and artist information to be transmitted as radiotext automatically as each song plays. A sim-

The service and support we received from RE America is also quite impressive. Its parent company has several years of experience with RDS in Europe, and John Casey, RE America's sales engineer, spent considerable time in developing the U.S. RBDS standard, demonstrating the system at local SBE meetings and national trade shows. The quality of the product is excellent, and the supplied software and manual are among the best I've used.

□ □ □

For information about RE America products, contact John Casey or Dan Ohlson in Ohio at 216-871-7617; fax: 216-871-4303; or circle Reader Service 34.

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USER REPORT

EBSCentral Helps Solve WKBM FCC Worries

by **Ralph Sherman**
General Manager
WKBM(FM)-WKOT(FM)

WILMINGTON, III. As with most ideas, **RodmanBrown and Associates'** EBSCentral (Model 2112) was born of necessity.

The FCC inspected our station last year. Its biggest concern was our inability to meet our Emergency Broadcast System responsibility. WKBM(FM), like many stations, is satellite-programmed with the usual amount of "walkaway."

At the time, meeting our EBS responsibilities was difficult at best and, unfortunately, not good enough for the inspector. WKBM(FM) had to deal with EBS and walkaway or be fined at the next inspection. But when the station engineer and I tried to solve this problem, we couldn't find equipment to fit our requirements at a price the station could afford.

Finding the solution

We needed something to utilize any dial up phone line for airing emergency announcements after regular working hours. This would give the personnel at our local remote control service or our own staff in the field the ability to remotely originate the emergency announcements to comply with FCC requirements.

We also needed the device to automatically transmit the EBS two-tone attention signal before the announcement went on the air, then return to regular programming after the announcement.

Fortunately, we had some resources at our disposal, including a local firm, RodmanBrown and Associates of "Desk Jockey" fame. Within a relatively short period of time, we were beta testing EBSCentral™.

The EBSCentral Command Module is an attractive black, gold and white box, rack mountable and 1 3/4 inches high. Even the LED on the front, which the FCC requires in Part 73 of the rules, is unique with its blue color. We're happy to report the EBSCentral meets all our expectations, and then some.

Using EBSCentral is straightforward. The user dials a channel followed by a raise or lower function wired to EBSCentral. EBSCentral then cuts off program audio, transmits the EBS attention signal for the proper length of time and puts the phone line on the air so the user can send the EBS announcement, either live or played back from tape.

When the announcement is complete, the user sends a command on the telephone touch-tone pad, which shuts off EBSCentral, returning regular programming to the air and making the remote control available for access.

Remote control

EBSCentral is controlled by your transmitter remote control, so it must be located at the transmitter. This is an important feature, because for many stations with separate studio and transmitter sites, the station can still transmit an emergency message as long as the transmitter site still has power. Any studio device is useless if the studio loses power and the transmitter site does not.

EBSCentral can be connected into a station's program feed, mono wire,

stereo wire or FM base band. The installing technician also has the option of configuring EBSCentral to drive external relays and run the program audio through them. This is especially useful when using one EBSCentral box to control two co-located transmitters, such as a commonly owned AM and FM. For the FM base band feed, an accessory relay card is also available.

At WKBM(FM), we interfaced the generator half of our existing Gorman Redlich CEB into EBSCentral, but an accessory Attention Tone Generator is available to fit inside the command module. We use this option at our sister station WKOT(FM). For either type of generator, EBSCentral not only provides the start signal, but controls the length of time it stays on the air.

Because the FCC is contemplating shortening the attention signal length, changing a jumper inside EBSCentral merely shortens the tone length without changing the external generator.

The EBSCentral has failsafe protection designed into it. If the unit is falsely started without a call on the phone line, it shuts down in less than a half second. A built-in dial tone detector also returns normal programming to the air in case the user hangs up without commanding the unit to return to normal.

Another plus is that there are no program amplifiers in the EBSCentral Command Module audio chain, only sealed relays, so there are no audio reliability problems. There is a telephone line audio amplifier inside to bring the normal phone line audio signal up to broadcast audio level. After all, the emergency message isn't useful if it can't be heard.

Real situations

The station engineer and I thought about EBSCentral placing calls to station personnel. At first it sounded practical, but we were hard pressed to conceive a real-world situation in which this is an advantage.

We determined that a lot of precious time is wasted on such procedures as automatic calling lists, especially if the emergency is fast approaching, and if the person at the first and/or second number on the calling list is not at home. An opportunity to warn our listening area of an impending emergency is lost.

The personnel at our 24-hour remote control and monitoring point are equipped with an EBS receiver and the training to monitor it, so putting an emergency message out to the public is just that much faster. Another consideration regarding callout is the annual maintenance cost of a dedicated telephone line for this purpose.

At WKBM(FM), monitoring the primary EBS stations in Chicago for weather emergencies is not practical, as the Northeastern Illinois Operational area no longer uses the CPCS-1 stations for weather-related emergencies unless ordered to by the state. However, we still have the weather, a nearby oil refinery and two area nuclear power plants for plenty of potential trouble near the station.

Therefore, with encouragement from our area EBS leadership, WKBM(FM) is also making extensive use of NOAA weather radios, police radios and EBSCentral. In case of any local emergency, staff mem-

bers can call the station from wherever they are and alert our listeners.

The procedure during regular hours is to go through the station console. But after hours, we now use EBSCentral.

One more persuasive argument for EBSCentral is the cost of the fines levied by the FCC on stations without such a system. We found the minimum to be around \$1,000, the maximum about \$12,000, and the median a little over \$7,000. At about \$650 for the EBSCentral Command Module, and without the cost of an extra dedicated telephone line, EBSCentral is a cost-

effective means of ensuring compliance with FCC rules regarding EBS.

We consider EBSCentral to be an insurance policy against an FCC fine. Now that we have the unit in operation at WKBM(FM), we're better able to inform our public of emergencies as an automated station. As such, EBSCentral has become a permanent full-time employee for a one-time fixed expense.

□□□

For information on EBSCentral, contact Doug Thompson in Illinois by phone or fax at 708-983-0977, or circle Reader Service 118.

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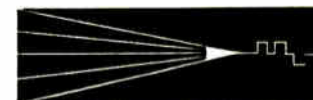
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USER REPORT

Bext Bests KKIQ(FM) STL Situation

by John Buckham
Chief Engineer
KKIQ(FM)

LIVERMORE, Calif. People often comment on how terrific our new booster sounds. When they ask how we do it, I tell them we receive the signal, use an STL system as an ICR to relay the program material and then retransmit.

The next question is, "What kind of equipment did you use?" I then tell them my secret: Bext. "Bext? Who's that?"

Reliable boosters

We have two boosters on the air at KKIQ(FM). The first employs equipment supplied by Bext, which has always been reliable. The latest system starts with the LCR-FM receiver. This is a synthesized receiver providing the user with a frequency programmable, extremely high performance receiver with no less than four adjustable composite outputs, one of which is inverted.

A built-in demod is available to use the receiver as an off air monitor at the studio. The front end is protected with a built-in multistage helical resonator.

We're using one of our STL-FMs to receive KKIQ from 15 miles away. No big deal, except the receiver is bombard-

ed with a strong first adjacent signal and is co-located with a second FM station 5.6 MHz above the receive frequency at the receive site.

This is a hostile environment for any receiver, but the Bext took it all in stride with no overload or crosstalk problems—and we aren't using any special external cavities to reject the local station. Signal-to-noise ratio is an impressive 76 dB through the system.

The output of the receiver feeds the input of the STL (or in this case, intercity relay) transmitter. There is a second connection on the back of both the receiver and transmitter, providing muting if the signal is lost to the receiver.

In the event of signal loss, the receiver mutes and switches off the STL transmitter. Like the receiver, the LC-STL system is also frequency agile from the front panel. To change the frequency, you simply dial the new frequency with a small screwdriver, then remove the power to the transmitter, wait a moment, then apply power again. The lock indicator begins to flash when you change the frequency, informing you a change was dialed in.

Two power levels are available, a 6 W and 1.5 W unit. Bext also has a 15 W STL RF power amp that can be used

with the 1.5 W unit for really long hops. Because our path is 21 miles, we used the 6 W unit, which provides ample receive signal in excess of 1 mV.

Operating perimeters such as forward power, AFC, power supply voltage and modulation are available from a push-button selectable, peak-holding LED bar graph meter. When I tested the transmitter on the bench, all of Bext's specifications were met or exceeded.

The other side

On the other side of that 21 mile hop is a Bext LC-STL-R receiver that is almost identical to the LC-FM-R, except the frequencies cover the 943-951 MHz band rather than the 88-108 MHz FM broadcast band. The outputs are composite, with a built-in composite DA with no less than four adjustable outputs, and, like its FM brother, one output is inverted.

If you have a situation in which discrete left and right channels are needed, such as a stereo AM station, a built-in stereo demod is available from Bext. The receiver here, too, shows its true colors.

Although we fully coordinated the ICR path with the local frequency coordinators, we situated the receiver in an area receiving almost 100 μ V of signal from a co-located station. We identified the station using the handy front panel phone jack for monitoring. We then called the station to determine if we caused any interference when our ICR transmitter was turned on. We determined it wouldn't be a problem.

When we turned the ICR transmitter on, the signal was in excess of 1 mV. The desired-to-undesired signal ratio was only 20 dB, but it didn't seem to bother the receiver. After running the ICR proof, we had an signal-to-noise of 75 dB, which is quite adequate indeed. We adjusted the squelch on the LC-STL-R so any signal less than 400 μ V would squelch the receiver and switch the exciter off.

System exciter

The next item in the chain was a Bext PTX-30 Exciter. This is a high quality, 30 W frequency agile unit. The front panel has a selectable multi meter, which is a multi-color modulation bar graph display with a 100 percent modulation peak hold indicator. It includes a X10 position to set the stereo pilot and SCA injection if you don't have a modulation monitor handy.

In addition, there is a digital display showing the operating frequency of the exciter and three push buttons to set the frequency. The action of the buttons is very slow, with the extended button hold times to slew the frequency up or down, then a 10-second push and hold routine to set the frequency.

The display flashes before frequency is set. If no attempt to input the frequency is made, the display returns to the operating frequency. You aren't going to bump into the exciter and change the frequency of your radio station by accident. But just to be sure, I installed a clear plastic cover over the exciter to keep busy fingers at bay.

The frequency display blanks after about five minutes. One nice feature is that each input has its own gain control.

You can touch up the composite or the SCA injection if necessary, without removing anything from the rack. The power output adjustment is a screwdriver adjustment on the front panel.

The exciter was most impressive on the bench. Its performance was better than most analog STL systems. Response was ruler flat from 20 Hz to 100 kHz. Signal-to-noise was an impressive -89 dB referenced to 75 kHz deviation. Distortion was a low 0.01 percent as measured with a TFT-844 modulation monitor and Sound Technology 1710A.

On the RF side, I measured a maximum of 31 W out, with all harmonics suppressed a minimum of -81 dB as measured on the spectrum analyzer. Because this exciter uses "single speed" AFC, I then unsuccessfully attempted to unlock the AFC by feeding the PTX 30 amplifier 20 Hz square waves. The carrier frequency wouldn't budge, move or otherwise show any signs of distress. This exciter should handle the most demanding program material in stride.

Transmitter feed

The exciter feeds Bext's PJ 1002 MOSFET 1 kW solid state transmitter. This system consists of two PJ 501 MOSFET amps and a combiner. The amps sport semi-switching power supplies, automatic power control, modular construction and plenty of cooling.

Inside each chassis are two 250 W amps. If an amp becomes inoperative, operation could continue at reduced power. There is full remotable metering and status indication, and the amplifiers are remote control friendly.

We used a Burk ARC-16 and didn't need any form of buffering. The amps can be run from 120 or 208/240 volt AC power. We chose to run the amps on 208 V power because of a lower current requirement. The amps can be interconnected to provide shutdown should the reject load overheat or exciter shut down, which it shouldn't because it's conservatively rated. Even with one transmitter off, operation continues indefinitely at one fourth of power.

Installation was easy, as the transmitter is rack mountable. We simply mounted both amplifiers and the combiner in the rack along with the exciter, STL receiver and remote control. The whole system fit nicely in a 48-inch high rack. Interconnection with the combiner was easy thanks to Bext's coded cables.

We also installed an MGC surge suppressor on the service panel feeding the transmitter, as solid state transmitters aren't tolerant of large voltage spikes. When we applied AC and RF power, the transmitter worked properly.

Once again, the system met its published specs with no problems. Metering is complete, and the system has full protection from excessive VSWR, over-temperature and excessive drive levels.

I installed the whole system three months ago and haven't had a single problem with any of the equipment. This is unusual for me, because I expect one or two problems in the first 90 days of operation with non-Bext equipment. I would not hesitate to recommend Bext equipment to any broadcaster.

□ □ □

For information, contact Michelle DeFazio in California at 619-239-8462; fax: 619-239-8474; or circle Reader Service 172.

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USER REPORT

Henry Simplifies Station Information Lines

by Tom Koza
Chief Engineer
KPWR(FM) Los Angeles

LOS ANGELES Like many stations, KPWR(FM) receives hundreds of phone calls each day from listeners requesting various kinds of information. Listeners typically want to make a request, directions to the studio or information about a concert or other special event.

For many years, we used old cart machines with auto-answer couplers to answer these calls. Listeners called and heard a recorded message from the cart machine.

This approach had several disadvantages, such as the cart machines wearing out or the carts jamming. Our biggest problem was that to give out three messages, we needed three separate phone numbers and cart machines. This was confusing to listeners and a pain for the jocks—they had to remember which number to promote for each message.

It's in the name

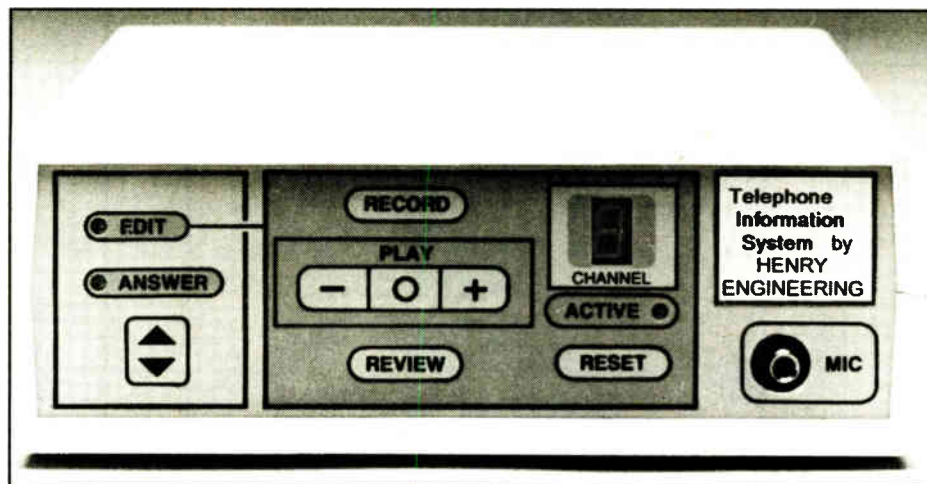
We discovered the solution in the Telephone Information System by Henry Engineering. You can tell from the name that it's a product actually designed for our situation.

The Telephone Information System is a digital audio storage system storing up to 10 separate messages for callers to hear. The systems store the messages in digital memory (RAM), so there are no playback mechanisms to maintain and no cart jams. Over eight minutes of audio messages can be stored in the TIS memory.

The unit is about the size of an answering machine and similar in use. There is a modular cord to plug the unit into a regular modular telephone jack. There are buttons for recording, playing and editing the messages in the unit. An LED display shows the active messages.

To record messages, we use the micro-

phone that came with the TIS unit. The messages are recorded in logical numerical sequences. Just press the "Record" button to record the first message, and that's it.



The Telephone Information System by Henry Engineering can store up to 10 separate messages in RAM for callers to hear.

Pressing it again records the second message, while pressing it again records the third. By using the edit buttons, you can "scroll" through the various messages to check or rerecord them. It's important to note that the eight and a half minutes of digital storage time is "soft sectored." There is no need to make each message the same length, because the time is divided among the messages as they are recorded.

Once all messages are loaded, press the "Answer" button. The system is now on-line and ready to accept calls. When the TIS is called, it answers after the first ring and begins playing the first message.

The first message is our "menu," which informs callers about the available information: "Thank you for calling the KPWR information line. To hear the request line number, press one...To get directions to our studio, press two...For

concert information, press three..." and so on.

The TIS then waits for the caller to select a message(s) via touch-tone. The caller can select messages in any order

(in rotary) with a TIS on each line. There is a "digital copy" feature on the TIS units allowing messages to be recorded to both units simultaneously.

Another feature is the "operator assistance" function. There is a modular jack on the TIS unit where a standard telephone can be connected. If the caller presses the "#" button on the phone, the TIS unit produces an electronic "ringing" sound, telling someone to pick up the phone to speak to the caller. We don't use this feature, but it could be handy if an application required callers to actually speak with a live human.

We've had the TIS in use for several weeks, and it has worked well. My only complaint is the lack of a "line-input" audio jack. Sometimes we dub a message from a cassette. To do this using the mic input, a simple attenuator patch cord is used to drop the audio level from the tape deck to about -40 dBm, matching the input level of the mic input.

Other than this, we're very happy with the TIS. It saves our staff time by eliminating a maintenance headache (carts), and it's a big hit with our listeners.

□□□

Handy features

This device allows KPWR(FM) to use one phone number for all of our information services, because any message can be accessed through the TIS system. We actually have two incoming phone lines

For information on the TIS, contact Hank Landsberg in California at 818-355-3656; fax-on-demand: 818-355-4210, document 108; or circle Reader Service 141.



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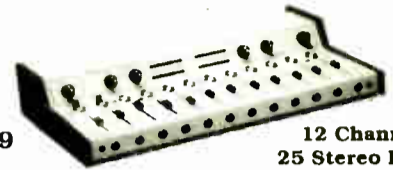
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READER SERVICE NO. 205

USER REPORT

Moseley Clears Jammed STL Channel for MPR

by **Kim Knocker**
Engineer
Minnesota Public Radio

St. Paul, Minn. Minnesota Public Radio (MPR), a network of 25 radio stations and 13 translators, began digital operation through its existing Moseley 606 STL gear in November 1991. Our classical music station in Minneapolis-St. Paul, KSJN(FM), was the first to convert, beginning operation at a new eight-station FM combiner, sharing tower facilities with six VHF and UHF TV stations.

After moving to the site we experienced intermod problems in the noise floor of our 950 MHz channel. Because a frequency change was not possible and Moseley had just introduced its DSP6000 system, we decided to give it a try.

The DSP6000 offers multiple audio data channels without the expense of a new system. Using our existing STL gear, the DSP6000 coder/decoder converts left and right audio into a shaped digital signal that fits nicely into a 950 MHz composite STL channel.

In conjunction with the Moseley 606, 505 or 6020 STL links, this 16-bit PCM data provides up to four discrete program channels and two low-speed asynchronous data channels. Transmission rates are selectable from 64 to 512 kbps, and channels are programmable for 15 or 7.5 kHz audio using sub-band ADPCM. Data coding using 4:1 apt-X100 compression produces a slightly audible delay of 3.8 ms.

An alternative to the built-in A/D-D/A converters is the AES/EBU format sampled at 32 kbps. (See figure for various configurations.)

Transmission rates are determined by channel configuration, which yields carrier deviation and a 256 kHz occupied bandwidth. Unlike analog FM transmission, the digitally modulated carrier always occupies the full bandwidth.

Conversion of existing composite STL radios involves a recalibration of the transmitter audio monitor and attention to receiver baseband filtering.

When operating alongside signals 10 to 15 dB above received levels, external filtering may be required. The receiver has to exhibit a very flat group delay or data errors may occur, requiring adjustments in IF tuning, high-frequency tilt, removal of ceramic filters, level adjustment and squelch and meter recalibrations. We've had success with receive levels as low as -85 dBm yielding a bit error rate of 10⁻⁴.

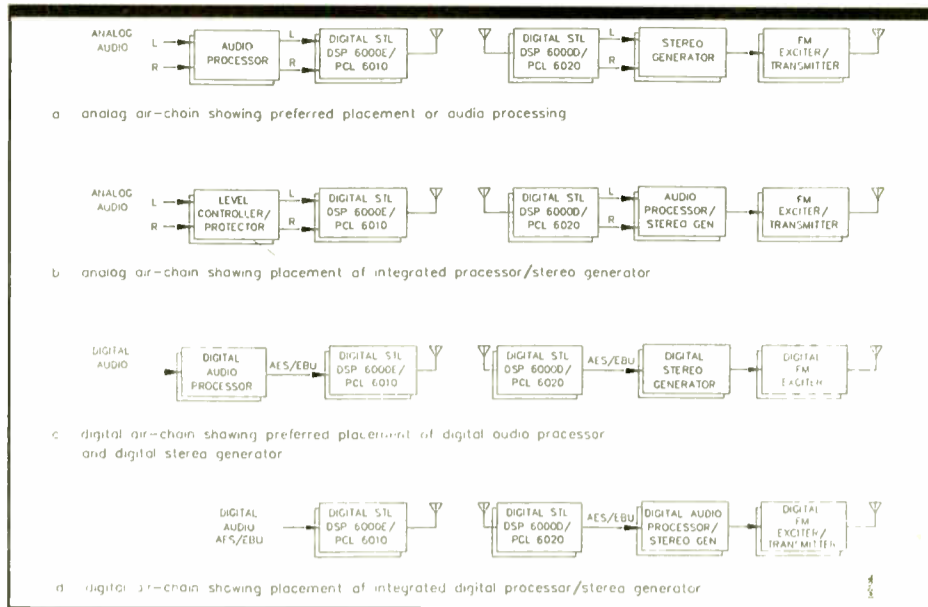
Our first two-channel DSP6000 has been in use and trouble-free for two years. Since then, we have expanded to using four-channel 6000s to feed our network of stations. The programs are uplinked from our St. Paul headquarters on Galaxy IV Transponder 3, and then downlinked at the network studios for local broadcast. The DSP6000 sends two channels of our classical music service, one channel of our news and information service, plus SCA audio to the respective transmitters in each market using a single STL channel.

Our experience with the DSP6000 has shown it to be a reliable and cost effective addition to MPR.

I have only one word of warning about its implementation: audible degradation is possible when data compression schemes are combined. Digital devices and signal paths using data compression require an effective management plan, and subjecting the audio to repeated compression should be avoided.

□ □ □

For information contact Dave Chancey in California at 805-968-9261; fax: 805-685-9638; or circle Reader Service 4.



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USER REPORT

MSI: Setting a RBDS Standard at WYPL

by Steve Terry
Station Manager and CE
WYPL(FM)

MEMPHIS, Tenn. WYPL(FM), a public library-owned station in Memphis, has closely followed RBDS development during the past three years. Since the publication of RBDS standards by the joint EIA/NAB National Radio System Committee, I began contacting potential RBDS product manufacturers in hopes the station could fully use all of the present RBDS capabilities. In addition, I hope to implement future uses such as paging, GPS and electronic sign programming.

To my great surprise, our old friend **Modulation Sciences Inc.** was in the final stages of developing an RBDS encoder. WYPL has been a user and strong advocate of a Modulation Sciences sister product, the Sidekick SCA generator, for over a decade.

PC compatibility

After talking with Brett Porter and Eric Small, I was excited to learn the product was based on a PC card footprint. I wanted a product and company that would give us special software changes, allowing the station to fully use the PS (program service), RT (radiotext), and PTY (program type) codes as a station program billboard.

MSI was working along those very lines. In fact, because the RDS-I is software controlled, not only could we change these data streams as often as needed, but we could develop data files allowing the system to pull up any file from its file library at a particular time and/or day of week without further staff control. This function is referred to as "Walkaway Dynamics" by Modulation Sciences, but I simply call it Automated RBDS.

With the promise of an RDS-I encoder to come, I began looking for a RBDS receiver so I could begin bench testing this project. Again an old friend, Ed Catlett from General Motors/Delco Electronics, agreed to help WYPL launch RBDS in Memphis by supplying a testbed receiver.

Prior to the arrival of our RBDS encoder, MSI already began the thinking process on how to display the information, how to build our RBDS file library and how to prepare a micro computer to accept the encoder.

WYPL assembled a PC 386/33 with a single floppy drive, 1 MB of RAM, mono monitor and 1200 baud modem. I simply had to buy a new motherboard and case for a total of \$250.

Next, I developed a bootable disk that would reboot upon power failure and load all of our RBDS EXE and DATA files to a RAM drive automatically upon

power up. Brett Porter even developed some sample text ideas based on the station's program schedule and mailed them to us prior to receiving the encoder so we could begin building our library.

The encoder arrived and we slipped it into the awaiting slot. The sample disc

could be as fast as two seconds; however, the human brain and eye requires at least three seconds of displayed information.

Care must be taken in programming radiotext. Some home receivers can scroll information while most car radios only allow two lines of display with eight characters per line. With this in mind, it's easy to create radiotext messages for transmission that are both readable by the home and car listener.

The RBDS computer was then moved

RBDS can be used to advertise products, promote station activities or generate revenue through associated services such as paging, billboard control, GPS, promotion of station activities, soliciting pledge donations, etc.

was loaded, power was supplied and *voila!* WYPL was sending an RBDS signal to our Delco receiver via our test generator. With all working well, a part-time, computer-illiterate staff member and I began building our file library.

Informing the public

We wanted to use the receiver's PS window to inform the mobile public of our broadcast schedule, which changes hourly. As a public radio station, our format is the reading of newspapers, magazines and books.

We wanted to use the radiotext 64-character display window to first inform the public at home, and second, the mobile public, of events and services offered by the Memphis Public Library and its 22 branches. Six hours later, a disk of 94 files was created. Each PS file contained our call letters (WYPL), our geographic location (MEMPHIS), our frequency on the dial (89.3 MHz), the name of the program being broadcast at that time of day (PEOPLE MAGAZINE or USA TODAY FRONT PG NWSPAPER).

Keep in mind that you only have eight characters per line when sending code to the receivers' PS and PTY windows. While testing the Delco receiver with the MSI encoder, I found that the rate of data update/window display change

to our transmitter site. The injection level was set, the frequency was checked, and phase error confirmed. WYPL began broadcasting its RBDS signal.

Three days later, on Sept. 14, 1993, WYPL hosted a demonstration for all Memphis radio and TV station managers and engineers, advertising agency executives and the editors and publishers of local print media comprising the WYPL Broadcast Advisory Council.

Fascination and imagination was the overwhelming response to our launch of RBDS to the Memphis market. I've never heard so many different ideas of how RBDS could be used to advertise products, promote station activities or generate revenue through associated services such as paging, billboard control, GPS, promotion of station activities, soliciting pledge donations, etc.

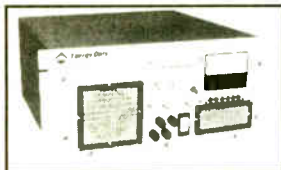
RBDS will certainly allow stations to use their imagination as no other station service in the past. I'm very pleased with the support service WYPL received from Modulation Sciences and some of the receiver manufacturers assisting us in launching this new service.

□ □ □

For information, contact Art Constantine at Modulation Sciences in New Jersey at 800-826-2603; fax: 908-302-0206; or circle Reader Service 210.

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USER REPORT

KXKL Remote Needs Met with Burke ARC-16

by **Ted Nahil**
Chief Engineer
KXKL-AM-FM

DENVER The remote control system was one of the first things I evaluated as the new chief engineer at KXKL-AM-FM Denver.

Although our studios are in the Denver Post Building downtown, our AM transmitter site is 15 miles south in Littleton, Colo., and our FM site is 25 miles west on Mt. Chief, 7,500 feet above sea level, in the foothills of the Rockies. The road to the site is steep, narrow, full of switchbacks and impassable from November to March.

We needed a reliable, easy-to-use remote control with multi-site capabilities. The Burke ARC-16 fit the requirements.

We installed an ARC-16 and two IP-8 interface panels at the FM site to control and monitor our FM operation, two combined Continental 831-G transmitters. We also equipped the ARC-16 with a DSU speech unit allowing the engineering department to call the site directly in the event of a severe emergency.

Similarly, we installed an ARC-16 and two IP-8s at our AM site to operate our four tower, DA-2 facility. Telephone lines handle all of our studio-to-transmitter communications. Our studio unit has the SIO option, a CI-16/DSU board, and one IP-8. In addition to the CI-16 software, we also run AutoPilot to perform routine and emergency functions at both transmitter sites and the studio.

Installing the ARC-16 units was simple and straightforward. The IP-8 interfaces disperse control, status and metering functions to barrier strips. The status inputs can accommodate DC inputs of up to 28 V without buffers or level-shifting circuitry, which meets our transmitters' needs.

At the AM site, the IP-8s interface directly with the Potomac AM-19 antenna monitor. Controlled by the AMI software option in the ARC-16, constantly updated readings are available at a fourth "site" created by the software for data storage.

In our 11th-floor main studio, the SIO studio input/output option controls equipment in our 22nd-floor microwave room. The multi-site capabilities of the system allow us to control or meter any one site from any other site. However, the CI-16 interface and AutoPilot are what make the system easy for our operators to use.

We have an AT computer, VGA monitor and wide carriage printer located in the air studio. Normally, we leave the display at the bar graph screen so the air personality notices immediately if one of our transmitters experiences a problem.

The first five bars monitor current and power output from each FM transmitter and total combined output power. The bottom three bars monitor voltage, current and common point current at our AM site.

Each site screen is clearly labeled allowing the operator to review readings, or execute a control function. During a

recent FCC inspection, our operator, a member of the morning team, had no trouble taking readings for the inspector.

We use AutoPilot to change patterns at our AM site, and to perform power monitoring and trimming as required from one pattern to the other. In addition, it switches our audio to the back-up feed in the event of an STL carrier loss.

At the FM site, we use AutoPilot to monitor various building and environmental conditions. Our generator supports another FM and some two-way equipment during a power failure. In this event, AutoPilot switches to only one

transmitter to conserve fuel.

The weather can be beautiful in Denver and absolutely abysmal in the foothills. Our antenna can become icy before we even realize it is snowing. AutoPilot controls our de-icers. It monitors two samples: the outside temperature and a heated rain detector.

The detector indicates precipitation, which prompts AutoPilot to turn on the de-icers, but only when the temperature is below 33 degrees. It is faster and more reliable than looking out the window and guessing. Since we installed the ARC-16, we have experienced no down time

or power cutbacks due to ice on our antenna.

The versatility and flexibility of the Burk ARC-16 is limited only by your imagination. Control of routine functions, ease of use by any operator and the handling of any situation make the ARC-16 Remote Control System a good system for multi-site, multi-function facility control.

□□□

For information, contact Phil Halter in Massachusetts at 800-255-8090; fax: 508-433-8981; or circle Reader Service 92.

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

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

TIME	CART NUM	DESCRIPTION	Duration	Code
5:27:00p	5301	Radio Shack Corp.	3:00.00	A
	4901	Radio Shack Corp.	3:00.00	A
	5310	Radio Shack Corp.	3:00.00	A
	5301	Radio Shack Corp.	3:00.00	A
5:27:00p	5317	Radio Shack Corp.	3:00.00	RF
	5320	Radio Shack Corp.	3:00.00	A
	5312	Radio Shack Corp.	3:00.00	A
5:29:00p		3 Optional Break	2:00.00	B

Station: KXKL-101	Source: The Touch
Time: 5:15:00p	Voice: Nancy Johnson
5:04:00p Log Problem Rpt. 02/12/93	Liner: Mandatory Break
5:04:00p Expired Cart Rpt	Legal ID: Clock Sync
5:04:00p Expired Source Input # 1:1	Optional Break: Magic Call

can create reports to keep you informed on a number of topics, from a list of expired spots to an analysis of potential mistakes in your log. The Phantom also maintains a history of system activity.

The PHANTOM Digital Audio Automation

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

The Phantom can retime spots to fit them cleanly into a satellite break without inserting silence, overlapping, or running late. The Phantom

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

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

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

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

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BRIDGEPORT, N.J. The TI-101 telephone interface by Radio Systems Inc. uses an electronic hybrid circuit for maximum trans-hybrid loss for clear telephone audio.

The full duplex analog hybrid yields effective isolation between the studio's send to the telephone line and the caller return feed.

The TI-101, formerly manufactured by Symetrix, features a two-band caller EQ with 8 dB of boost and cut at 400 Hz and 2.5 kHz. Other features include a send limiter to prevent overdriving the phone line and a receive compressor/expander to maximize caller levels and minimize noise during pauses.

Two TI-101 units can be linked for conference capability.

For information contact Radio Systems in New Jersey at 609-467-8000; fax: 609-467-3044; or circle Reader Service 187.

CAT-LINK Digital STL :

TOP 25
MARKET SWEEP

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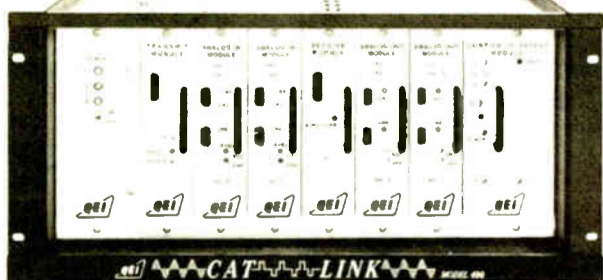
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*U. S. Patent # 5,054,070



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Circle (90) On Reader Service Card

AEQ

TH-02 EX Digital Telephone Hybrid Update Works With TLE-02 Digital Line Extender

TEMPE, Ariz. AEQ recently upgraded the Digital Telephone Hybrid TH-02 EX, with frequency extender capabilities as a standard feature, to work with the company's new Digital Line Extender.

The frequency shift of 250 Hz is performed with digital precision. AEQ's hybrid comes in a one-rack unit chassis and works with one or two telephone lines. The second phone line, a plug-in card in the same chassis, is optional.

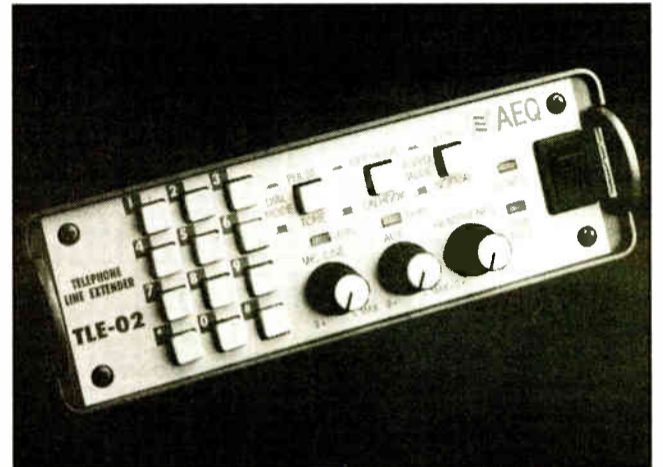
A unique feature of the TH-02 EX is its hybrid null performance of more than 60 dB. When the second line is installed, the unit can provide a full multiconference mode.

The operator and the two incoming callers can talk simultaneously, meaning users can talk to everyone while listening with flawless audio quality.

A companion for the Digital Telephone Hybrid is the Portable Digital Line Extender TLE-02 with full digital telephone hybrid capabilities. It can provide any reporter or caller with frequency extender abilities in almost any situation.

Studios with the Digital Hybrid TH-02 EX can establish a full duplex conversation with the caller in frequency extended mode using the Portable Digital Line Extender.

It weighs only three pounds, including



the batteries, and is the size of a portable tape recorder. The non-technical user can quickly learn to operate its control layout.

The TH-02 EX lists for \$1,295 and the TLE-02 for \$895.

For information, contact Gerardo Vargas in Arizona at 602-431-0334; fax: 602-431-0497; or circle Reader Service 218.

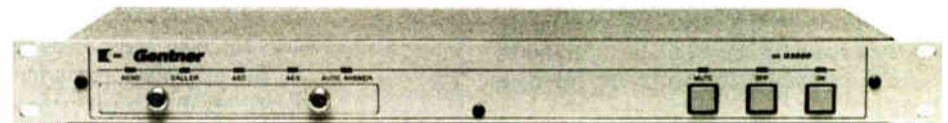
GENTNER

Two New Digital Telephone Superhybrids Feature DSP Line Echo Cancellation For Isolated Audio

SALT LAKE CITY Gentner Communications Corp. released two new digital telephone hybrids, the G2500 and G3200. Using DSP line echo cancellation to "auto null" to the telephone line, the hybrids provide isolation between send and receive audio.

The acoustic echo canceller in the G2500 automatically generates a "mix minus" feed to the caller, eliminating the

caller audio sent over room speakers and picked up by mics is digitally removed from the hybrid's send path. This eliminates distortion and feedback in the caller's audio feed, making the call more intelligible and permitting the studio speakers (carrying caller audio) to be run at a higher volume. The G3200 is capable of recognizing and removing reflected caller audio in a room up to 50 feet long.



need for a special caller module in the console. The G2500 recognizes caller audio appearing at the hybrid's send input and digitally adapts to remove this

Both hybrids provide auto answer/disconnect, automatic re-nulling on new line selection (such as through a call director), receive mute,



audio from its feed to the caller.

The unit's "auto mix minus" permits use of the G2500 with any audio board with line level inputs and outputs, such as a production room or news-room module. It can also be used in a master control room to add an extra telephone line to the console, such as a VIP line.

The G3200 Superhybrid provides up to 224 milliseconds of acoustic echo cancellation, technology originally developed for the acoustics of corporate boardrooms.

RS-232 control and an echo suppressor, providing additional feedback control in poor acoustic environments. The G3200 also provides automatic mixing of up to three microphones, and a three-watt power amplifier with speaker binding posts and front-panel volume control.

The G2500 lists at \$1,995, and the G3200 sells for \$2,495.

For information, contact Elaine Jones in Utah at 801-975-7200; fax: 801-977-0087; or circle Reader Service 216.

THIS CONSOLE



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Circle (146) On Reader Service Card
World Radio History

TFT

DMM92 Digital STL Offers Four Channels, Accommodating Two STL Paths in One System

SANTA CLARA, Calif. The TFT DMM92 provides four CD-quality channels to accommodate two STL paths within a single digital STL system, with additional channels for data and SCA.

The unit is especially suited for areas

with crowded frequencies, because it allows six audio channels to fit into 250-kHz channel spacings.

The DMM92 is designed to work with TFT's 9100A/9107A composite aural STL transmitter/receiver. The 9100A/9107A STL is frequency synthesized to

provide an accurate, stable signal with a high interference immunity, accommodating the full stereo baseband.

For information, contact Darryl Parker in California at 408-727-7272; fax: 408-727-5942; or circle Reader Service 1.

HALLIKAINEN

DRC200 Control System Uses Full Duplex Circuits Arranged Between Sites in Any Required Topology

SAN LUIS OBISPO, Calif. As the design of the DRC200 transmitter control system progresses from a single transmitter site system to one that supports 254 sites (any combination of transmitters and control points), Hallikainen & Friends Inc. faces inter-

esting decisions in network design.

A multisite transmitter control system is similar to a local area network (LAN) in that boxes at several sites must talk with each other. The distances between sites typically exceed the distances utilized in LANs, so it qualifies as a wide area network.

The DRC190 control system utilizes a half-duplex communications system in which any site directly transmits to any other site over a single voice grade circuit. This is typical of LAN systems. The DRC200 control system utilizes dedicated full duplex communications circuits between sites arranged in any topology.

In most systems, these communications circuits utilize 2,400 bps full duplex modems internal to the DRC200. These modems then communicate over voice grade circuits. Any link between sites may be used as long as there is a direct digital circuit between two sites over that link.

One way of doing this is using several logical channels on a single radio packet modem at a site. Through this one modem, there may be up to 10 dedicated links to other sites.

The DRC200 sends data through the network in packets. Each packet includes a header with source and destination sites, and error checking data. Site numbers may be between one and 254. A site number of 255 sends the packet to all sites in the system. Transmitter site status (site number, date, time, digital status, logging comment and analog readings) is broadcast to all sites through the destination address of 255.

Each site has up to 16 network ports, which connect to other sites through the communications circuits. Each time a valid packet is received, the port the packet was received on is stored in a routing table based on the packet source address. For example, if we received a valid packet from site 13 on port four, four is stored in the routing table for site 13.

If a received packet is addressed to the site that received it, the packet is passed to the remainder of the software and acted upon.

For information, contact Harold Hallikainen in California at 805-541-0200; fax: 805-544-6715; or circle Reader Service 62.

MARTI ELECTRONICS

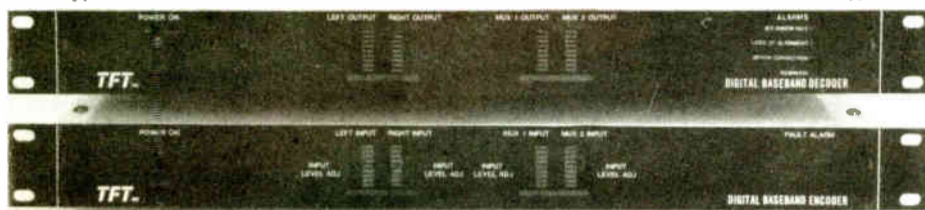
Composite STL System Forms Radio Communications Link

CLEBURNE, Texas Marti Electronics recently introduced a new composite STL system, the STL-15C Transmitter and R-15C Receiver. The system is designed to form a high-quality, frequency-synthesized, radio communications link.

The system is available in bandwidths from 140 MHz to 960 MHz. Depending upon the available bandwidth, it can transmit either composite FM stereo with two subcarriers or monophonic audio with two subcarriers. With the addition of a modem, the STL-15C can transmit digital stereo audio or digital data.

Other features of the system include: bargraph modulation meters; precision "peak-hold" modulation meter; high interference rejection receiver; nominal 15 W power 140-480 MHz, 9.5 W 890-960 MHz; and a provision for automatic switching.

For information contact Dan Rau in Texas at 817-645-9163; fax: 817-641-3869; or circle Reader Service 83.



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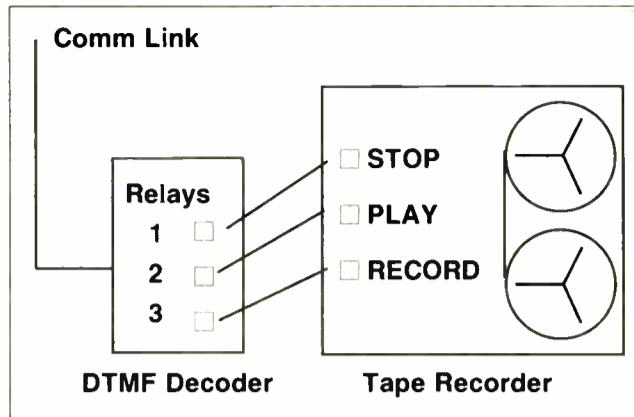
AVOCET

Three-Channel, Addressable DTMF Decoder Designed For Any Remote Application

CAMPBELL, Calif. Avocet Instruments is producing the DTMF 300, a small circuit board containing a three-channel, addressable DTMF decoder.

The DTMF 300 can be used for remote operation of equipment at unmanned sites, or in any remote application. Three relays can control three separate devices or multiple operations on one device (such as play, record and stop on a tape recorder).

Each relay circuit can be selected as momentary or latched, and either normally open or normally closed. The relays can be activated separately or tied together for tape recorder "Record" type operation.



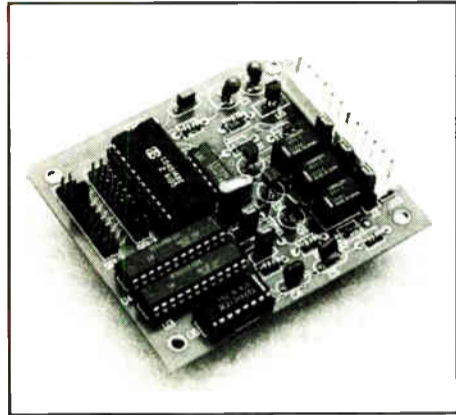
In addition, three universal commands activate all boards. All decoders are addressable, and more than one DTMF 300 can be connected to a communication channel, while each can be controlled separately. A pound sign (#) followed by an address (except the universal command addresses) sets specific decoders into ready mode.

Activation of relays on addressed decoders is accomplished by sending function commands to individual relays.

A typical DTMF 300 application involves controlling tape recorders at multiple remote locations for recording on-air broadcasts. Each DTMF 300 has jumpers positioned to individual addresses for normally open operation of the relays and for tying relays two and three together for record operation. Relay three now acts as the record button.

Prior to record time, the central control site operator clears all addresses and resets all relays, and then addresses the decoder sites.

For information, contact Eric B. Lane in California at 408-376-3700; fax: 408-376-0777; or circle Reader Service 102.



INTRAPLEX INC.

T1 Line Offers Flexible STL/TSL Links

WESTFORD, Mass. Model 4200 STL+ by Intraplex Inc. is a complete program audio transmitter and receiver system using telephone company standard digital T1 circuits. These circuits combine audio program links with data monitoring links, regular voice, remote feeds and metering links onto a single line.

The T1 line is full duplex, so backhaul and other TSL links can be accommodated. Because of the high bandwidth involved (over 1.5 million bits per second), broadcasters can send audio in an uncompressed linear format or via a number of compression formats.

The system transmits uncompressed program audio using 16-bit sampling of either 7.5 kHz or 15 kHz stereo audio. In addition, the T1 line can accommodate other applications.

Intraplex also manufactures other broadcast products for STL and TSL applications, including highly compressed audio transport systems using the 4:1 apt-X compression algorithm and moderate compression modules using the industry-standard J.41 compression algorithm.

For information contact Christine Doyle in Massachusetts at 508-692-9000; fax: 508-692-2200; or circle Reader Service 11.

TELOS

Talk Show System Includes Desktop Switch Control For Placing Calls and Putting Callers on Hold

CLEVELAND The Telos ONE-x-Six contains all the telephone interface equipment needed for talk show programming. A single rack mounting unit houses both a Telos ONE digital hybrid and a six-line broadcast phone system that includes features found in Telos'

top-of-the-line Direct Interface Module.

For system control, the ONE-x-Six is

packaged with a desktop switch console. Special function buttons on the switch console automatically select the next caller, control external recorders and delays and access several other features.

The unit itself is easy to use. The switch

console is used to place calls, to put callers on the air or on hold and to conference. A standard telephone set may be used for call screening.

To meet the needs of smaller installations, the ONE-x-



Six is easy to install. All six phone lines are connected using standard RJ-11C plugs and all audio connections are XLR.

For information, contact Danielle Cline in Ohio at 216-241-7225; fax: 216-241-4103; or circle Reader Service 86.

T-TECH

Fiberoptic Transmission Offers Virtually Unlimited Bandwidth and Immunity to Lightning Hits

HUDSON, Mass. Fiberoptic transmission has lower loss and greater common-mode immunity than copper, and essentially unlimited bandwidth. It offers higher signal-to-noise than RF STLs and needs no code compression. In addition, it remains immune to lightning strikes "end to end."

T-TECH uses a higher sampling rate than the ordinary AES-EBU standard, which permits the handling of more general signals like composite stereo with SCA through the link.

A shielded package, rather than the customary "card cage," is designed for RFI-plagued broadcasters, and FCC part 15 requirements are met comfortably.



The field-proven design features four independent audio channels, each having DC-95 kHz bandwidth (DC-53 kHz linear-phase at 0.01 dB inte-

gral flatness or DC-67 kHz at -3 dB). The signals are error-corrected. Link transmitter model FOA1T costs \$3,800, including BNC or XLR inputs, while the receiver model FOA1R costs \$3,000. Multiple receivers allow a distribution system to be obtained.

The transmitter uses a laser with 1,300 nm wavelength. The link's audio delay is less than 50 microseconds, equivalent to increasing the distance from the loudspeaker by six-tenths of an inch.

T-TECH uses proprietary A/D and D/A converters and dither, with a 20-bit digital architecture to permit future expansion or enhancement. The ultrasonic dithering can be switched off for any of the four channels handling composite 38 kHz stereo.

For information, contact Dan Talbot in Massachusetts at 508-562-5820; fax: 508-568-1219; or circle Reader Service 171.

TRANSTREAM INC.

Switched 56/112 Digital Modems for Digital Audio

Raleigh, N.C. Transtream Inc. T-1000/T-1100 digital modems interface with codec to provide high quality, cost effective audio signal transport on digital networks. With more than 4,000 units installed, the Transtream shelf-mounted TVX-2W and TVX-4W modems can be used for remote broadcasts.

The codec accepts digital audio and

compresses it at a bit rate of 56 to 112 kbps, achieving 7.5 kHz to 20 kHz audio, and it operates with Transtream T-1000/T-1100/TVX(2W/4W) digital modems. Transtream products fulfill a variety of digital audio applications, including sports broadcasts, weather reports, live remotes, concerts, festivals or stadium events and program distribution.

For information contact Diana Webb or Jackie Godlewski in North Carolina at 919-713-2400; fax: 919-713-2420; or circle Reader Service 63.

FIBER OPTIONS INC.

Fiber Optic Audio Transmission System Offers Many Options

BOHEMIA, N.Y. The Series 312B Stereophonic Audio Transmission System by Fiber Options Inc. is designed to fill the need for high-quality, trouble-free audio routing for editing, master control operations and links to and from transmitters.

Distortion is kept very low, less than one percent, meeting the broadcast industry's stringent quality requirements. The system frequency bandwidth ranges from 20 Hz to 20 kHz. Input/output impedance is 600 ohms, balanced or unbalanced. The system can operate at 850 nm and 1300 nm.

A two-color LED at the transmitter end

indicates input audio level and clipping, eliminating the need for a scope. A Level/Loss™ LED at the receiver indicates received optical power. Links are available as either stand-alone modular units or rack-mountable units.



For information contact Fred Scott in New York at 516-567-8320; fax: 516-567-8322; or circle Reader Service 50.

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Dynaco ST120 factory built, gd cond, BO. R Robinson, 203-269-4465.

Ramko DA-6 RS, 1x6 dist amp w/rack mtg, \$65. E Davison, WNNS, POB 7167, Springfield IL 62791. 217-787-0800.

Belar RFA-1 tuned to 89.3, gd cond, \$200/firm. L Holley, CCS Prod, POB 34321, Houston TX 77234. 713-944-7959.

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

Want To Buy

McMartin LT-80C, 108C, & MS105 amplifiers wanted working cond. E Davison, POB 7167, Springfield IL 62791. 217-787-0800.

ANTENNAS & TOWERS

Want To Sell

ERI 10 bay CP antenna on 93.3 MHz, \$6500. E Moody, KESE, 216 N Main, Bentonville AR 72712. 501-273-9039.

Jampro JMPC-10, 1 yr old on 107.1 MHz, 10 bay circular antenna. B Zellmer, KSIR, Box 2475, Greeley CO 80632. 303-353-6522.

Phelps-Dodge 2 bay tuned 90.5 & mounting hardware. J Waugh, WHVT, POB 273, Clyde OH 43410. 419-547-8254.

400' of 4" coax pressurized on spool, several various size lengths of 3" coax, new, perfect for repairs, assorted 3" & 1 5/8 connectors. K Looney or B Vance, 409-564-4444.

ERI SHP-1AE single bay, CP, tuned to 90.7 MHz, \$1500/BO. M Ebron, WOTJ, 4723 Country Club Rd, Morehead City NC 28557. 919-240-1600.

Andrew A10R50507 coax, new 1-5/8", (2) 275' rolls, \$7/ft. S Ross, WQFE, 733 N Green St, Brownsburg IN 46112. 317-852-9119.

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Gates/ERI CP-239, 3 bay FM w/tower brackets for 18" face w/heaters, mates to EIA flange, TX power 2.2 kW equals 3.0 kW ERP, circular polarized, \$995 plus shpg. F Vobbe, GNBC, 419-228-4199.

Two homspun type WG 50 ohm dummy loads, 2 kW ea, toaster element type, \$250 ea. L Nixon, Classic City Prod, 1094 Baxter St, Athens GA 30606. 706-613-6724.

Shively 6813 3 bay tuned to 92.7 MHz in great shape, BO; Andrew 70' 1-5/8" w/con-nec-tions; Andrew 90' 3-1/8" both w/ground-ing, gd cond, BO. C Hall, KYKN, POB 165, Naphi UT 84648. 801-623-4010.

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ERI FML-1E 4 yr old rototiller antenna on 95.3 MHz, excel cond, \$1000. M Persons, KAGE, 752 Bluffview Circle, Winona MN 55987. 218-829-1326.

Electro Impulse C7797/DPTC 25K FM dummy load, used twice, \$3000/BO. M Grubbs, KATG, POB 1047, Luling TX 78648. 210-875-2555.

MTI motorized coaxial switch, 50 ohm, 4 port, 6", \$3000; Myat 50 ohm, 6" to 3" transition, coaxial (4), \$500 ea. R Miller, WGBY, 44 Hampden St, Springfield MA 01103. 413-781-2801.

ERI 4-bay hi-powered, tuned to 103.7 FM w/350' 3" Helix, gd cond, currently on tower, \$8000 + you remove, insured climber only. P Urso, WWRX, 75 Oxford St, Providence RI 02905. 401-781-9979.

Mark 4' 950 MHz STL dishes (2) w/1/2" runs foam core coax, 2 runs of 200'+, currently on tower, free for the taking, insured tower climber only. P Urso, WWRX, 75 Oxford St, Providence RI 02905. 401-781-9979.

Want To Buy

Tower phase monitors, 5 or more needed; 5 or 10 kW dummy load, AM needed. George, WNQM, 1300 WWCR Ave, Nashville TN 37218. 615-255-1377/1300.

Four bay on or near 98.3 & 350' 3" coax for C-2 upgrade; also (3) 200' AM towers, etc for 50 kW DA-1 project. B Zellmer, KSIR, Box 2475, Greeley CO 80632. 303-353-6522.

2-3 bay CP antenna, tunable to 100.1 MHz, minimum 6 kW ERP. D Carver, 107 S Main, Brookfield MO 64628. 816-258-7458.

FM 3-bay or 2-bay at or near 103.3, fax info. C Tiemann, WAIV, Box 103, Spring Valley IL 61362. 815-663-0103.

AUDIO PRODUCTION

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Consoles, \$500 & UP. Financing avail-able (OAC). Call Mark at 619-758-0888.

Kurzweil Midboard & modules incl fullsize keyboard & 2 digital sound modules, 1000PX plus & 1000 Hx, will sell indivi-dual or as set, \$2800. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

Burwen DNF-1201 dynamic noise sup-pressor for phono rcds, clean, \$50; Technics SH9010 5 band parametric EQ rk mtg, like new, \$275; Daven (2) 500/500 ladder atten w/cue on panel w/ADC 1-1 xfm, \$50; Surround sound processor, Shure HTS5000 Home Theatre, like new, \$100; Stereo EQs 5 & 6 band unbal RCA conn clean, \$35. E Davison, POB 7167, Springfield IL 62791. 217-787-0800.

Eddcor AM 400 4-chnl automatic mic mixer, \$125. G Wachter, KFYL, 602-258-6161.

Yamaha DEQ-7 digital EQ, stereo, BO; Moog 902 VCA module w/PS, BO. R Robinson, 203-269-4465.

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Burwen 7000A transient noise eliminator, rk mt, EC, \$275. S Hofmann, Sounds Impossible, 7109 NW Birch Pl, Lawton OK 73505. 405-536-0559.

ADC Paragrophic EQ like new, very ver-satile, \$250; BiAmp graphic EQ, balanced or unbalanced, I/O, \$100. Richard, 713-859-0531.

Orban 622B parametric EQ; (2) dbx 160x compressor; Valley People 430 Dynamite, 2 chnl; CE 1700 DDL; Aphex Type B exciter. S Erickson, Erickson Audio Prod, Brooklyn NY 11238. 718-638-8610.

Yamaha SPX 1000 digital audio proces-sor, like new, \$1200/BO; Audio Technica ATRMX 64 6 chnl mixer board w/EQ & cassette recorder, like new, \$500/BO. M Grubbs, KATG, POB 1047, Luling TX 78648. 210-875-2555.

dbx 155 (2) Type I encode/decode NR, \$200 ea or \$350/both. P Cibley, Cibley Music, 138 E 38 St, Nyny 10016. 212-986-2219.

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Orban stereo synthesizer, \$150 ea plus S&I; Orban stereo compressor, \$250 ea plus S&I. F Vobbe, GNBC, 419-228-4199.

dbx 150 Type I NR syst, \$100; UREI 530 9 band stereo graphic, \$150; UREI 535 10 band stereo graphic, \$200. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Keidrick KY 40949. 606-546-6650.

Eventide H949 Harmonizer w/manual, exc cond, \$500; Eventide BD 955 delay, exc cond, \$500. J Katz, KJUG, 396 Buckley Rd, San Luis Obispo CA 93401. 805-541-8798.

Sparta TPA 7-1 (3), new, 25 W audio modules for MAS-50 monitor amps, \$40 ea or \$95/all prepaid UPS. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

Orban 245 E stereo synthesizer, new cond, \$150. L Nixon, Classic City Prod, 1094 Baxter St, Athens GA 30606. 706-613-6724.

Audio Digital TC-2 digital delay unit, no manual, \$490 prepaid UPS. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

ADC 48 patchbay phone jack. D Nelson, 619-758-0888.

Smartcaster, computer, digital audio: live or automated. D Nelson, 619-758-0888.

ADC 144 Pt TT patchbays, exc cond, 1 rk space, 3 rows of 48, top 2 rows nor-malled, \$129 (you remove old wiring) or \$199, we totally refurbish w/new front panel, ready to install. TT cords at cost w/purchase! Also 1/4" PB's. Audio Village, POB 2902, Palm Springs CA 92262. 619-320-0728, or Fax 619-320-2454.

Want To Buy

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

Digidesign Session 8 from someone wanting to upgrade. M Eaton, KAIM, 3555 Harding Ave, Honolulu HI 96816. 808-735-2424.

AUTOMATION EQUIP

Want To Sell

Sonomag MiniPro w/remote head, 2 Carousels, RS-350, 4 Revox PR-99, RSC-100 Carousel programmer, new in late '82, \$3500. S King, KGFL/KHPQ, Box 33, Clinton AR 72031. 501-745-4474.

Systemation X7-D automation syst w/16 inputs & 7 day memory, (4) Systemation cassette interface, 5 clone cassette inter-face, 8 Nakamichi MR-1 cassette decks, Systemation Main CR interface, Commo-dore SX-64 computer w/Systemation firmware, color monitor & internal 300 baud modem, (2) Commodore C-64 com-puters w/pwr splys, (2) monochrome monitors & (2) deck cntrl cards to in-crease capacity to 32 inputs, all equip wrkg, \$3500 FOB. L Barry, Manitowoc WI, 414-683-6800.

IGM Instacarts (3) in good condition, (2) stereo, \$2500/ea or BO; 1 mono, \$1000/BO; BE stereo triple stack, \$900/BO; BE Econo sat automation with encoder & interface, \$2000/BO; total sys-tem \$4950/BO. S Phillips, KMTX, 516 Fuller Avenue, Helena MT 59601. 406-442-0400.

SMC MSP-12 3 rack unit, 3 random Carousels, 4 R-R ARS-1000, BO/will sell components separately. R Ness, WCSJ/WCFL, 1802 N Division Ste 403, Morris IL 60450. 815-942-0022.

Harris 9002, (5) ITC 750/720 PB's, 48 tray mono Instacart, 3 cart deck PB's, 2 VOT's, manuals & schematics, in case. J David, KMPL, POB 907, Sikeston MO 63801. 314-471-1520.

Scully 100 automation system, \$300/BO. J Kesler, WOZ-TV, POB 220, Livingston KY 40445. 606-843-2209.

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SMC DP-1, (3) 350 stereo Carousels, (2) dbl play cart decks, DP-1 Brain w/remote keyboard, (4) tone sensors, (6) ITC R-R PB, BO. M Casey, WKSX, Drawer 1, Johnston SC 29832. 803-275-4444.

Cetec 7000 automation system, \$1000, Carousels 250, \$300 ea, Audiofiles (4), \$600, Carousels 350, \$400 ea. E Moody, KESE, 216 N Main, Bentonville AR 72712. 501-273-9039.

Gates SC 48, 3 racks, w/(2) stereo SMC Carousels, (2) mono SMC Carousels & (2) Scully PB decks, \$1000/BO. L Nixon, Classic City Prod, 1094 Baxter St, Athens GA 30606. 706-613-6724.

IGM SC, complete automation syst w/16 inputs, relay card plus spare cards, (5) IGM G-Carts & (3) Otari ARS 1000 stereo PB R-R's, IGM encoder w/terminal & keyboard. J Lotspeich, KTSM, 801 N Oregon St, El Paso TX 79902. 915-532-5421.

SMC Controller, Pro 1 Brain to ctrl unit, \$1500/BO. R Coleman, WGEN, 1003 Oakwood, Geneseo IL 61254. 309-944-4633.

Smartcaster digital automation sys, computer, 5 hrs record time, complete, in svc, \$4900. G Kauffman, KCLN, 1853 442nd Ave, Clinton IA 52732. 319-243-1390.

Harris 9000 w/(3) SMC 350 & SMC 250 mono Carousels, \$1000. M Persons, KAGE, 752 Bluffview Circle, Winona MN 55987. 218-829-1326.

Want To Buy

TM Century Auto-Seqe controller/Brain. R Michaels, SCB Inc, POB 7762, Amarillo TX 79114. 806-355-1044.

CART MACHINES

Want To Sell

Spotmaster 505 gd cond, gd heads, new paint, looks & works almost as new, \$250. R Franklin, 1004 Dekalb St #11, Norristown PA 19401. 215-646-7788.

Fidelipac Dynamax CTR12 PB (3), CTR14 R/PB, rack shelves (2), excel cond, \$4000 for set. Stu, First Take Recording, 301-963-7758.



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Telex 36 cart deck, 4 trk head mono, w/auo trk switcher, rack mntg, brand new in box, \$100. E Davison, POB 7167, Springfield IL 62791. 217-787-0800.

Fidelipac CTR-112 stereo cart PB, sec & ler tones, very clean, \$700; Spotmaster 500-BS stereo cart R/P, lw hrs, excel cond, \$400. P Bammerlin, WRQK, 4111 Martindale Rd, Canton OH 44705. 216-492-5630.

Spotmaster D100 cart Fault/splice detector w/manual, reconditioned, very little use, \$140. 619-457-3535.

ITC stereo rec & PB, new in box, will trade for R-R 8 trk in gd cond. Stars of Tomorrow, 2725 Forrest, Nashville TN. 1-800-530-9255.

RCA RT-27 monophonic, all 3 cue tones, rebuilt, \$75 ea plus S&I; SMC-250 Carousel, IGM-20ARS, sequential, monophonic, all three cue tones, rebuilt, \$775 ea plus S&I. F Vobbe, GNBC, 419-228-4199.

ITC triple deck PB only, mono, \$750/BO. R Coleman, WGEN, 1003 Oakwood, Geneseo IL 61254. 309-944-4633.

Several cart machines for parts, BO. R Smith, WSHF, POB 3115, Valdosta GA 31604. 912-242-1636.

ITC Delta triple play, mono w/tones, (2), excel cond, \$110 ea/\$2000 both; ITC Delta single play, mono, w/tones/ff, exc cond, \$450; Dynamax CTR 11 mono play w/ff (2), exc cond, \$425 ea/\$800 both; ITC Series 99 R/P, w/tones, working cond, \$250. J Katz, KJUG, 396 Buckley Rd, San Luis Obispo CA 93401. 805-541-8798.

CART MACHINES:
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For Sale: \$395 & UP
Repairs: \$100 per deck + parts
Recond: \$150 per deck + parts.
Financing Available
Call Mark @ 619-598-3311

Spotmaster 505-B, Spotmaster 500-RP, Audi-Cord A-10, Tapeaster 700-P, all working when removed from service, \$200 ea/BO. R Smith, WSHF, POB 3115, Valdosta GA 31604. 912-242-1636.

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

ITC stereo & mono machines, R/P & play only, single & triple decks, all w/3 tones, call for individual prices. D Matys, KVET, 705 N Lamar, Austin TX 78703. 512-495-1300.



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Audicord E-20, new, R/P, \$750. G Grassie, RNTC Bdctg, POB 146, Dexter NM 88230. 505-734-5565.

Spotmaster 505-C loaded, microphone preamp, aux tone, cue edit, good condition, \$175 plus S&H. G Gibbs, KMNS, 901 Steuben St, Sioux City IA 51102. 712-239-3966.

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Want To Sell

Otari MX-5050 MK III-8 8 track 1/2" at 7.5 & 15 ips w/manual, supplies & pedestal. Very low hours, original hours, original condition, \$1100. ITM, 777 W Peachtree St, NW, Atlanta GA 30308. 404-347-8580, Ovie Sparks.

Scully 100 16 trk; Scully 280B 2 trk recorders. J Grill, Grill Studios, 619 Melwood Ave, Pittsburgh PA 15213. 412-681-5557.

Scully 284 8 trk recorder, \$4500. H Sewell, Oakridge Music Recording Services, 2001 Elton Rd, Ft Worth TX 76117. 817-838-8001.

Pioneer RE701, new heads, \$300; Ampex ATR700, gd cond, \$700; Tapesonic TR70, gd cond, \$250; Telex 235 w/(2) RP110 elect, \$200; TVC MC 1636 Mark II, new in box, \$300. J Parsons, Parsons Snd Srvc, 2781 Fayson Circle, Deltona FL 32738. 904-532-0192.

Tascam 58-OB, 1/2" 8 trk, mint cond, +4 and -10 in/out, connects for SMPTE lock-up w/video, \$3000. Whirlwind Prod, 10356 W Warren Ave, Dearborn MI 48126. 313-584-9201.

Tape-Athon 702 free to good home, (3) 7" & 10" bi-directional PB @ 3 3/4 ips, also spare parts, \$100/packing & shipping, in Springfield IL; Ampex 601 in larger brown case, full trk @ 7 1/2 ips, some wear, was working, 10 day money back guarantee, \$150. E Davidson, 217-787-0800.

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Ampex AG440B transport plus 2 channels electronics, needs little TLC, \$300/BO. Richard, 713-859-0531.

EMPLOYMENT

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HELP WANTED

ELECTRONICS ENGINEER

Minimum 3 years broadcasting experience, with customer service exp. w/ electronic assembly/repair. Provide technical support with products including application, specification, theory of operation, troubleshooting, etc. Send resume to J. Murray, AKG Acoustics, Inc., 1525 Alvarado Street, San Leandro, CA 94577. EOE

For details on space availability contact Simone at 1-800-336-3045

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Young personality talker ready to roll, fluff, sports, N/T, looking to entertain, have fun, do my thing, open to all possibilities. Rocco, 716-283-4054.

Looking South & Gulf Coast avail now, exper prod/promo/AT, affordable, bags packed & ready. Steve, 806-385-3888.

Dedicated hard working confident young man looking for opportunity on-air news, sports, N/T, writing copy, willing to relocate. S Herrick, 216-442-5238.

AT w/CHR, AC & country exper seeks pos in CO/NV/NM, news, dances, call-in shows, board op, gd voice, prof delivery, reliable. Laura, 303-824-9650.

Gen Manager for FLA med or lg mkt, 29 yrs exp in sales, prgrmg & engrng, turn-arounds or start ups, avail immed. 813-849-3477.

Rocking Rick Allen also known as Rick Savage from Akron, OH is avail, call & let's talk radio. 216-773-1549.

Exper air talent, prodcr, prgrmr, NPR news format, country, folk, jazz, bluegrass music, supervisory & video exper also, call for tape & resume. 904-224-2900.

Assiat Chief Eng high energy, dedicated, hard wkg personality sks entry lev prefer FL, will consider all. S Flehry, 508-583-3168.

Young fireball w/awesome production & copywriting skills, natural finesse in on-air talents, will relocate, recent bdcgt school graduate. Lori, 405-794-6495.

Engineer w/18 yrs exper, AM including DA, FM, satellite & automation, prod, on-air, computer, prefer SE. Richard, Rt 1 Box 91C, Carrollton AL 35447. 205-367-2113.

New grad w/fresh ideas lkg for start in SE US as on-air/prod talent, ready, willing, able & trained to start immed. Kay, 405-733-1355.

Unconventional bdctrs welcome change. Unafraid of being helped by Janet's computer literacy, PT announcing, mktg exp, brains? Seeking FT announcing, prgrmg, serious only! Call Janet at 502-895-5888.

Exper air talent, music wants to help starting or changing oldies, classic rock station, will relocate, have references. Luke, POB 84, MI Carroll IL 61053.

Over 25 yrs exper all areas of radio, seeking program dir/news dir or GM for small mkt position, prefer SE. Bill, 816-699-2475.

Radio broadcaster w/6 yrs on-air exper w/engr background looking for FT position in NJ, prefer southern, but will travel. John Samuels, 814-539-3084.

Got radio in my blood, exper team player seeks FT AT in NE/New England, AOR/Modern/CHR, any shift, bloodtype FM. Blake, evenings, 908-241-0024.

Loveable DJ ready, willing & able to hit the airwaves in a new home. Call Steve 405-348-7404.

Bdctr w/17 yrs exper seeking announcing C/W format, NW NC, SW VA preferred, vast knowledge of C/W, real personality, great voice, prod. Ron, 919-679-7035.

Experd female bdctr seeks PD/MD's pos in Cincinnati/DaYton/ Columbus area, currently news dir, have been assist PD, PSA & MD. Call KJB, 513-382-5001.

Broadcaster w/6 yrs exper, college graduate w/degree, exper in sales & concert promoter, will relocate, call 908-671-6491.

Creative, talented bdctr w/announcing, production & sales exper seeks opportunity in talk radio. Drew, 309-755-0262.

25 yr old in search of FT CHR or Hot AC gig, Rick Savage aka Rick Allen. 216-773-1549.

ABOUT OUR EMPLOYMENT SECTION

HELP WANTED: Any company or station can run "Help Wanted" ads for \$1.50/word or buy a display box for \$55/column inch. Payment must accompany insert, use your MasterCard or VISA; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$10. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for details.

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.

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CASSETTES & R-R...WTS

Scully 284 8 trk recd, \$4500. H Sewell, Oakridge Music Recdg Srvs, 2001 Elton Rd, Ft Worth TX 76117. 817-838-8001.

Tascam 38 1/2" 8 trk recd w/8 chnl of dbx type I NR, \$1500 w/o dbx, \$1200. P Cibley, Cibley Music, 138 E 38 St, NNY 10016. 212-986-2219.

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Otari MK-III 8 trk on stand w/snake, \$2395; Panasonic SV-3700 Pro DAT w/remote, \$795; Eventide H3500 Ultra-Harmonizer, \$2995; 18-chnl Audionics 110A console, \$650; Kurzweil K1200 Pro Keyboard w/stand, \$1795. Steve, St John Prod, 504-464-8881.

Two portable R-R's, \$25 ea; 1978 LPB audio compressor/limiter, \$100; (2) AC voltage regulators, \$50 ea. J Wisbach, WMSS, Middletown PA 17057. 717-948-9136.

All parts for Scully 280 mchs, motors, cards, etc, 8 trk 1" R/P combo head, & erase head to match for Scully 100 machine. R Robinson, 203-269-4465.

MCI JH-110B (3) 2 trk stereo RRs roll around stands w/manuals, \$595/ea. D Matyis, KVET/KASE, 705 N Lamar, Austin TX 78703. 512-495-1300.

Wollensak 1520-AV R-R recd, built-in compressor, (10) new 7" reels of tape, \$80. R Franklin, 1004 Dekalb St #11, Norristown PA 19401. 215-646-7788.

Cipher Digital Softouch controller; (2) Cipher Digital Shadow II sync, all cables for Otari MX 55 TN & Otari MX 70. S Erickson, Erickson Audio Prod, Brooklyn NY 11238. 718-638-8610.

ITC 859-0005 Series 850 (2), R/P in roll around cab, one needs service, clean w/manuals, \$600/both. C Chamberlain, WUCO, POB 60, Bellefontaine OH 43311. 513-592-8606/644-1160.

Otari MX55 R-R, 2 trk w/rolling stand, low hrs, perfect, \$1500. A Jacobson, Work of Art Prod, 352 Maple St, W Hempstead NY 11552. 516-483-9086.

Tascam 22-2 (2), \$450 ea; Tascam 234 syncassette (2), \$700 & \$450; Teac X-300, \$375; Revox B-77 (2), \$600 & \$450. G Grassie, RNTC Bdctg, POB 146, Dexter NM 88230. 505-734-5565.

Teac 22-2 stereo R-R (2), 1/2 trk decks, \$250. D Matyis, KVET, 705 N Lamar, Austin TX 78703. 512-495-1300.

Studer Revox PR99 (2), A77 (5), B77 (2), will sell as group or individually. D Matyis, KVET, 705 N Lamar, Austin TX 78703. 512-495-1300.

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Telex 230 RP 85 preamp, 1-7/8 x 3-3/4 sp 1/2 trk mono in wood case, excel thru-out, \$250. J Addison, Stowe Media, 171 Hartford Rd A-7, New Britain CT 06053.

Otari CB-109 auto locators (3), \$200 ea; Metrotech dual deck slow speed logger syst, \$300. C Hall, WJMN, 235 Bear Hill Rd, Waltham MA 02154. 617-290-0009.

Teac X300, \$300/BO; Otari MX 5050 B11, \$1500, both in excel cond. M Grubbs, KATG, POB 1047, Luling TX 78648. 210-875-2555.

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Ampex 1200 bias amps, mint from spares, \$125. F Long, Acme Soundworks, 221 W 26th St, NNY 10001. 212-647-1827.

Revox A-77 in vgc, \$250 plus S&H; Magnecode 1024, stereo, factory re-cond w/little use, \$300 plus S&H. G Gibbs, KMNS, 901 Steuben St, Sioux City IA 51102. 712-239-3966.

ITC 750 R-R in exc cond, \$350 ea; Ampex AG 440-B F-T, \$350; Wollensak 1500-SS R-R, \$50. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Keidrick KY 40949. 606-546-6650.

Otari MX 70 16 trk w/remote; Otari MX 55 TM ctr trk time code w/remote; Otari MX 5050 BII 1/4" 2 trk w/remote; (2) Studer B67 VU console recorders; Panasonic SV 3500 DAT; Panasonic SV 250 DAT; PCM 501/SL300 digital converter/Beta recorder; Nakimichi MR1, MR2 cass, package pricing avail. S Erickson, Erickson Audio Prod, Brooklyn NY 11238. 718-638-8610.

Nortronics CH3-R sensor type tape heads (8), \$10 ea or \$75/all prepaid UPS. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

Revox A-77, stereo w/rack mounts (3), can supply Conex 25 Hz detector for all three if all purchased, \$450 ea plus S&L. F Vobbe, GNBC, 419-228-4199.

Otari w/automatic rewind (5) in excel cond, \$550/BO. R Coleman, WGEN, 1003 Oakwood, Geneseo IL 61254. 309-944-4633.

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FAX (408) 363-0957

Revox PR-99 MK II stereo 2 trk play units (4) w/25 Hz sensor, still in boxes, \$850 ea, FOB Las Vegas. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

16 trk 2", \$3450; Otari 1" 8 trk, \$2450; 5050 III-8, \$1950; Ampex ATR800 mono, \$750; Tascam 25-2, \$750; Tascam 52 mint, \$1200; MCI Locator III, \$1195; Ampex AG350 solid st electr, \$100/ch. W Gunn, 619-320-0728.

Recorder heads, used Scully mono & 2 trk, \$25 50, ATR100's, 3M M79-16 & 8's, Otari 1/2" 8 trks, \$495. W Gunn, 619-320-0728.

Otari Mark II-IV 1/2" 4-track, multi-track, mint, less than 50 hours, Best Offer. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Want To Buy

American S505-2R4 Concertone, operating w/manual, w/all functions, reasonable, state asking price. J Addison, Stowe Media, 171 Hartford Rd A-7, New Britain CT 06053.

Marantz PM 201 or PMD 221 any cond, physically complete preferred but not mandatory. J Glass, 317 Eureka, Genoa IL 60135. 815-784-2179.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 4646 Houndshaven Way, San Jose CA 95111. 408-363-1646.

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

Otari Mk III-8 head bridge w/o heads. R Robinson, 203-269-4465.

COMPUTERS

Want To Sell

Technics SL-P1200 4 units, all need minor repair, BO. R Ness, WCSJ/WCFL, 1802 N Division Ste 403, Morris IL 60450. 815-942-0022.

NEC P6 24 pin dot matrix printer w/8 internal fonts & 5 unused ribbons, \$125. P Cibley, Cibley Music, 138 E 38 St, NNY 10016. 212-986-2219.

Racal Vadic VA1251GK modems (2), \$75 ea. C Hall, WJMN, 235 Bear Hill Rd, Waltham MA 02154. 617-290-0009.

ATT PC 6300 1985 bdct computer w/40 MG 5.5" drive, keyboard, monitor, manuals & software for traffic & billing for two stations, \$500/BO. B Christie, Grande Radio Group, POB 907, La Grande OR 97850. 503-963-4121.

Want To Buy

CD plyr w/variable speed such as Denon 2560, DCD970 or DCD 660. R Robinson, 203-269-4465.

Tandy 2000 w/software, \$375; Kaypro port, \$200; Texas Instruments 810 printer, \$450. R Robinson, 203-269-4465.

MSD super disk drive for Commodore-64, books & software, like new, \$100. R Franklin, 1004 Dekalb St #11, Norristown PA 19401. 215-646-7788.

CONSOLES

Want To Sell

Ward-Beck Systems R1200 Radio Console 12 channel radio control board, 2 chan. EQ, 2 mic pre amps, 2 chan input select, 2 chan out select, remote control 4 tape units. Currently in operation. \$6000. ITM, 777 W Peachtree St, NW, Atlanta, GA 30308. 404-347-8580. Ovie Sparks.

Russco Mono 505 rack mount, 5 chnl, \$300; Ramko DC5AR 5 chnl mono, \$300; Grommes Precision M15 6 chnl mono tube type, \$275. J Parsons, Parsons Snd Srvc, 2781 Fayson Circle, Deltona FL 32738. 904-532-0192.

Yamaha DMP-7 digital mixer/processor, rk mt, EC, \$975. S Hofmann, Sounds Impossible, 7109 NW Birch Pl, Lawton OK 73505. 405-536-0559.

RCA BC-7A stereo 10 chnl console w/manual. J Waugh, WHWT, POB 273, Clyde OH 43410. 419-547-8254.

Audionics 110A, 18 in, 4 out, 3 band EQ, 2 aux sends, 8 meters, \$2600. Gary, Pranova, 1227 Sierra Alta Way, Los Angeles CA 90069. 310-271-3235.

LPB Monogram II 5 chnl, 12 input, manual, \$800. C Hicks, WEAX, W Park Ave, Angola IN 46703. 219-665-7310.

Presto 900-A1 vintage port rcgd mixer used w/disk rcdr or early port tape deck, 3 mics, large VU, octal tubes, \$250. R Franklin, 1004 Dekalb St #11, Norristown PA 19401. 215-646-7788.

Wheatstone 8X recdg console, LED meters, lots of bells & whistles, extremely clean & can be expanded to 24 chnl, perfect cond, midwest delivery, \$4250. J Lee, JL Prod, 3215 Jackson St, Rockford IL 61107. 815-397-7005.

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Gates Yard II mono in gd cond, just removed from service, BO. D Goodale, WJRI, POB 1350, Lenoir NC 28645. 704-754-5361.

Gates Gateway 80 mono in mint cond, BO. D Goodale, WJRI, POB 1350, Lenoir NC 28645. 704-754-5361.

Tapco 6000 mixer w/reverb, 6x1, rough, was working, \$35. E Davison, POB 7167, Springfield IL 62791. 217-787-0800.

Autogram Pacemaker 828 8 chnl stereo, slide control, excel cond, \$3500. R Michaels, KQFX, POB 7762, Amarillo TX 79114. 806-355-1044.

RCA BC-8A dual chnl, solid state, self contained, plug in modules, 30 inputs, 2 program outputs, cue/monitor amps, mono, \$600 plus S&H. G Gibbs, KMNS, 901 Steuben St, Sioux City IA 51102. 712-239-3966.

McCurdy SS8808A bdct console, 10 chnl, 2 chnl has multi-input selectors, also has (3) spare pwr supplies, BO. M Jennings, Common Mode, 50 Northfield Ave, W Orange NJ 07052. 201-736-7191.

Ramsa WR-8118 18x4x2x2, hi/lo shelving, mid sweep, mint cond w/Calzone ATA flight case, \$1800. F Long, Acme Soundworks, 221 W 26th St, NNY 10001. 212-647-1827.

Shure SE-30 mixer w/built-in gated compressor, 3 chnl balanced in/out plus aux, VU meter, AC/DC, vgc, \$125. Write: WB Haley, Recording F/T Blind, 1021 Millmont St, Charlottesville VA 22903.

RCA BA-7 mono/dual/stereo 10 chnl first five as mics, one output module needs repair, \$750 plus S&L via truck. F Vobbe, GNBC, 419-228-4199.

Cetec Audio Series 20 w/16 input modules, external power supply, service manuals, schematics & maint records, BO. D Horney, Grace Schools, 2440 W Bethany, Phoenix AZ 85017. 602-242-2010.

Telfax TFX-131 4 chnl remote audio board w/Two Astrolite 2636-G1 headsets, excel cond, \$500/BO. R Fess, WLRB, 309-833-5561.

RCA BC-14 rack mount mono 4 chnl, 16 inputs, excel cond, \$175 plus S&H. W Tinsley, Air-Checks USA, 1123 Holcomb St, Watertown NY 13601. 315-788-3549.

Gatesway M5133 mono tube console, w/3 mic preamps, works, sounds good, \$300. L Nixon, Classic City Prod, 1094 Baxter St, Athens GA 30606. 706-613-6724.

Ramsa 8616 prod/sweetening mixing board, 24/4/2, 24 inputs, 10 stereo line inputs, 4 mono/mic line inputs, 4 group outputs, extensive monitor section. S Erickson, Erickson Audio Prod, Brooklyn NY 11238. 718-638-8610.

Tascam M-30 8 chnl, 24 input 6, 4 output busses, stereo output, 3 band EQ, vgc w/manual, \$375/BO. G Kintz, WLG1, Rt 2 Box 69, Hemingway SC 29527. 803-555-2977.

Broadcast Electronics BE-4M50A, new, never used, \$625. G Grassie, RNTC Bdctg, POB 146, Dexter NM 88230. 505-734-5565.

Ramko DC 8 MS 8 channel stereo board, excellent condition & extras, \$650, Shure M-67 mixer, \$75. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Keidrick KY 40949. 606-546-6650.

Visual Electronics M2146 7 channel stereo, 2 input each (2), channel, EQ, remote start button & more, working when removed, \$500 plus S&H or pick-up. C Chamberlain, WUCO, POB 69, Bellefontaine OH 43311. 513-592-8606/644-1160.

Ramko DC5AR 5 channel mixers, 14 available, very good condition, \$225 each. 916-334-9449.

Want To Buy

Audionics 200 Series, white or blue, 12 or 18 fader capacity, complete w/SLO-200, MNO-200 output modules, must be rebuildable, complement of MIC-200 mic & SLI-200 line modules, CRM-200 control room module, TEL-200 telephone module, PEQ-200 voice EQ, LS-8-200 switcher, timer & clock all desired. M McCarthy, WABT, POB 445, Mt Prospect IL 60056. FAX 708-439-1464.

ADM CA1970's, need info to acquire all or parts, especially Audex buss-select cards. D Gaydos, Opal-Gaydos Stds, 295 Doublass St, Brooklyn NY 11217. 718-875-6140.

UREI 1691/1681, broken, dead, working models wanted for parts, we'll pay shipping, call w/details & price, parts also wanted. Wil, WXAC, Reading PA 19612. 215-921-7545.

DISCO & SOUND EQUIPMENT

Want To Sell

Echo plate #2, \$600. H Sewell, Oakridge Music Recdg Srvs, 2001 Elton Rd, Ft Worth TX 76117. 817-838-8001.

Aphex type III, \$500/BO; Furman comp/limiter LC3A, \$180/BO; Lexicon LXP-1, \$389/BO; Foxtex 4030/4035 synchronizer, excel, \$947/BO. Peter, 607-734-1751.

Bose 402E speaker equalizer, EC, \$50. S Hofmann, Sounds Impossible, 7109 NW Birch Pl, Lawton OK 73505. 405-536-0559.

Soundtech US-15C, pair of pro mobile DJ loudspeakers, 15" cast frame woofer with compression driver/cd horn, black carpeted cabinets with corner bumpers, steel grills & handles, 65 pounds ea, new condition, \$200 ea. Doc, KPOK, Box 829, Bowman ND 58623. 701-523-3884.

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Brother MD1-40 MIDI sequencer with 3-1/2" floppy drive, stores up to 30 files; Analek pocket sync FSK synchronizer, locks sequencer to tape, MIDI cbis & doc; incl. \$200/both. C Yengst, WAWZ, Weston Canal Rd, Zarephath NJ 08890. 908-469-0991.

Duntech Sovereigns 2001, light oak, fine cond, \$6000/firm, local Miami pickup or buyer pays S&H. Insight Prod, 305-866-6048.

Burwen DNF-1201 dynamic noise filter for phono records. E Davison, WNN5, POB 7167, Springfield IL 62791. 217-787-0800.

Roland D-20 keyboard sampler, \$700. C Hall, WJMN, 235 Bear Hill Rd, Waltham MA 02154. 617-290-0009.

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LIMITERS

Want To Sell

Aphex 250 type III aural exciter, new cond, '93 mdl, all papers, invoice, manual etc, original carton, \$695. J Masters Ying, Ariel, 140A Bellevue Ave #5, Newport RI 02840. 401-846-9743.

Optimod 8000A, \$1500. R Michaels, KQFX-FM, POB 7762, Amarillo TX 79114. 806-355-1044.

Harris MSP-100 audio processor, BO. M Casey, WKSX, Drawer I, Johnston SC 29832. 803-275-4444.

CRL SPF-300A NRSC adapter, \$400; SEC-400 4 band compressor, \$1000. M Persons, KAGE, 752 Bluffview Circle, Winona MN 55987. 218-829-1326.

EXR Corp exciter, like new, cost 2K, sac \$275. F Virtue, Virtue Recdng, 161 N Broad St, Philadelphia PA 19115. 215-763-2825.

Optimod 8000A, \$1500. R Michaels, KQFX, POB 7762, Amarillo TX 79114. 806-355-1044.

CBS 410 FM Volumax (2), \$50 ea; dbx 140, \$25; dbx 142, \$25; Optimod 8100 card SCA filter cards 8100-AFC (2), \$100 ea. C Hall, WJMN, 235 Bear Hill Rd, Waltham MA 02154. 617-290-0009.

Orban Optimod 8100, working, still in service, avail immed, \$3000/BO. B Erlanson, KIXX, Watertown SD 57201. 605-886-8444.

Aphex 320 Compellor in excel cond & Dominator in excel cond, \$900/BO. J Silver, PS Comm, Box 2324, Chicago IL 60611. 312-280-1112.

dbx 150X type I (16 chnl); Dolby 361 w/A cards (4). S Erickson, Erickson Audio Prod, Brooklyn NY 11238. 718-638-8610.

MICROPHONES

Want To Sell

Sennheiser 441, new w/all papers & response curves, \$425. R Payne, 313-786-1767.

Neumann U87A mint cond, \$1600. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

Neumann KM-86 3 pattern condenser mic, mint, \$650; EV CO 90 lavalier condenser mic, \$55. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Keidrick KY 40949. 606-546-6650.

Shure 540 omni probe dyn 12" long, black, 1" dia ideal for interviews, \$25/each or 5/\$100; Shure 578 omni probe satin chrome dyn 7/8" dia, a neat mic, new, \$35; AKG D110 lavalier dyn 7/8" dia, new good sound, large size, \$35; Eddor wireless lavalier EV CO90 microphone on 49.83 Mhz, \$50; Shure 545-L dyn lavalier or stand MTG, 1 1/4" dia, uni-directional with cord & XLR, (3), \$25/each; Shure 571 lavalier dyn 1" dia with cord, & stand holder, as new, \$35. E Davison, POB 7167, Springfield IL 62791. 217-787-0800.

Audio-Technica 4033 excellent recording/on-air studio large diaphragm mic, 2 available, \$379/BO; Gefell UM-70 3 pattern studio mic large diaphragm as new, 2 available with winde screen, \$895/BO. Peter, 607-734-1751.

Neumann U-89's (2) with shock mounts, Jeweler's cases, mint condition, \$3000/pr, \$1600 ea. Whirlwind Productions, 10356 W Warren Ave, Dearborn MI 48126. 313-584-9201.

Neumann U-67 excellent condition with power supply, \$2455; Sony C-35P (2), new with power supply, \$500/pair. F Virtue, Virtue Recording, 161 N Broad St, Philadelphia PA 19115. 215-763-2825.

Trade RCA 77-D ribbon mic for new EV RE-27, RCA mic working & has complete yoke, would prefer RE-27 complete w/shock mount & arm. T Heathwood, Heritage Radio, POB 16, Boston MA 02167.

Vega R-33-77 DII, \$895; R42-77DII, \$1300, wireless microphones in excellent condition. Don, Scales Film Sound, 3142 Market Pl, Bloomington IN 47403. 812-339-4446.

AKG 414's, \$695, original D12 like the Beatles used, \$295, Sony ECM54, \$150, Beyer M500 lk new, \$300, Demoler 4-ch tube DI rack mount like new, \$875. W Gunn, 619-320-0728.

Gefell Neumann UM57 tube mics, New capsules for SM2 & many others, New AC701 tubes for Neumann mics, \$275. W Gunn, 619-320-0728.

Want To Buy

77-DX's, 44-BX's, KU-3A's On-Air lights. Top price paid. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131.

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

Sennheiser KZU or K3U condenser mic pwr unit. E Davison, 217-787-0800.

MISCELLANEOUS

Want To Sell

INVENTORY REDUCTION SALE! Over 500 item list (fax or mail). Financing available (OAC). Call Mark at 619-758-0888.

Key Industries T2000-A2 rotary phase convertor, 1 phase input, 3 phase output, \$800/BO. M Hendrickson, Hedberg Bldg, POB 528, Spiit Lake IA 51360. 507-526-4044.

Sales training ideas, excel content & prod, \$500. Richard, 713-859-0531.

Key rotary phase converters (2), 120 in, 230 out, \$3500 ea plus shpg. P Urso, WWRX, 75 Oxford St, Providence RI 02905. 401-781-9979.

Rack mount for Shure M67 mixer, \$18 prepaid UPS. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

Up timers (2), new, 2" readouts, counts to 9:59 & resets, momentary closure resets unit to 0:00, \$65 ea, postpaid. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

Anvil rack case, 16 space, 18" deep, \$200/BO. G Kintz, WLGI, Rt 2 Box 69, Hemingway SC 29527. 803-555-2977.

Altec case for 1567 mixer, \$25, home-made case for 1567, \$15; old Canon connectors, P3F, P3M, mating chassis, 8 pin chassis, UA3-11 & 3-12, SK-M7-21C for Bell system recorder connector. E Davison, WNN5, POB 7167, Springfield IL 62791. 217-787-0800.

Teletype 28R0, 28KSR, 19KSR, 32ASR w/manuals, BO. R Meyers, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963, FAX 305-264-2357.

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Audio & RF tech manuals for Sparta equip, write for list; New & like new audio transformers, write for list & prices. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

Powerstat 136-B variable power transformer, new in box, \$75 plus S&H. W Tinsley, Air-Checks USA, 1123 Holcomb St, Watertown NY 13601. 315-788-3549

Western Electric 111-C coil, \$30. WC Florian, WNIB, 1140 W Erie St, Chicago IL 60622. 312-633-9700.

All metal contest registration drum on rollers, 5'x2'x4', \$350/BO; Model 1000 drive buy radio, micro FM bdct station w/endlss tape loop (3) new in box, \$250 ea/BO; hundreds CD's, mostly LP's store bought, lite jazz, soft hit vocals, new age, BO. M Grubbs, KATG, POB 1047, Luling TX 78648. 210-875-2555.

Want To Buy

UTC LS-10X, 12X, LS-15, LS-15X, LS-18, A-10, A-11, A-12, A-24, A-25, A-26 xlrms, schematic for Western Electro-acoustic Labs cond mic PS#120A; Hycor 4201 passive EQ, Cinema Eng 6517E filters, 4031 EQ, Burwen modules BC 302, VF 301, AT 200, manual & schematic for Gates Level Devil limiter, manual & schematic for CBS mdl 600 decibel meter. R Robinson, 203-621-7445.

Operating manual for Hickok #605-A tube checker, copy ok; audio output transformers, Peerless #S-268-Q or AcroSound #TO-350. B Leslie, Pro Recording, 13709 Mapleleaf Dr, Cleveland OH 44125. 216-662-1435.

Tube output transformers by UTC, Triad, Freed, WE, Acrosound, Peerless. L Blackmon, RQ Studio, Lawson Rd #4, N Reading MA 08164. 508-664-0174.

Giant boom box outdoor display, less electronics, cheap, send photo & details to WDCI, POB 371, Bridgeport WV 26330. 304-842-8644.

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MISCELLANEOUS...WTB

Jazz record collections, 10" LP/12" LP be-bop, swing, dixie, highest prices paid. B Rose, Program Recordings, 228 East 10th, NYNY 10003. 212-674-3060.

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

Western Electric amplifier, speakers, tubes. 1-800-251-5454.

Ampex tube recorders and mixers. W Gunn, 619-320-0728.

MONITORS

Want To Sell

Gates MO-2696 external rack mount monitor amp for very early Gates consoles, 666 output tubes, collectors delight, \$200. R Franklin, 1004 Dekalb St #11, Norristown PA 19401. 215-646-7788.

RCA BW-50 freq & mod monitor, standard 10 kHz US spacing 530 to 1800 kHz, calibration verified 8/2/93, \$550 plus S&I via UPS. F Vobbe, GNBC, 419-228-4199.

Belar RFA-1 FM tuned to 96.7 MHz, \$400; Belar FMM-2 mod monitor tuned to 96.7 MHz, \$1200; Belar FMS-2 stereo mod mon, \$1500 or all for \$3000.

Want To Buy

McMartin (buy & sell) any model. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886 or fax 402-493-6821.

RECEIVERS & TRANSCEIVERS

Want To Sell

AM/FM/Cassette Delco car radio, new from '86 GMC van, \$35. E Davison, POB 7167, Springfield IL 62791. 217-787-0800.

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Altec 711A FM receiver, early selective, \$75/BO + UPS. E Davison, 217-787-0800.

Marti SCG-10 92 kHz subcarrier generator, SCD-10 92 kHz subcarrier demodulator. R Rynders, 613 Fourth St Ste 203, Santa Rosa CA 95404. 707-576-7542.

Moseley-RCA BTX-101 67 kHz SCA gen SCG-8 (2), \$300 ea; Moseley subcarrier demod SCD-8 185 kHz, \$300; Moseley TR-55 telemetry rcvr, \$25. C Hall, WJMN, 235 Bear Hill Rd, Waltham MA 02154. 617-290-0009.

Professional SCA demod card with excellent crosstalk rejection, \$20; Superadio III with SCA, \$85, performance guaranteed. 1-800-944-0630.

Johnson ST4A subcarrier receivers (2), 67 kHz; McMartin TR 55D subcarrier receiver, all in good condition, \$75 ea. L Nixon, Classic City Productions, 1094 Baxter St, Athens GA 30606. 706-613-6724.

Want To Buy

SCA plug in module for RCA BTE-15A exciter. WC Florian, WNBH, 1140 W Erie St, Chicago IL 60622. 312-633-9700.

Various FM monitors needed such as Marantz, Korg, REL, Scott, Fisher & McIntosh. L Blackmon, RQ Studio, Lawson Rd #4, N Reading MA 08164. 508-664-0174.

RECORDING SERVICES

CD 1-off copies from your DAT master. 48 hour turnaround. Integrated Digital Systems
310-478-4264
fax: 310-444-9224

REMOTE & MICROWAVE EQUIP

Want To Sell

Marti STL-10 stereo, 2 TX & 2 RX, \$4000. R Michaels, KQFX-FM, POB 7762, Amarillo TX 79114. 806-355-1044.

COMREX RENTALS

1, 2 and 3-Line Extenders Switched 56 Systems
Call Steve Kirsch for details
Silver Lake Audio
(516) 623-6114 FAX: 377-4423

Micro Controls DLC-9-9 chnl remote cntrl studio & xmtr unit working when removed, \$400. S King, KGFL/KHPQ, Box 33, Clinton AR 72031. 501-745-4474.

450 Mhz 25 W RF amp for mobile Yaesu hand held radio w/mike & mounting, \$50; VHF NEC hand held radio/telephone, not wkg, 4 chnls, \$20. E Davison, POB 7167, Springfield IL 62791. 217-787-0800.

4 wire switched 56 data service unit, rack mount incl mdl 1056R, \$745. G Wachter, KFYL, 602-258-6161.

RENTALS
RENTALS
RENTALS

COMREX 3-line extender

Frank Grundstein
Audio/Video 215-642-0978

Telfax T31-B remote mixer w/telephone interface, perfect for sports bdct, \$300. Richard, 713-859-0531.

TFT 8300 rcvr auto switcher panel mdl 7773, \$325. C Hall, WJMN, 235 Bear Hill Rd, Waltham MA 02154. 617-290-0009.

Gentner digital hybrid w/ANA upgrade; Telemix 10 w/switch console. R Lide, Jim Gibbons Radio, POB 151, Frederick MD 21705. 301-663-4181.

Gentner SPH-3 analog telephone hybrid, excel cond, \$300. P Bammerlin, WRQK, 4111 Martindale Rd, Canton OH 44705. 216-492-5630.

Marti & TFT CR-10 RPU & 7705 rcrs only, mono, \$500 ea/BO. M Grubbs, KATG, POB 1047, Luling TX 78648. 210-875-2555.

Marti STL-10 stereo 2TX & 2RX, \$4000. R Michaels, KQFX, POB 7762, Amarillo TX 79114. 806-355-1044.

STLs and RPUs repaired and retuned
STLs upgraded

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504-292-4189

Circle (57) On Reader Service Card

Decibel Products DB-420 vertical antenna, type N male on pig-tail, vgc, \$450 plus S&I via truck. F Vobbe, GNBC, 419-228-4199.

Want To Buy

Wish to rent a remote van radio studio during remodeling. J Stilt, WCIN, 106 Glenwood Ave, Cincinnati OH 45217. 513-281-7180.

SATELLITE EQUIPMENT

Want To Sell

Equitorial 5100 controller sat rcvr. T Wortmann, WSAG, 309 Braasch, Norfolk NE 68701. 402-371-0780.

Wegener 1601 mainframe w/1683 & 1621 cards w/Crystal Systems GLR 75 rcvr, \$1150. J Katz, KJUG, 396 Buckley Rd, San Luis Obispo CA 93401. 805-541-8798.

Scientific-Atlanta 7300 Wideband BPSK rcvr, 7325 digital processing unit, \$4900/BO. Russ Spice, 708-263-6400.

STATIONS

Want To Sell

Beautiful coast of NC, 3 kW FM CP w/25 kW CP needs owner/operator, 25 kW will cover beach, \$165000 w/\$65000 down, owner will finance balance. R Michaels, 806-355-1044.

If you ever wanted to own a radio station, read this! Class A FM in small mkt about to boom, needs committed owner/operator ready for once in a lifetime opportunity, some TLC & \$39500. Richard, 713-859-0531.

FM station equipment from mics to 4 bay antennas, complete, send best application + \$100, best application gets complete station equip, no refunds. R Franklin, 1004 Dekalb St #11, Norristown PA 19401. 215-646-7788.

700 Watts 90.5 FM w/seven room house on one acre, \$75000 firm. 314-686-1663 or 314-785-0006.

For Sale
FM-6KW, AM-1KW
Leadville, Co.
Fax Inquiries to
(719) 630-0220

1 kW full timer 1230 AM in Lynchburg, Virginia area. Ideal for country or gospel format, buy or lease real estate, negotiable. GL Jones, 804-376-5534.

Missouri Ozarks 1 kW AM, 3 kW FM w/6 acres in town, \$300,000 w/\$150,000 down, owner terms. Lou, 417-469-4287.

Beautiful coast of North Carolina, 3 kW FM CP w/25 kW CP needs owner/operator, 25 kW will cover beach, \$165,000 w/\$65,000 down. Owner will finance balance. Ron Michaels, 806-355-1097.

DONT BULLDOZE A TAX WRITEOFF

Our non-profit 501(C) (3) organization is acquiring AM/FM Radio Stations and wants to know about your property. Will consider purchase if no write-off available. Donations of equipment or towers also accepted. All situations considered. All information will be held in strictest confidence. Address all correspondence to
Chuck Harder
People's Network Inc., 2nd Floor West Wing, 3 River Street White Springs, FL 32096

5kW day/29W nite with new tower/ground system, with 4 acres in Jacksonville, FL metro market. Beautiful historic beach town. Best cash offer over \$200,000. Bill, 205-238-0281 or Mark, 205-236-6484.

Want To Buy

Husband/Wife broadcast prof with 25 plus years experience, wishing to relocate to small market, interest in FM only, or AM/FM combo, in Ohio, Michigan, or North Dakota only, will locally own/operate & pay fair price, no leverage buyout. We know the business! Send call letters of facilities with rate card & coverage map, all replies will be strictly confidential, include confidential contact address. Write to Radio World, POB 1214, Falls Church VA 22041. Attn Box: 93-10-2RW.

STEREO GENERATORS

Want To Sell

QEI stereo gen, vgc, \$795. L Nixon, Classic City Prod, 1094 Baxter St, Athens GA 30606. 706-613-6724.

TAPES/CARTS & REELS

Want To Sell

Approx 1000 carts, various lengths & brands incl Fidelipac 300, Master Cart & Scotch Cart, most in gd shap all in service, \$1 each. D Goodale, WJRI, POB 1350, Lenoir NC 28645. 704-754-5361.

Rare collection of Jazz tapes on 7" reels, Basie to Grover, all dbx mastered, no COD's, \$150. D Pulwers, Dave's Price Audio Prod, 310 N Howard St #103, Alexandria VA 22304. 703-751-9346.

1" Scotch 8206 on 10 1/2" metal NAB reels, \$5/ea. G Wachter, KFYL, 602-258-6161.

Fidelipac Gold Master carts, several hundred music lengths with oldies & Big Band music, 2:30's, 3:30's & 4:30's, \$1.20 per cart. E Moody, KESE, 216 N Main, Bentonville AR 72712. 501-273-9039.

10.5" R-R's (9) of Elvis Presley's life & music as heard on NBC in the '70s, \$25 ea. G Erway, Erway Bdct Co., 3450 SE Martinique Trace, Stuart FL 34997. 407-283-6871.

Want To Buy

Need 16" radio transcriptions, cash paid. Joe Salerno, 713-981-9803.

TAX DEDUCTIBLE EQUIP

FT educational college needs equipment incl cart machines, telephone hybrid, consoles, mics, etc in working order, tax deductible. E Slater, WNTI, 400 Jefferson St, Hackettstown NJ 07840. 908-852-4545.

Reading Service for the visually & physically impaired in need of automation system, studio equip & other broadcast equipment for non-commercial FM, non-profit 501(c)3, organization will provide letter of receipt. E Harper, 901-427-8000.

TEST EQUIPMENT

Want To Sell

Fluke 8012A true RMS digital multimeter with battery opt & low ohm range, \$135; Tektronix 5441 50 MHz storage scope with dual timebase & differential input high sensitivity 1 Mhz audio plug in, \$295. G Wachter, KFYL, 602-258-6161.

Sealed Bid Sale of test equip, bid opening Dec 15, 1993. For descriptions & bid form send S.A.S.E. to: Test Equipment Sale, Benchmark Comm Corp, 4700 SW 75 Ave, Miami FL 33155.

Panaramic audio spectrum analyser & (2) supersonic audio spectrum analysers, BO. R Meyers, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963, FAX 305-264-2357.

TEST EQUIPMENT repaired & calibrated:
Scopes, generators, analyzers, counters, impedance bridges
PATTON & ASSOC.
504-292-4189

Circle (48) On Reader Service Card

Technical Materials Corp 5 kW dummy load, convection cooled, 50 ohms, up to 30 MHz in 6" high by 4" wide by 2.5" deep ventilated weather proof fiberglass cabinet, new, \$1000/BO. R Meyers, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963, FAX 305-264-2357.

ITT 1735D 17" oscilloscope with manual, needs work, clean, BO. R Meyers, Benchmark Communication, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963, FAX 305-264-2357.

Want To Buy

AM field strength meter in gd cond, prefer Potomac mdl but will consider others. D Palmer, POB 128, Moberly MO 65270. 816-263-9390.

Manke M-1 wow & flutter meter in gd cond, top dollar paid. E Davison, 217-787-0800.

TRANSMITTERS

Want To Sell

AEL solid state exciter crystalized to 92.7 MHz, BO. C Hall, KYKN, POB 165, Naphi UT 84648. 801-623-4010.

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Circle (214) On Reader Service Card

Jingle masters (tracks) to Pams jingle packages, series 14, 16, 18, 19, 20, 23, 33 & other, also series pre-record masters, other company masters & demo masters, prime material for serious studio musician or collector in 2 trk & 4 trk format some w/dbx Type I NR, \$20/complete inventory list & terms, no rights transfer, sale tape only, \$1500 firm to first buyer. Write to: Radio World, POB 1214, Falls Church VA 22041. Attn Box: 93-10-1RW.

Rare collection of Jazz tapes from Basie to Tyzik, all dbx mastered, \$150/BO. D Pulwers, Dave's Price Audio Prod, 310 N Howard St #103, Alexandria VA 22304. 703-751-9346.

Pams Jingles ref tapes, 1951-1976, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7825.

Educational cable FM station needs prod boards, carts, TT's, STL equip & any other equip. S Marvin, KBCC, 1801 Panorama Dr, Bakersfield CA 93305. 805-395-4523.

Grant-a-Wish Foundation, non-profit helping children with life threatening illnesses, seeks donated 3/4" editing & character gen & prod equip for PSA. Call 1-800-933-5470 or FAX 1-410-242-8818.

Christian mission needs all equip for Class A FM station including 175' guyed tower, will pay shpg or pick up. L Harper, Western Indian Ministries, POB F, Window Rock AZ 86515. 505-371-5587.

Non profit needs all types studio, recording & broadcasting equipment in working condition, educational use, will pay freight & give receipt. Dr Newcomb, 216-548-2053 or 216-893-4125.

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1 kW FM 1978 Collins 831C2	1 kW AM 1974 Harris BC1H1
2.5 kW FM 1978 CCA 2500R	1 kW AM 1978 Harris MW1A
3 kW FM 1975 CCA 3000D	1 kW AM 1988 Harris SX1A
3 kW FM 1974 Harris FM3H	2.5 kW AM 1982 CCA 2500D
5 kW FM 1968 Harris FM5H	2.5 kW AM 1976 McMartin BA2.5K
10 kW FM 1976 Harris FM10H3	5 kW AM 1979 Harris MW5A
25 kW FM 1981 Harris FM25K	5 kW AM 1968 Harris BC5H
	5 kW AM 1979 Cont. 315F
	5 kW AM 1977 RCA BTA 5L

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Circle (199) On Reader Service Card

TRANSMITTERS...WTS

BE 250 W IPA drawer B-series, \$2700. C Hall, WJMN, 235 Bear Hill Rd, Waltham MA 02154. 617-290-0009.

ITA FM-15000 ITA FM power amplifier, 15000 W output, complete with power supply, BO. A Weiner, WHVW, 507 Violet Ave, Hyde Park NY 12538. 914-471-9500.

CCA 1000D FM transmitter with SI-10E exciter & TRC-15 Moseley remote control. W Wright, WTZE, POB 69, Tazewell VA 24651. 703-988-4150.

Harris FM 5H, good condition, \$10000; Harris FM 5K, \$15500; Harris MX-15 exciter, excellent condition, \$3000; Energy-Onix SST-30 exciter, \$2000. R Michaels, KQFX-FM POB 8862, Amarillo TX 79114. 806-355-1044.

RCA BTF-50 new snl phase pwr sly w/manual & harmonic filter tuned to 90.5, xtra tube. J Waugh, WHVT, POB 273, Clyde OH 43410. 419-547-8254.

DEMOED EQUIPMENT

BEXT Inc. has a few demoed exciters, amplifiers and STL's for sale. All demoed systems are sold first come first served and have the same 2 year warranty as BEXT's new equipment. For information: **619-239-8462**

Gates FM1C 1 kW FM w/M6146 stereo gen & M6095 exciter. J M Kissick, WYNI, 201 Office Park, Monroeville AL 38460. 205-575-9964/9966.

Collins A-830-2 10 W tube exciter & 786M-1 stereo gen, needs minor work, \$400/BO. L Nixon, Classic City Prod, 1094 Baxter St, Athens GA 30606. 706-613-6724.

Trade Gates FM-5-H, 3 phase spare tubes in excel cond for a 2.5 single phase RFM xmr. M Taylor, KNEO, 700 Spencer Dr, Neosho MO 64850. 417-451-5636.

Major market general manager w/the right experience, skills & abilities. History of successes & turnarounds. Excellent credentials & references. Station sold and I'm available! Write to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box #93-10-13-01RW.

NEW 3 kW FM transmitters for under \$14,000.
Call for details
Bill Hoffman
518-583-9490

Henry 3000-95D 3000 W FM xmr, tuned to 97.5 MHz, full remote control, new cond, \$8000. R Wright, WLLX, 1208 N Locust Ave, Lawrenceburg TN 38464. 615-762-6200.

Harris MX-15 exciter, excel cond, \$3000; Energy-Onix SST-30 exciter, \$2000; Harris FM 5K1, \$15,500; Harris FM5H, gd cond, \$10,000. R Michaels, KQFX, POB 7762, Amarillo TX 79114. 806-355-1044.

CCA Electronics has the following used equipment for sale:
Harris FM 2.5 transmitter with MX-15 exciter. Also a Collins 831D2 with 310Z exciter.
Call Steve or Howard at CCA Electronics at 404-964-3530

RCA BTE 15 exciter, factory re-built on 107.9 used 30 hrs, excel cond, \$995; Harris RF choke for HT3.5 xmr, 4500 V DC (2); Harris transformer for Harris HT3.5 Series xmr. B Carr, WRED, 1201 Fremont Pike, Woodville OH 43469. 419-837-9696.

FM - TRANSMITTERS
Factory new not used. Why buy a used Transmitter when you can own a new FM Transmitter for about the same cost? Call JIMMIE JOYNT at 214-335-3425.

Rockwell/Collins 828E-1 5 kW, 3ph AM transmitter with 500 W option, on 1440, spare tubes, new 70 kHz filter, 3ph loss kit & other spares, great condition, currently on air, \$15000/BO. M Martindale, KVON, 1124 Foster Rd, Napa CA 94558.

RCA BT-1D 1000 W FM transmitter tuned to 104.3 MHz, with Harris MX-15 exciter, recond but never used, \$5000/package or \$1800/exciter only, FOB Las Vegas. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

CCA Electronics has the following equipment for sale: CSI-3000E 3KW FM transmitter with EX-20F exciter; Harris FM2.5K 2.5 KW FM transmitter with MX-15 exciter. Contact Steve or Howard, 404-964-3530.

Want To Buy

Collins 820 F1 10 kW AM xmr in good condition. George, WNQM, 1300 WWCR Ave, Nashville TN 37218. 615-255-1377/1300.

RCA Mdl ACT-150, pre-war, pair of 808s modulating a pair, all in a short rack, information also wanted, not a dealer, private. P Courson, 202-736-9548.

Harris THE-1 wanted in gd operating cond. F Nymeyer, KPER-FM, 1423 W Bender, Hibbs NM 38240. 505-393-1551.

25/30 kW FM & 50 kW AM with phasor, etc for 3-tower DA-1 project, older units OK if good condition & well maintained. B Zellmer, KSIR, Box 2475, Greeley CO 80632. 303-353-6522.

Collins 310-Z2 modulator card. W Blackwelder, Broadcasters Unlimited, 3810 Brookside Dr, Tyler TX 75701. 903-581-0606 x 642.

FM 2 kW, 3 kW or more & exciter at 103.3, mono okay, must be in gd working cond, fax info to C Tiemann, WAIV, Box 103, Spring Valley IL 61362. 815-663-0103.

Late model 5 kW AM in gd cond, Harris MW5/SX-5 or equiv preferred, send photo, desc & price first letter. J Stitt, WCIN, 106 Glenwood Ave, Cincinnati OH 45217. 513-281-7180.

CSI 10 or 20 kW. R Michaels, SCB Inc, POB 7762, Amarillo TX 79114. 806-355-1044.

Gates TE-1 exciter needed for parts, any cond considered. R Lide, Jim Gibbons Radio, POB 151, Frederick MD 21705. 301-663-4181.

McMerrin AM/FM xmr, any model, exciter or stereo modules. Goodrich Ent, 11435 Manderson, Omaha NE 68164. 402-493-1886.

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Want To Sell



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- 4CX15,000A
- 5CX1500A
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FAX: 415-233-0439

Elmo 4-400C (2) new in box, \$125/ea; GE 833A never used, no box, \$75. E Duellman, WOMT/WQTC Radio, POB 1385, Manitowoc WI 54221. 414-682-0351.

Audiophile EL-34, used Mullard four for \$40 postpaid, NOS Westinghouse, original boxes. \$60 for four. David deForest 305-866-5401.

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NOTICE!
To all buyers and sellers of used broadcast equipment including AM/FM/TV/shortwave transmitters, antennas, STLs and studio equipment—To better serve you, we have moved to our new location with over 40,000 square feet of warehouse and service facilities. For transmitter sales, parts, service and technical assistance, please make a note of our new address and phone number.
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24 HOUR FAX: 315-673-9972

ACTION-GRAM

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Radio World's Broadcast Equipment Exchange provides a FREE listing service for radio stations and recording studios only. All other end users will be charged. Simply send your listings to us, following the example below. Please indicate in which category you would like your listing to appear. Mail your listings to the address below. Thank you.

Please print and include all information:

Contact Name _____ Title _____ Company/Station _____ Address _____ City/State _____ Zip Code _____ Telephone _____

I would like to receive or continue receiving Radio World FREE each month.
 Yes No

Signature _____ Date _____

Please Circle only one entry for each category:

I. Type of Firm
D. Combination AM/FM station
A. Commercial AM station
B. Commercial FM station
C. Educational FM station
E. Network/group owner
F. Recording studio
G. TV station/teleprod facility
H. Consultant/ind engineer
I. Mfg. distributor or dealer
J. Other _____

II. Job Function
A. Ownership
B. General management
C. Engineering
D. Programming/production
G. Sales Manager
E. News operations
F. Other (specify) _____

Brokers, dealers, manufacturers and other organizations who are not legitimate end users can participate in the Broadcast Equipment Exchange on a paid basis. Line ad listings & display advertising are available on a per word or per inch basis.

WTS WTB Category: _____
Make: _____ Model: _____
Brief Description: _____
Price: _____

WTS WTB Category: _____
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*Closing for listings is the first and third Fridays for the next month's issue. All listings are run for 2 issues unless pressed for space or otherwise notified by listee.
Broadcast Equipment Exchange
Phone: 703-998-7600 PO Box 1214, Falls Church, VA USA 22041 FAX: 703-998-2966

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Circle (60) On Reader Service Card

TURNTABLES

Want To Sell

JVC 4-DD-5 CD4 disc demodulator, low hrs, \$80/BO, no COD's. D Pulwers, Dave's Price Audio Prod, 310 N Howard St #103, Alexandria VA 22304. 703-751-9346.

JVC 4-DD-5 CD-4 quadrophonic disc demodulator, low hrs, \$85/BO. D Pulwers, Dave's Price Audio Prod, 310 N Howard St #103, Alexandria VA 22304. 703-751-9346.

Technics SM-10-B3 bases for SP-10 TT's (2), \$100 ea; Technics base for SP-25, \$50. C Hall, WJMN, 235 Bear Hill Rd, Waltham MA 02154. 617-290-0009.

Harris CB-1201 w/Micro-trac 303 tone arm, gd cond, \$125 plus S&H. G Gibbs, KMNS, 901 Steuben St, Sioux City IA 51102. 712-239-3966.

Presto 6N lath, 500 ohm cutter, \$200; Presto M8 cutter, complete in case, \$120. J Parsons, Parsons Snd Srvc, 2781 Fayson Circle, Deltona FL 32738. 904-532-0192.

Want To Buy

Fairchild 16" TT, 33/45 ips, \$100-125. H Sewell, Oakridge Music Recdg Srvs, 2001 Elton Rd, Ft Worth TX 76117. 817-838-8001.

Need info on adding variable speed cntrl to Technics SP-10 turntable. R Robinson, 203-269-4465.

WE 9A reproducer group, cartridges, repeat coils, arms, EQ's. L Blackmon, RQ Studio, Lawson Rd #4, N Reading MA 01864. 508-664-0174.

62 Years Ago

Reprinted from Radio World October 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.

Advertising Space Available!

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ADVERTISER INDEX

This listing is provided for the convenience of our readers. Radio World assumes no liability for inaccuracy.

Table with 4 columns: Page No., Advertiser, Reader Service No., Page No., Advertiser, Reader Service No. Lists various companies and their corresponding page numbers.

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Free Subscriptions are available upon request to professional broadcasting and audiovisual equipment users. For address changes, send current and new address to RW a month in advance at P.O. Box 1214, Falls Church, VA 22041.

OUTLAW SOVIET AND DRUG RING RADIOS FOUND

MARCONI TALK FROM ENGLAND IS HEARD HERE

Washington.

Two outlaw radio stations, one in regular communication with the Soviet authorities in Moscow and the other directing, it is alleged, a gigantic narcotics ring thought to be under Japanese auspices, have been discovered in New York City, according to reliable information.

The Soviet station, which, it is alleged, is operated by the Amtorg Trading Corp., the Soviet agency in this country, has been under investigation for more than a year, operatives of the Department of Justice and the New York police cooperating. Due to the relations between Russia and the United States government, the State Department has also been consulted during the investigations.

The existence of the narcotics station was discovered only a few months ago. Apparently this station has been used to direct agents of the ring throughout the country and for communicating with ships at sea and through them with the sources of supply of drugs in foreign countries.

Station Directs Agents

The two stations have been operating in the amateur band where they did not interfere with commercial traffic and where they were comparatively safe from discovery. They have also been using the beam system making detection still more difficult. Once the Russian station was traced down to a point in Manhattan but when the police arrived to the place where it should have been, there was no trace of the station. The operators had become suspicious and had moved the station to a suburb.

Coincident with the opening of the public show in New York City, Senator Guglielmo Marconi spoke before a microphone of the British Broadcasting Company, in London, and his talk was carried by the WABC and WJZ chains. The Senator, an Italian, spoke with an English accent, for he has lived much of his life in England. He said in part:

"I am supposed to confine myself to an account of point-to-point wireless telegraphy, but broadcasting has become such an important factor in the daily life of nations that the practice of it depends on principles which are common to wireless telegraphy.

"The thing from which it may be truly said that wireless has sprung was the discovery made by Michael Faraday 100 years ago, that it was not necessary for two electrical circuits to be in actual physical contact in order that electrical energy might pass through the small space between them.

"The great need of the present day is for a better understanding between men and nations," said Senator Marconi. "This understanding can be fostered and helped by improvements in our communications. A most direct and satisfactory means of communication between men is the spoken word. In this respect broadcast telephony occupies a unique position as being the most potent means for the dissemination of instruction and entertainment that the world has ever known. I am happy if by any effort of mine I have been able to make some contribution toward international sympathy and understanding."

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