

## RBDS in Spotlight During WCES Demos

by John Gatski

**LAS VEGAS** Touted as the most significant receiver innovation in 10 years, RBDS (Radio Broadcast Data Service) was the center of attention at the Winter Consumer Electronics Show (WCES) last month, as broadcasters and receiver manufacturers launched a major promotion of the technology.

The Electronic Industries Association (EIA), which sponsored the WCES, and RE America led an impressive demonstration of RBDS's potential, according to broadcasters and electronics manufacturers.

The promotion, covered by most major national and international news organizations, included a large-scale exhibit on the show floor and a showcase of 10 Las Vegas stations on the air with RBDS (the EIA dubbed Las Vegas "RBDS City.") Participating stations included KRR1-FM, KFBI-FM, KKLZ-FM, KOMP-FM, KNPR, WEDG-FM, KFMS-FM, and KEYV-FM.

Eight major manufacturers supplied RBDS radios to the exhibit and promised to deliver products to the market by early 1994.

### Standard adopted

The U.S. RBDS standard also was officially adopted at WCES by the National Radio Systems Committee (NRSC), the joint broadcaster/electronics industry working group. Because of the cooperation between broadcasters and manufacturers, the standard was adopted in less than two years.

RBDS is based on the European-developed RDS (Radio Data System). It is a broadcaster-transmitted, 57 kHz digital sub-carrier capable of carrying data for radio text display, station selection and scanning by format, translator switching, traffic

updates, automatic EBS alerts and other functions.

During a press conference early in the show, RE America's John Casey said broadcasters will be able to utilize the text display feature for generating revenue and to enhance station identification beyond a DJ reciting the call letters and logo. RBDS encoders start at less than \$2,500, according to RE.

"In America, we could be looking at the billboard of the future," Casey said.

NRSC Chairman Charlie Morgan said broadcasters will embrace the new technology. "We've taken more than two years to (adopt the standard), and I think we did it right," Morgan said. "I think the broadcasters will accept this just as soon as the receivers are made."

Almon Clegg, a Denon engineering consultant and co-chair of the NRSC's RBDS subcommittee, said the technology is exciting for broadcasters and manufacturers because receivers have changed little since the advent of digital displays about 10 years ago.

### A little digital for analog

Clegg also noted that RBDS is an intermediate step to bridge the gap between traditional analog FM and full-blown digital



**NRB**

**City of Angels:**  
National Religious  
Broadcasters to convene  
in Los Angeles.  
For details, see p. 9

broadcasting, which is still a few years in the future. "It brings a little bit of digital to analog," he said.

There are numerous RBDS capabilities for broadcasters that have not been publicized, including EBS alerts (a proposal being considered by the FCC), translator and booster switching, remote functions such as turning tower de-icers on and off, and even electronic navigation.

EIA Consumer Electronics Group Vice President Gary Shapiro said the RBDS promotion at WCES eliminates speculation that the technology will succumb to "the chicken or the egg syndrome," a label used to describe the plight of AM stereo.

continued on page 8 ▶

### RUNNING RADIO

## Research Targets Listeners, Not Just Listening

by Mary Ann Dorsie

**WASHINGTON** Music and talk may be the sound of radio, but its real voice comes from the listeners, according to some radio research firms.

During the last few years, results of programming and sales research have led broadcasters at radio stations across the country to become more conscious of their listeners.

### Hello out there

"Over the years, we have been focusing on radio listening," said Peter Mokover, Spectrum Research president. "In addition to that, we should also focus on radio listeners."

"The more we know about each of them as a total person—the other 99 percent of their lives—the better we will be able to serve them when they are listening to the radio."

Ted Bolton, president of Bolton Research Corp., said the current economic environment is mandating changes in station programming in an effort to attract listeners.

"The sense I'm getting from managers, operators and owners is that when they're in a competitive environment, they're looking for something new," Bolton said. "The sameness of the past is not quite as effective as it used to be."

He said new ways to program and market stations should be developed.

"The audience has seen and heard it all before," Bolton said.

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# NEWSWATCH

## CellularVision, Anyone?

**BROOKLYN, N.Y.** Using an FCC "Pioneer's Preference," CellularVision provides up to 49 video channels of "cellular TV."

The brainchild of engineer Bernard Bossard, the technology uses the 27.5 MHz to 29.5 MHz spectrum allocated to the Local Multipoint Distribution Service (LMDS), a new FCC authorized service.

The company claims that by using reverse polarization techniques, it can deliver 100 video channels. The main signal is transmitted via an omnidirectional antenna to the various cells, which then transmit the signal

by a highly directional antenna to homes and other cells.

The receive antennas are window-sill mounted, flat panel antennas connected to an FM-to-AM converter.

## ComStream Goes to China

**SAN DIEGO** ComStream has signed a contract to design and install a digital audio broadcast network in the People's Republic of China.

The contract, signed with China's Ministry of Radio, Film and Television, initially calls for audio to be uplinked in Beijing and transmitted to three receive

sites within the Guangdong Province, which is located near Hong Kong. Future plans call for broadcasts into 15 other provinces in China.

The ComStream system uses the ISO/MPEG compression standard (MUSICAM) to deliver CD-quality digital audio at as little as 128 kilobits per second (kbps).

## Group W's Thompson to Join Liberty Broadcasting

**NEW YORK** Group W Radio President Jim Thompson will be leaving the company to join Liberty Broadcasting as co-chief executive officer. A company spokesman said Group W will be conducting an "aggressive" search throughout the industry for a new president.

In a memo to Group W employees, Group

W Broadcasting Chairman Burt Staniar praised Thompson's tenure at the company. "Since becoming President of Group W Radio, Jim has helped to forge one of America's most powerful and influential radio companies, a source of pride to us all," Staniar said.

"He has always kept close to the philosophy that holds broadcasting to a higher standard of community service, a higher responsibility to society," Staniar added. "In that regard, he represents the very best of Group W."

Liberty Broadcasting was formed by former Group W Radio Vice President, Mike Craven. Craven and Thompson served as Group W Radio's senior management. Craven formed Liberty Broadcasting in mid-1992 to acquire radio stations.

## Stern Broadcasts Bring Down Wrath of FCC

**WASHINGTON** The FCC has levied a series of fines totaling \$600,000 on Sagittarius Broadcasting and Infinity Broadcasting for alleged indecent broadcasting during several broadcasts of the successfully syndicated Howard Stern Show in 1991.

The fines were on Sagittarius Broadcasting's WXRK-FM (New York City), Infinity's WYSP-FM in Philadelphia, and WJFK-FM in Manassas, Va. Each station was fined \$20,000 for each of 12 Stern

continued on next page ▶

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# SW56 and ISDN Offer Backhaul Alternatives

by Dee McVicker

**TEMPE, Ariz.** Digital telco lines such as Switched 56 and its more advanced cousin ISDN have the capability of becoming a veritable backhaul expressway for remote broadcasts. What's more, these services are saving some radio stations considerable sums of money over other backhaul methods.

With bandwidths of 7.5 kHz and speeds of 56 or 64 kilobits per second (kbps), these high-speed digital thoroughfares are more dependable, more widely used, and more affordable for remote applications than ever before.

Codec units for digital remote backhaul are available from several companies, including Comrex, Corporate Computer Systems (CCS) and Audio Processing Technology (APT).

According to CCS spokesperson Sheila Cohill, ISDN and Switched 56 technology present a wealth of possible backhaul applications, including sports events, newscasts, weather, traffic, interviews and audio portions of TV broadcasts. The digital leased lines also present possibilities beyond 7.5 kHz backhaul, said APT's Mike Smyth, who speculates that the services will likewise become more practical for transporting wideband audio.

It wasn't very long ago, however,

that the such services were scarcely available. "Two years ago you could hardly get ISDN or Switched 56 anywhere and they were priced out of sight," said Tom Hartnett, chief engineer for Comrex Corp. Today, he said, these digital leased lines are making extraordinary inroads.

Dan Joffee of Integrated Network Corporation (INC) agreed. Joffee, whose firm manufactures Switched 56 inter-

faces for telephone companies and end users, noted that more phone companies are gearing up their local exchange carriers (LECs) for either Switched 56 (SW56) or Integrated Services Digital Network (ISDN) service.

### Now more cost effective

CCS's Cohill pointed out that the increased availability of lines has made backhaul over ISDN or SW56 lines relatively inexpensive compared to analog phone program circuits. Bidirectionality is another benefit for broadcasters, Cohill said, allowing for a remote feed and talk-back to take place over the same line.

For basically the price of a phone call, broadcasters can backhaul 7.5 kHz bandwidth of audio over these high-speed digital lines. Even adding in requisite equipment, the digital leased lines can still be more cost effective than more traditional backhaul methods.

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**These services are saving some radio stations considerable sums of money over other backhaul methods...**

# NEWSWATCH

▶ continued from page 2

broadcasts in 1991. Last fall, Greater Los Angeles Radio Inc.'s KLSX-FM in Los Angeles was fined \$105,000 for the same broadcasts, which has appealed the fine.

Infinity and Sagittarius were to have responded to the fines by mid-January.

In comments regarding the mammoth fine, Commissioner Ervan Duggan's statement indicated the FCC is not likely to levy higher fines if the alleged violations persist.

"I will simply suggest that forfeiture of this unprecedented magnitude probably represents the outer limit of what the Commission is willing to do by way of a mere, although substantial fine," Duggan said.

Some industry insiders believe the fines on the bawdy morning drivetime Howard Stern Show were part of former FCC Chairman Al Sikes' efforts, with the blessings of other key commissioners, to take a stand against indecency.

Although obscenity is strictly defined and for the most part the ban is adhered to by radio personalities, Indecency, however, is a more vague concept.

### CCA Adds Second Service School

**FAIRBURN, Ga.** Due to the popularity of CCA's service school held last December, the company tentatively has scheduled another session in June.

Like the December classes, which included engineers from all over the U.S. and sev-

eral overseas countries, June sessions again will cover installation, operation, maintenance and repair of CCA's AM and FM transmitters.

For more information, contact Steve McElroy at CCA, 404-964-3530.

### Opry Inducted into NAB Hall of Fame

**NASHVILLE** The Grand Ole Opry has been named to the NAB Broadcasting Hall of Fame. The 67-year old country music institution will be honored at NAB's spring convention in Las Vegas, April 18-22.

The Opry's lineup over the years has included country superstars Hank Williams, Roy Acuff, Patsy Cline, comedienne Minnie Pearl, Porter Wagoner, and Randy Travis.

"It's a tremendous honor for the Grand Ole Opry," Opry General Manager Hal Durham said.

### Radio Systems to Produce TI-101

**BRIDGEPORT, N.J.** Radio Systems Inc. has obtained the rights to manufacture and market the TI-101 telephone interface, formerly a Symetrix product.

The product will be called the Radio Systems TI 101, and will be shown at the company's booth at the NAB convention in April.

"The TI-101 is a proven market leader that has held up well as the standard in basic, affordable phone interfaces," Radio Systems President Dan Braverman said.

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# Radio, People, Places and Things

by Alex Zavistovich

**WASHINGTON** Before I do anything else, I need to make a blanket apology to the citizens of South Dakota, for perpetuating the myth that Sen. Larry Pressler was defeated in elections this past fall. Apparently, our source for political information fell asleep before the final count came in from South Dakota, because Pressler was not defeated; he was re-elected by a narrow margin. Embarrassingly for me, Sen. Pressler was referred to not once but twice in these pages as the "former" senator. My apologies. To paraphrase Mark Twain, the reports of Sen. Pressler's defeat were greatly exaggerated.

This month at *RW* has been like business at a small-town airport: one departure, one arrival. I'd be remiss if I didn't tell you about the goings-on.

Jim Somich, author of our *Bottomline Broadcaster* series, is leaving the fold. We were all sorry to see him go, and frankly, a little worried about finding a replacement for him.

Fortunately, Edwin Bukont, who just completed a series on studio design for our Running Radio section, volunteered to take up the *Bottomline Broadcaster* gauntlet. He does so ably in this issue with his first installment, which will help you get all the value possible from equipment that may now be languishing at your station.

Long-time readers of *RW* will certainly remember my predecessor Judith Gross. When Judith left a couple years ago, some folks expressed hope that she might rejoin the paper some day. Well, I'm happy to report that Judith Gross is back with *RW* again, as of this issue.

As the latest columnist in Running Radio, Judith is launching *Tech Talk*, which presents broadcast technology as part of the bigger picture of station operations. Judith inaugurates the feature with a look at revenue-generating possibilities of the radio

data system (RDS). We all welcome her back after a long absence from these pages.

Talking about RDS is somewhat confusing these days, especially now that the National Radio Systems Committee (NRSC) has formally introduced its voluntary standard for the Radio Broadcast Data System (RBDS), which is a modification for American broadcasters of the RDS technology already used in Europe.

It seems that the term RDS belongs to a European firm, which was unwilling to



have it used in an American transmission standard that's somewhat different than the European. So the NRSC adopted the RBDS moniker.

The catch is that receiver manufacturers don't feel like retooling to change the faceplates of RDS radios—which have already been sold in large quantities abroad—to reflect a difference that will be largely invisible to consumers. Unfortunately, this has all caused no small amount of debate as to what the technology should be called: RDS or RBDS?

From what I've heard, I think the EIA would be happy just to have RBDS fade into the background now that the standard has been introduced, and have everyone just refer to the technology as RDS.

Oh, and on another technical note, USA Digital, the consortium behind the Project Acorn in-band DAB system, took part in a

meeting with the International Radio Consultative Committee (CCIR) in Los Angeles in mid-January. It's the first time the Europeans have ever really been exposed to U.S. in-band DAB technology. Did it have any impact on them? Find out in our next issue.

Who will be the next chairman of the FCC? We still don't know, even though former chairman Al Sikes conducted his last meeting on Jan. 14 and exited the post on Jan. 19.

The rumor mill is still grinding out names, but as of press time, no one had been confirmed. Sen. Ernest Hollings' communications counsel Toni Cook is still the number one name on most lists. Then there's Commissioner Ervin Duggan, who's been eyeballing the position pretty closely, and who would probably be pretty warmly received as far as some in the FCC are concerned.

It's all still up in the air, though. In mid-January, the FCC hadn't even announced an interim Chairman, although most observers agree the position will fall to James Quello, who has seniority over the others.

Several years ago, when the CBS CopyCode system was proposed as a way to avoid digital piracy on DAT recorders, NTIS, the National Institute of Standards and Technology (at the time, the National Bureau of Standards) conducted a study to determine whether such coding was an effective preventative.

The CopyCode placed a "notch" at 3500 Hz that would flag circuitry in the DAT recorder, preventing or rendering imperfect digital copies made from DAT. The notch was supposed to be inaudible.

The problem was, it *wasn't* inaudible. I know, because I took part in the subjective listening tests conducted by NTIS. In fact, the study proved that the coding was not only audible but easily defeated.

I bring this up because of a recent conversation with Larry Albert at Murray State University who remembers the whole thing. Apparently, it got Larry thinking about Arbitron's recently announced passive people meter, which would require an "inaudible" tone to be transmitted by stations to make audience measurement more accurate and less artificial. The system should work for radio and TV, according to Arbitron.

Then along comes Larry Albert, who in his spare time likes nothing better than to come up with ways to defeat such technological advances. Larry dismisses the Arbitron system in five short steps, a procedure he modestly calls "How to Cheat":

- 1) Sell production time cheap.
- 2) Produce several local spots.
- 3) "Accidentally" encode these spots.
- 4) Distribute copies of commercials to other local stations.
- 5) Watch ratings improve.

Of course, *RW* would never condone or encourage unethical behavior. I just hope it shows the Arbitron people a potential for abuse of the system; something they can address now instead of some time down the road.

That's it for me. Tune in next time,

*Alex*



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## Kudos to Studio Sessions...

Dear RW,  
 Congratulations on the expansion of RW to a greater in-depth coverage of the world of audio. (*Editor's note: See "Studio Sessions," RW, Jan. 6, 1993.*) This coverage now makes RW even more vital to the industry, and particularly the audio aspects of broadcasting.

Your concerns with highlighting audio are also ours, and I am sure the AES conventions and their technical content will be of even greater interest to RW. I will make sure the information flows to you and your staff.

Donald Plunkett, executive director  
 Audio Engineering Society  
 New York, N.Y.

## ...And RW in general

Dear RW,  
 As a former corporate director of engineering and current contract engineer, I consider RW to be an "invaluable" industry publication.

Please renew my subscription to RW effective immediately, and if you would, please send the most recent issue.

Thank you for providing enjoyable hours of intelligent and educational reading. I'm anxiously awaiting my next copy!

TJ Cantrell  
 Citrus Heights, Calif.

## Of companies and killer clichés

Dear RW,  
 Two articles in your Dec. 23, 1992 issue caught my attention. The first was a letter from Michael McCarthy in which he responds to a letter from me that you printed in October. The subject matter was a now defunct equipment manufacturer known as Versa Count.

In particular, I was interested in reaching Versa Count's customer service manager Alfred Williams. A tip from one of your readers allowed me to contact Williams, who explained to me that Versa Count was counted out about five years ago.

Seems that the company's demise resulted from the death of their design engineer, Don Carlson.

Mr. McCarthy's letter provides a phone number for reaching Williams, but it is the wrong number. Al can be reached at 708-965-6554. He told me that he'll stand by Versa Count products to the best of his ability.

The other interesting article was Ty Ford's treatise on "Killer Clichés." Ford mentions some 30 overworked expressions that seem to make their way into radio commercials. Unfortunately, he omits mention of the most overworked word in the industry, which is "great."

"Great" is found in at least half of all spots, and may ads use the word several times: "Great deals, great values, great selection, great prices and you'll feel great."

"Great" grates on my nerves to the point that I've banned the word on our station.

Paul S. Lotsof, manager  
 KAVV(FM)  
 Benson/Tucson, Ariz.

Dear RW,  
 The commentary by Ty Ford "Don't Get Caught by Killer Clichés" was on target. While not actively involved with the direct production of many clients' messages, I have, over quite a few years, felt that the message is critical to the success of any radio campaign. I can only add another copy cliché that turns me off, as well as listeners: "that's right," as in, "20 LeBarons in stock are now a low \$9,990. That's right, \$9,990."

Another area that should be of concern is pronunciation. How many times have you heard "ah-leven" instead of the correct "ee-leven"? It happens daily on most every TV affiliate promoting the news "at six and ah-leven."

We all agree the medium is right...let's assure advertisers that the message is right.

Gary Girard  
 CRN/Connecticut Radio Network  
 Hamden, Conn.

## EBS white elephant

Dear RW,  
 I read a recent article about the proposed changes in the EBS; it brought to mind the events of June 28, 1992. We were at the epicenter of the 7.5 Landers earthquake. While we were not on the air at 4:55 a.m., we came on at 7:00 a.m. when the power came back and there was no notification that EBS was activated.

In fact, that whole day the only information we got was through the local sheriff, the local Red Cross, and our listeners and neighbors.

It seems to me that the need for a national EBS has passed and that more thought and money should be spent on localized EBS systems. Instead of requiring small rural stations to purchase unneeded equipment, the money should be used to educate local authorities on how to best utilize the local stations in an emergency.

One of the EBS's glaring deficiencies on June 28 was the lack of coordination and dissemination of real "official" information. The Red Cross, which is tasked with coordinating relief efforts, was never

# Chicken and the Egg

Which came first: the chicken or the egg? This age-old riddle has had impact on the audio industry more than once. Most often, it relates to whether broadcasters should first adopt new transmission technology to spur demand for new receivers, or whether the availability of such receivers should act as a gauge for broadcasters contemplating adoption of the new technology.

Fortunately, in the case of the recently-introduced radio broadcast data system (RBDS) standard, the question is moot. The subcarrier technology is receiving equally strong support from broadcasters and electronics manufacturers, judging by reactions at the Winter Consumer Electronics Show in Las Vegas.

As a project of the National Radio Systems Committee, a group jointly supported by the NAB and the Electronic Industries Association (EIA), the RBDS standard already has seen cooperation from both sides. Approximately 50 stations already use the technology. Denon reportedly has projected 10 percent market penetration by 1994.

And, unlike AM stereo, RBDS has garnered early receiver industry support. Some observers believe RBDS will be a boon to the receiver industry, which has not had a successful new technology or upgrade for radio tuners since the introduction of digital displays.

For broadcasters, RBDS offers numerous benefits: display of call letters, slogans, format, scanning by format, automatic translator switching, sub-audible communications between transmitter and studio sites (de-icing, messages, processing control), EBS alerts (with sub-audible testing), traffic alerts and more.

Stations will be able to add RBDS at comparatively low cost: in the area of \$2,500 for a basic encoder. AM concerns are addressed in the new RBDS standard with the ID Logic B provision, and Real-Time Design's research for an AM compatible system also seems promising.

RBDS also offers equipment manufacturers new opportunities in the development of encoders, peripherals, accessories and test equipment. Receiver manufacturing processes will be less expensive and easier because RBDS is based on a technology already proven in Europe.

Early cooperation between broadcasters and the electronics industry in RBDS has de-fanged the "chicken or egg" dilemma that has plagued other new transmission technologies. With RBDS, both sides are developing simultaneously and will grow stronger together. Hooray!

—RW

given the access to the EBS on a local or county level.

These are the things that Sen. Hollings should be looking into, not how to spend small stations' money on a system that has no bearing on the site of a real natural disaster. I can only hope that someone from the FCC will see that logic is what is called for—not another expensive white elephant that will take another 40 years to dismantle.

Larry Waxman  
 KROR-FM  
 Yucca Valley, Calif.

## Long-term master storage

Dear RW,  
 I want to make some suggestions on mastering tapes for long term storage.

First of all, if you are recording in the digital medium, I prefer one of the four following options:

1) Master all your tapes on the Studer Dyaxis I (two-channel digital audio workstation);

2) Rent a Sony PCM-3402 and master them on Scotch 275 (0.25-inch);

3) Rent a compact disc recorder; or

4) Purchase any of the nine Sony DAT recorders and master them on Scotch R-90.

Secondly, if you are in the analog medium, Scotch offers a wide variety of cassette and reel-to-reel tapes:

1) Reels: 806, 8807, 808, 809, 226, 227, 250, 966, and 996.

2) Cassette: BX, CX, XS-I, XS-II, XSM-

IV, XS-IIS, AVX, or SX.

I am speaking from experience: I have some 35-year-old Scotch tapes that even sound better than some pre-recorded compact discs.

David S. Pulwers  
 Alexandria, Va.

## Solution to Jan. 6 Puzzle

U	F	O	I	G	N	I	T	E	D	E	N	O
S	T	U	E	F	T	I	N	X				
F	A	A	N	A	T	A	E	V				G
A	R	E	C	E	I	V	E	C	Y	O	R	E
B	A	I	O	D	T	I	C	K	R	E	N	
O	B	A	C	M	E	R	U	P	G	T		
A	I	M	O	U	R	O	H	N	R	A	I	N
R	B	I	O	L	D	E	B	O	N	E		
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D	O	Z	P	B	E	X	T	N	S			
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K	I	N	T	R	O	N	I	C	A	C	A	B
T	D	E	E	N	D	M	E	R	R	Y		

## Correction:

In the Jan. 6 RW article titled "Expanded Band Delayed," the Disney World information service was listed as an example of a low-powered AM Traveler's Information Service (TIS), located on frequencies 530 kHz and 1610 kHz. The Disney service, however, actually is authorized for broadcast under Part 15 of the FCC rules.



Voll. 17, No 3 February 10, 1993

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**Next Issue of  
 Radio World  
 February 24, 1993**



November 25, 1992

Mr. Ron Oler  
Harris/Allied Broadcast Division  
3712 National Road West  
Richmond, Indiana 47375

Dear Ron:

I wanted to express our extreme satisfaction with the Audio Metrics CD-10 compact disc players. In a national broadcast environment such as Jones Satellite Networks, we demand only the most reliable equipment with state-of-the-art performance. Jones Satellite Networks is known for the finest audio quality in the business, so we were not ready for any compromises.

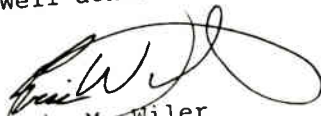
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After an extensive testing period, we have used the CD-10 players on the air for over six months. Without one skip! Our affiliates appreciate the digital quality, I appreciate the lack of on air "glitches".

The CD-10 is clearly superior to other units. I say this as I order another six players. Every type of broadcast equipment has a leader, and Audio Metrics leads the way into the next century with a first rate product.

Well done!

  
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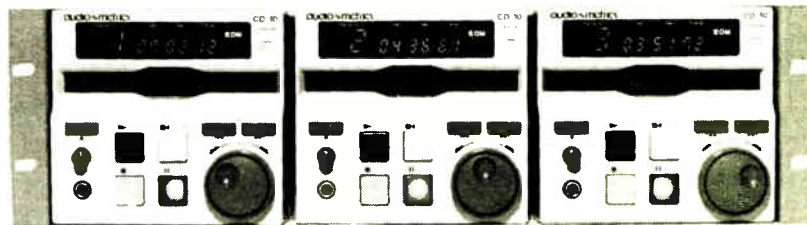
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### Getting Started with Digital Telco Lines

**TEMPE, Ariz.** Most metropolitan areas in the U.S. provide Switched 56 (SW56) and a few provide ISDN, depending on the capability telco local exchange carriers (LECs).

Long-distance toll for the lines is provided by a long distance carrier such as AT&T or MCI at anywhere from nine cents a minute to 21 cents a minute, depending on the carrier and the time of use. AT&T in particular offers the ACCUNET switched digital service, for which users are billed on a per-use basis.

Equipment required for backhaul of remote broadcasts typically includes a codec and a CSU/DSU (modem) at the station and the remote location. For ISDN service, a terminal adaptor is required in place of the CSU/DSU.

CSU/DSU equipment is made by Motorola, AT&T, Integrated Network Corporation (INC) and other companies, and should be configured for the type of service installed. Switched 56 usually comes from your telephone company as two-wire, four-wire or dedicated service and requires a corresponding two-wire, four-wire or dedicated CSU/DSU to operate.

INC puts out a handbook on SW56, including a listing of local exchange carriers and the types of SW56 they offer. To get a copy, call 1-800-241-EASY or write INC, 757 Route 202/206, Bridgewater, N.J. 08807.

For the more broadcast specific analog-to-digital/digital-to-analog conversion of audio, several broadcast manufacturers offer codec units, including Audio Processing Technology (APT), Comrex, and Corporate Computer Systems (CCS). Comrex's DX-R and portable DX-P codecs, and CCS's Micro56 and Micro66i use the G.722 algorithm. APT's DSM-100 uses the APT-x algorithm. CCS also uses MUSICAM compression in its CDQ-2000 codec unit.

# SW56, ISDN Offer Backhaul Alternatives

► continued from page 3

Flagship stations for the National Basketball Association (NBA) playoffs, for example, expect to save almost half the cost of satellite feed using a combination of ISDN/SW56 services, according to Doug Lane, engineer for the Boston Celtics' flagship station, WEEI(AM) of Boston, Mass.

Lane began researching digital telco lines over a year ago. After adding up

Moreover, unlike satellite for backhaul, WEEI(AM)'s digital backhaul provides bidirectional feed for talk-back, saving the station even more in phone line charges.

But, Lane warned, not all stations can expect savings of this magnitude. For one, few local exchange carriers provide ISDN, the more affordable of the two services. For another, costs for the more widely available SW56 vary dra-

book put out by INC (see sidebar) that lists what local exchange carriers are calling the service, and how they offer it.

"Depending on the type of equipment the local exchange carriers have for their computerized switching system, they'll bring either two wires or four wires to the site," Lane said. He recommends that engineers should first find out how their local exchange carrier provides SW56 service before ordering equipment. Switched 56 is typically provided two-wire, four-wire or dedicated.

To set up this type of backhaul system  
continued on page 8 ►



Boston Celtic's flagship station WEEI(AM) expects to save as much as \$10,000 by using leased digital telco lines to backhaul coverage of the team's games.

the figures, he enlisted 18 of the 27 NBA teams to cooperate in a nationwide digital backhaul system connecting NBA arenas and flagships.

#### Savings of \$10,000

The new NBA backhaul incorporates a mixture of SW56 and ISDN services with backup lines at each arena. Digital lines link the flagship stations with their home arenas. The system already has carried some 216 games nationwide and will save WEEI(AM) in the ballpark of \$10,000 this season.

atically from one area of the country to another.

Moreover, according to Lane, the lessons in leased digital lines do not end here. The type of SW56 service also varies a great deal nationwide, he said.

#### The name game

Even the names for the service are varied, Lane said—some telco personnel have been known to refer to SW56 as "diginet," "datapath," and even ISDN. His advice: Get the SW56 hand-

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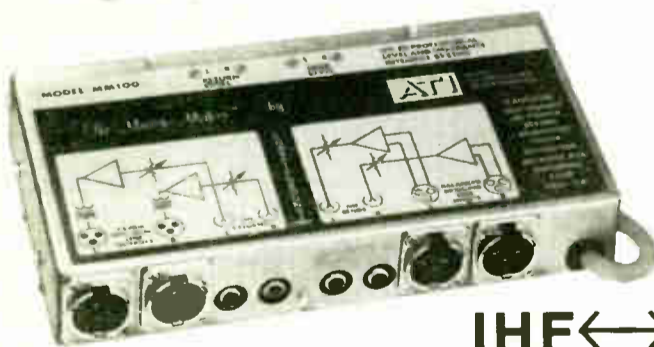
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# RBDS Takes Center Stage at Las Vegas WCES

► continued from page 1

One theory suggests that AM stereo floundered in the marketplace for more than a decade because of confusion over whether stereo transmission should build the demand for AM stereo receivers, or whether manufacturers should first produce radios to give broadcasters a reason to transmit in stereo.

There was a concern early on in the RBDS standard-setting process that the same thing could happen to RBDS. But Shapiro said manufacturers are already building radios, and are committed to RBDS. Radios displayed at the RBDS exhibit included Delco, Denon, Sony, Philips, Blaupunkt, Grundig, Kenwood and Onkyo.

Among automobile manufacturers, RE America's Andy Bosworth said Honda, Toyota and Ford have expressed interest in marketing RBDS radios.

Because most receiver companies already produce RDS receivers for the European market, production costs will be less than if it were a brand new technology.

One likely change from the European-spec radios will be a switch from LED to dot matrix displays, since text functions will be key to U.S. success.

## RBDS-equipped cars

Philips said it already has two RBDS models on sale in the U.S. Denon plans to market its receivers in March, according to Denon of America President Robert Heiblim.

Initially, RBDS will add about \$50 to a receiver's price, and will be included only in high-end models, Heiblim said; but with market success, the cost will come down.

Axcess Paging said it has a supplier that is developing a compact RBDS decoder/FM stereo decoder receiver chip set that can be produced for \$10.

Heiblim said he expects 10 percent of broadcasters to be on the air with RBDS by 1994.

Others at the show agreed that RBDS is likely to succeed with broadcasters. One broadcaster said as soon as one station in a market goes on the air and is able to transmit its call letters, the competitors will want to do the same.

Currently, there are about 50 stations on the air using RBDS. Many of the stations, however, have been given encoders. EIA actually bought the encoders for the Las Vegas stations, which will continue to broadcast for the RBDS promotion during the NAB convention in April.

## AM and ID Logic

During an RBDS workshop, NAB Manager of Technical Regulatory Affairs John Marino said RBDS is a "fascinating" technology with a lot of potential uses for radio stations at a "marginal" cost.

Broadcasters also worked hard to provide AM with some benefits of RBDS, he said. Since RBDS does not work on AM, part of the standard included a provision for adding ID Logic B to receivers. ID Logic B

enables receivers to scan stations by format like RBDS, but instead of a receiver looking for a broadcaster format code, the unit scans from an internal CPU with all U.S. stations programmed in.

Because formats and call letters change so frequently, however, RBDS advocates said that a designated FM RBDS station could be assigned to update ID Logic B receivers in each market.

In an attempt to counter the impression that ID Logic is just for AM, developer Pierre Schwob said that ID Logic works for both FM and AM, and can be an "interim step" for listeners to enjoy format scanning until large numbers of broadcasters are on the air with RBDS.

The only chink in the RBDS armor at WCES appeared to be confusion over what

to call the radios: RBDS or RDS.

During NRSC RBDS standard deliberations, receiver manufacturers argued that since they already make radios for Europe with the RDS logo affixed to the face plates, they do not want to retool to add "RBDS."

The consensus, according to NRSC members, was to call the standard RBDS and call the radios RDS. However, most people in the industry are calling them RBDS radios. At the RBDS press conference, several presenters said both acronyms, sometimes catching themselves and sometimes not. The EIA press releases even made reference to "RBDS radios"—not RDS radios.

NAB's Marino admitted the confusion could cause some problems with product identification for consumers and dealers, but the RDS tag for receivers and equipment may soon catch on as the talk of the standard diminishes.

# SW56, ISDN Lines for Backhaul

► continued from page 7

tem, broadcasters need several pieces of gear at both ends of the line. A codec provides analog-to-digital/digital-to-analog conversion and bit reduction of the audio signal. A CSU/DSU (Channel Service Unit/Data Service Unit) box terminates the signal from the phone carrier, and a v.35 data interface cable connects the codec and CSU/DSU.

CSU/DSUs are available through a number of companies, including Motorola, AT&T and INC, and are specific according to the SW56 service provided, whether its four-wire, two-wire or dedicated.

For stations fortunate enough to have access to ISDN service, a terminal adaptor is required in place of the DSU, according to Bob McCarthy of AT&T. "The terminal adaptor is simply another form of DSU that uses a different signaling protocol—the ISDN protocol," he said.

Can a two-wire SW56 call a four-wire, or an ISDN? These various forms

of digital telco can communicate with each other, said Dan Joffe of INC. Joffe's company supplied the CSU/DSU equipment needed for the NBA's mixture of Switched 56 and ISDN backhaul lines.

"We've had few problems," Lane concurred, who ordered 82 lines for the backhaul and experienced only one failed line and what he has surmised as power glitches on two others. "Out of 82 lines, that's not too bad. I had similar experiences with broadcast loops."

He's also impressed with the quality of the lines, stating that "Switched 56 sounds natural."

Although stereo and wider bandwidths are not yet practical over a single SW56 or ISDN channel, according to APT's Smyth, transporting high quality audio over several lines is possible. Advances in synchronizing technology at the codec end, he said, now make it practical to deliver almost limitless bandwidth over several synchronized lines.

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# 1993 NRB Convention Moves to Los Angeles

by Pamela Watkins

**LOS ANGELES** The National Religious Broadcasters (NRB) organization celebrates its 50th annual convention and exposition in the City of Angels, Feb. 13-16.

The NRB will be in Los Angeles for the first time, holding its convention at the newly refurbished Los Angeles Convention Center.

The NRB saw the need for change when it planned its convention roster two years ago. "Los Angeles is our first move in the new mode. In 1994 we're back in Washington; 1995 we're off to OpryLand (Nashville) and 1996 will find us in Jerusalem," NRB Executive Director Brandt Gustavson said.

In 1943, the NRB held its first convention in Washington, D.C., and it has been the convention's home ever since, except for one year, 1967, when it ventured to Chicago during a raging blizzard. The NRB went back to Washington, D.C. the next year and stayed.

## Traditional theme, new location

Gustavson conceded that the nature of the NRB convention will change in Los Angeles because in Washington, government involvement played an important role. In fact, Presidents Reagan and Bush have spoken and members of the FCC and Congress have participated in past D.C.-based NRB gatherings.

While in Los Angeles, the slogan "We Proclaim Christ" will continue the thematic tradition of past NRB conventions, but the involvement of Hollywood also will play a substantial role. Stars such as Angela Lansbury and Charlton Heston, who have produced wholesome programming, will attend either the general Sunday night session—"Hollywood Night"—or the Tuesday morning All-Media Breakfast.

"I think too often there's a lot of bashing of what comes out of Hollywood, but there's plenty of good, too," NRB Director of Conventions Michael Glenn said. "It's a good opportunity for us to utilize the expertise of people who are based out there.

The locale change, however, has created some anxiety regarding the religious market niche as well as the challenge of making the convention cost effective.

Of the NRB's 200 exhibitors, 20 percent are equipment manufacturers primarily from the East Coast. Some see the change of locale as drastic.

According to Jon Clark, marketing manager of Shively Labs, the new locale presents a doubled-edged sword. Aspects such as the newness, one hall instead of three for all exhibitors, and some new faces are positive.

## Fresh faces, but...

Radio Systems President Dan Braverman agreed that a new location can be refreshing. "We are looking forward to possibly meeting some new customers who never made it out to the East Coast..."

The less positive edge of the sword for manufacturers is the tradeoff between attending the show and time spent away from the company. Even though equip-

ment shipping and airfare will increase expenses 20 to 30 percent, "it's the cost in time that's hard to put a dollar value on," Shively's Clark said.

Radio Systems' Braverman said his sales staff is "concerned that the attendance, which has always been great (in Washington), will not be as good" in Los Angeles.

Gustavson disagrees that attendance will be a problem. According to his preliminary estimates, approximately 7,000 peo-

**Gustavson conceded that the nature of the NRB convention will change in Los Angeles...**

ple will be in attendance during the four days. After all, he said, "the main reason we're going to California is because it's the largest state for membership."

While Gustavson speaks in terms of religious organizations' membership, Glenn said that those exhibitors who drop out from the East Coast will be offset by new ones from the West Coast.

## Some new equipment

Despite their concerns, equipment companies said they plan to present their full range of bells and whistles at the Los Angeles Convention Center. For example, Cablewave Systems' Meola said the company plans to display newly designed low power TV antennas, standard coaxial products and their full line of FM antennas.

Radio Systems' Braverman said his company's full line will be showcased, including customized DAT machines, cart machines, new Dolby products and timer products such as a new digital micro-processor timer.

"It's a microprocessor-controlled, full digital master timer and clock system for timing applications," Braverman said.

Shively Labs will focus on the importance of translators in the religious community. "A lot of what's going on in the industry right now is the translator market," Clark said, "and there's a lot of activity in the religious community with FM translator stations, so we will focus on our translator Model 812."

Even though Shively Labs will focus on the FM translator market, the high powered RF transmission equipment will not be left out, Clark added. "A multistation combining unit and antenna which, for example, can take nine full 100,000 watt stations in Miami, Fla. and combine them all so that they use one run of transmission line and one common antenna...will also be displayed."

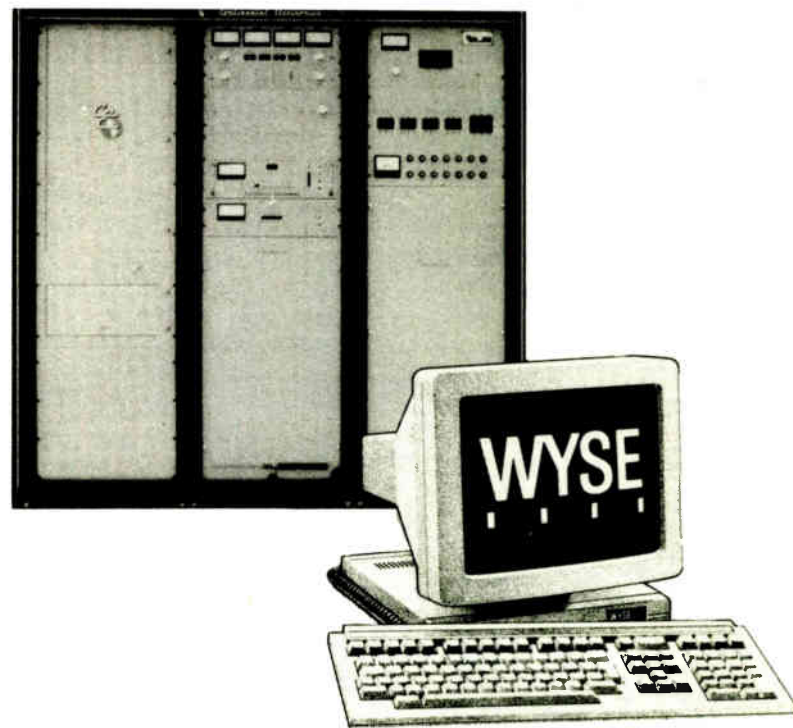
With any change in a trade show, pluses and minuses relating to cost effectiveness abound. However, many NRB exhibitors said the key is to keep yourself focused on your main reason for taking part in the show.

"The NRB is really the only opportunity we (Shively Labs) have as a manufacturer to address this market in this kind of concentration. It is a market segment; it is a very close-knit market segment, and it's valuable to us," Clark said.

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## Q-TIPS

# Enhance Your Knowledge by Teaching

by John "Q" Shepler

**ROCKFORD, Ill.** What's the best way to learn something? By teaching it to someone else.

Conventional wisdom tells us that such a notion is all backwards. After all, first you must learn. Then you must master the subject thoroughly. Finally, you are qualified to teach.

Another line of reasoning suggests that you only really understand the material when you can explain it to someone who knows little or nothing on the subject. If you doubt this, try explaining how the transmitter works to an inquisitive child. Do they understand? Have them explain it back to you.

## Know the material

My personal experience with the world of teaching began when I was asked to teach a night course in micro-processor electronics for associate degree students. I thought I knew the material fairly well. After all, I had taken the same course myself a couple of years earlier and had been designing circuits and programming ever since. I was pretty confident. Confident, that is, right up until I started presenting the material.

The difference between reading something and thinking you've got it, and

really having it down cold can be quite a gap. You realize this quickly when someone pipes up: "Hey, how did you say that interrupt is enabled? Is there a step missing here or what?"

## Teach and be taught

Teach a course and you will learn things you never saw in the text. Things that were there all the time. If your students don't point them out, you'll find them while you dig for the explanations.

Teach a course and your students will teach you. What's even more ludicrous is that they'll pay you to learn. The pay can even be as much or more per hour than you're earning now. Sounds interesting, right?

A little known gold mine of wealth and knowledge is the community college system. These are the two-year degree schools. They often offer non-credit adult education courses as well. What you might not know is that you are probably qualified to teach there.

The most important qualification for a part-time instructor in a technical field is the competence that comes from experience. Degrees and teaching credentials are secondary. You need to understand your subject. You don't need to be an authority.

As a part-timer, you are paid by the course. A course may run two nights a

week for 15 weeks. The school provides the text, the students, the classroom and the lab. You walk the students through the material, give the exams, conduct lab sessions if appropriate, and provide grades. You also get to participate in group discussions and show off at the blackboard.

Unless you're terminally shy, don't be in the least intimidated. The students will certainly know less than you do. They're a bit intimidated themselves and are looking more for a sympathetic instructor than razzle-dazzle entertainment. No need to rehearse for class.

## Tricks to make it easier

I found the toughest part was preparing the lessons for the first time. The trick, I discovered, is to follow the organization of the text book. Each chapter is one or more class sessions. You need to stay at least one chapter ahead. As you read the material, highlight the points that you'll emphasize later.

Multiple choice tests are the easiest to grade, so stick with those if you can. Try to hit the main points that students will use in their careers. When you need to give story problems or essays, make them interesting. It's a lot more fun to design a rocket launcher than just a timer that counts down.

Electronics and computer courses generally have lab sessions. These can be incredibly boring or mentally challenging, depending on how you run them. My vote is for interesting labs that try to mimic some of the problems that you might run into on the job.

For instance, you can have the micro-processor add a bunch of numbers—and meanwhile put everyone to sleep. Or, you can have the students build a reaction timer, a stopwatch, a 24-hour clock, a street light, or even an automation sequencer. Present a practical

problem to be solved and let them rack their brains for the solution. You'll probably get several different, but equally correct approaches you didn't even consider.

In classwork as well as labs, participation is the key to interesting classes. You lecture a bit and then discuss a bit. You may find that you only need to steer those discussions to make sure all the topics get covered. If things slow down, you'll need to rev them up again.

## Applies to almost any topic

My own experience has been with circuits and programming, but there is no reason the same techniques won't work with a course on radio production, copywriting, selling, or even financial management. You simply need to set up a class situation that gets the students actively doing what they are supposed to be learning. After they write that first program or cut that first commercial, they'll provide their own motivation.

Must you use a text? No. If there isn't an appropriate book available, you'll need to make up your own lesson outlines to provide some structure and direction to the classes. What's important is deciding what you want the students to know when they are done and then leading them to it by steps.

Another point about students. Some will be natural superstars. Keep your eye on the more talented and enthusiastic ones. You could be secretly auditioning prospective employees.

Is teaching fun? You bet. It's also a lot of work the first time through. After that, it gets easier. And remember, you also gain the benefit of being paid to sharpen your own trade skills.

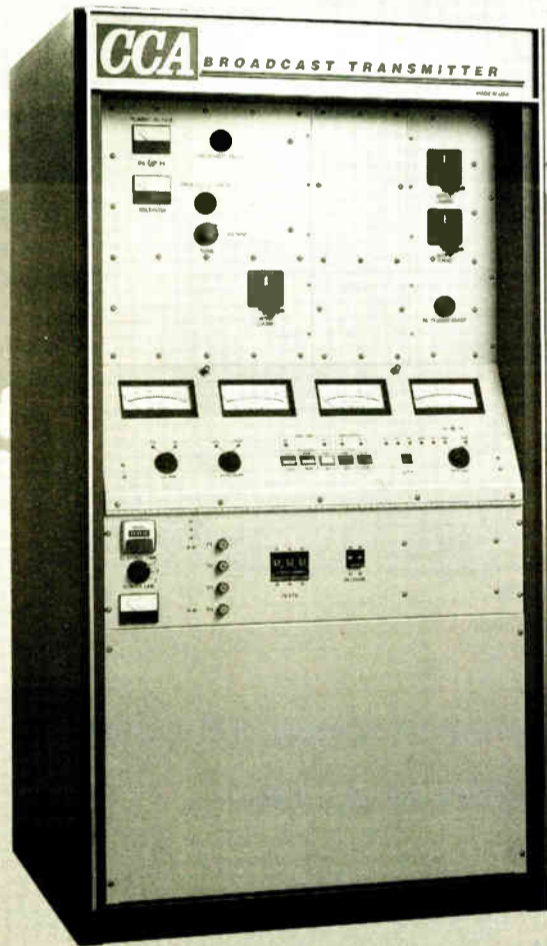
Teaching. It's a bit of professional moonlighting you should seriously consider.

□ □ □

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

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Not to mention that they're inexpensive, and available in eight channel, stereo or mono models.

Come to think of it, there is a lot to say for a Radio Systems DA.

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*This Auditronics 210-18 in KPFA-Berkeley's on-air studio is one of four 210s in use at the Pacifica Foundation station.*



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World Radio History

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## **...LOCAL SOURCE AUTOMATION, DIGITAL PRODUCTION, AND FULLY INTEGRATED OFFICE SYSTEMS!**

By John Schad, President,  
SMARTS Broadcast Systems

We've added a new product to our stable of digital devices that prove valuable to the broadcaster. We now have a unit that can do inexpensive digital production and editing in the production or newsroom, and still be a part of the overall SMARTS system that runs your radio station.

The digital editor can be used in a number of ways. You can hook it up like a tape recorder to your production board, and use standard production techniques to dub into the system. You can make it your production board, and in effect, create a small production room inside a computer. You can plug in a couple of high level sources (CD players, cassette decks, etc.) and a microphone directly to the editor, mix the sources with a control board that shows up right on the screen, and accomplish much of the simple production need for your spots without the need of any other mixing device.

The fun really begins, however with the digital editor. You can record the music background as an audio file, edit it, change levels, rearrange it, insert echoes, reverbs and other effects, then record the announcer on another file. Finally you can slide the two together with a computer mouse to produce a finished spot, and rearrange it digitally if you don't like the results.

The final copy transfers effortlessly to your on air SMARTCASTER. This unit can be set up live, with satellite automation, or even CD automation. The CD Jock-In-The-Box is the most up to date system on the market. Carl Wilson of KLDK Radio in Grants Pass Oregon bought the first one we made. Carl writes "After six months on the job, the SMARTCASTER Jock-In-The-Box amazes me! We're running a full time FM station with 2 employees, and yet we're playing the music that *We* want to play. The station is as local on automation as we want it to be. It's as live as our live hours are!"

And Carl is right. The music is all on CD, the music mix is done internally in the system by our own music software. You retain total control of everything involved in your format.

Of course, other stations prefer to let the satellite networks do the work. In Mt. Pleasant, Texas, Bob and Donna Hill at KLAQ Radio called recently and left a message in our overnight voice mail. Bob said that KLAQ wouldn't be there if it were not for SMARTCASTER. Bob's an old customer, but recently upgraded to our simultaneous record playback model, and said it hasn't missed a beat since it was installed.

And that brings up the whole

story of simultaneous record playback. BUYER BEWARE! If you are using a digital automation system, and want to record at the same time that you are using that system on the air, you have to do at least 3 things simultaneously to make that happen. First, you have to be able to record, secondly you have to be able to play back audio, AND THIRD, YOU HAVE TO KNOW THAT IT IS TIME TO PLAY BACK AUDIO! You wouldn't believe the systems out there that claim simultaneous record playback that do indeed record at the same time they are playing back, but they miss satellite breaks, or the end of local sources because they ARE NOT LOOKING FOR CUES FROM THE SATELLITE OR AUTOMATION SOURCE! You have to listen to the net signal and manually fire the break, because the system doesn't do it for you. SMARTCASTER DOES! We record, we play back, and we look for relay closures from your satellite or source, all at the same time. You can be recording spots while your unit is digitally accessing CD players, or firing network breaks, IDs, liners or jingles. It also does all this while it transfers information from the new digital editing system!

Of course we round out our products with our SMARTS billing, accounting and traffic systems. It's interactive to the SMARTCASTER and handles all the paperwork, from order entry to logs, billing and co-op affi-

dvits. The keystrokes inputting data from the traffic order are the same ones that ultimately put the spot on the air!

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# Running Radio

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**Promo Power:**  
The ABCs  
of promotion,  
page 17.

## Research Firms Focus on the Listeners

► continued from page 1

When typical radio formats and promotions are tested, "they get a great big yawn, particularly among 18-to-34-year olds."

This urge to veer away from the norm has led stations to strive to become unique, he added.

"This translates to a wonderful world of opportunity tempered by peoples' ability to be creative," Bolton said. "The key element for success is to understand what listeners want and what their needs are."

### New doors are opening

Bolton envisions a trend toward new radio formats and combinations, some of which are already forming. Examples include Rock and Adult Contemporary music combining to form Rock/AC, Country and Classic Hard Rock forming Young Country and News and Talk radio moving onto the FM dial.

One way Arbitron hopes to discover the types of radio stations people are interested in and which stations people listen to is through its new Pocket People Meter, set for use by Fall 1994 (see *RW*, Jan. 20, 1993).

The meter is a device people will carry with them for a week while it electronically measures coded station signals.



Dan Vallie, of Vallie Consulting

zo, the VP of marketing group research and consultation at Frank N. Magid Associates.

And with a greater emphasis on research results, the business is becoming more finite and dynamic, Biancuzzo

implement a newly-developed format because "by the time it's put on the air, others are already jumping on the bandwagon."

Results from the same in-house survey show the four top areas of research by the executives to be, again in order of importance: format research, music testing, marketing and positioning with listeners, and sales research.

On the sales side of research, there is more of an emphasis on the advertiser perceptual study, said Jon Coleman, president of Coleman Research.

Studies like these study measure advertising perceptions of radio stations, and help to direct the sales effort, he said.

"They look at perceived rates, perceived professionalism, perceived audience value," Coleman said. This helps researchers determine why advertisers choose to buy or not buy time at differ-

ent radio stations.

About 10 years ago, such research happened only a few times a year. Now, 10 times that amount is the norm, Coleman said.

Dan Vallie, president of Vallie Consulting, said his research has led him to witness a trend in listeners of all age groups toward the real, natural, general type delivery of radio versus the hype of a few years ago.

"The very aggressive, in-your-face attitude of the late 1980s...has burned out," Vallie said. "Today, people are more focused on reality and what's genuine."

Vallie added the key to getting useful responses when doing research is in "not only getting answers, but asking the right questions."

And unless broadcasters find a way in getting the research to "come off the pages and through the speakers," listeners won't be able to relate, Vallie said.

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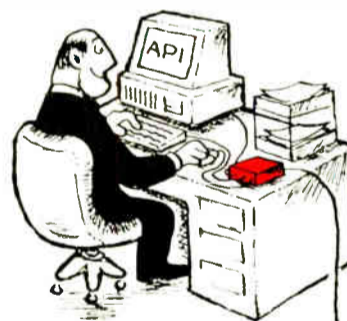
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## Spectrum Research

**ARBITRON**



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*Vallie*

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Frank N. Magid Associates, Inc.

said Jay Guyther, VP of radio sales and marketing for Arbitron.

"There's very little, if any, activity on the part of the participants other than to carry it with them," Guyther said. "It changes the whole perception of aided versus unaided recall."

The device is designed to pick up a radio station's signal, no matter whether the person is at home, work or in the car.

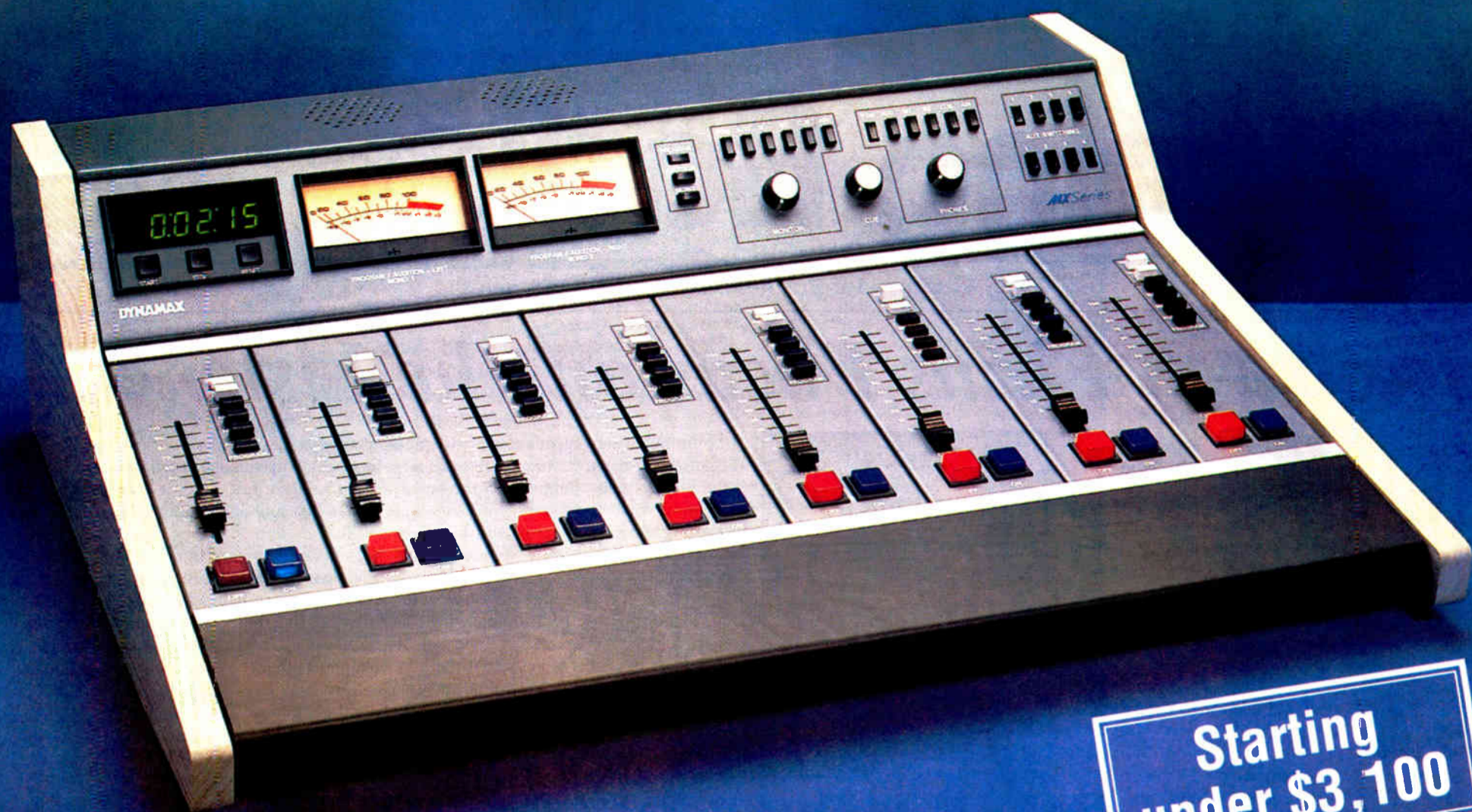
Although programming research of this nature has been conducted for years, the importance stations have placed on it has recently increased, said Frank Biancuz-

zo. The types of managers stations hire will change to reflect the station goals, he said.

### Some driving concerns

During 1992, Frank N. Magid Associates conducted a survey of executives from the 50 top radio markets. Results of the survey showed their top four issues, in order of importance, to be: format similarity, decreasing revenue, lack of in-house expertise and attracting new listeners.

Biancuzzo said a station should quickly



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## TECH TALK

# Reap the Financial Benefits of RDS

by Judith Gross

**EAST ROCKAWAY, N.Y.** RDS is here—are you ready for it? Thanks to final agreement on a transmission standard, as well as early enthusiasm from receiver manufacturers, this will *not* be another AM stereo.

First, though, there needs to be a little clarification about RDS technology. For starters, what is the difference between RDS and RBDS? And what about AM stations?

## A technology and a standard

Radio Data System, or RDS, was the original name of the system adopted by European broadcasters and is still used to refer to the technology itself. You will most likely hear the term "RDS" used when talking about receivers, station equipment and the system in general.

RBDS (Radio Broadcast Data System) is the name given to the transmission standard adopted by the National Radio Systems Committee (NRSC) and approved by broadcasters and receiver manufacturers who participated in the process through the NAB and the EIA.

That's right, RBDS is a transmission standard. Like the NRSC AM standard, it defines how FM stations will transmit RDS information through the 57 kHz subcarrier of their signals so it can be

decoded by compatible radios. RBDS is not a receiver standard.

In fact, including RDS in receivers is wholly voluntary on the part of receiver manufacturers. But the major players in both the car and home receiver companies are showing some real support for the system, so getting receivers into listeners' hands shouldn't be a problem (more about this later.)

Because it uses an FM station's 57 kHz subcarrier, an AM station can't broadcast the RDS information. Included as part of the RBDS transmission standard, however, is a way for AM stations to take

they make for cars and home. Panasonic is one company that already markets an ID Logic receiver.

AM stations will have to get their format information to a designated FM in the market so it can be detected by ID Logic receivers and allow AM some of the same features enjoyed by FM stations which have gone RDS.

## The benefits of RDS

There are a number of benefits a station can enjoy by going RDS. First, it allows a listener to tune to your station by format, according to an agreed-upon list of U.S. radio program format codes (see chart).

There also is an eight-character alphanumeric code which a station can use to identify itself. "Hot 97" can scroll across the RDS radio's display, which could be a real boost around Arbitron time.

RDS receivers have a traffic and other emergency alerting feature. Better traffic information, sure, but the best part about it is the way it will actually switch from a cassette back to your station when the message is broadcast. Not exactly a "captive" audience, but very, very close!



RE's 531 RDS coder

advantage of the station tuning-by-format feature by using ID Logic, a receiver-based technology.

ID Logic is a voluntary feature, and it will be up to individual receiver manufacturers to include it in the RDS radios

There is an income potential from RDS as well. One way is with paging. RDS has its own paging capability built right into the system, and Axxess (504-832-7927) is one company making RDS paging equipment. Extra revenue can come from leasing RDS paging capacity, and you don't have to give up another subcarrier to do it.

Radiotext can be important too. Studer-Revox and Denon have already announced radiotext receivers. These are home receivers (for safety reasons they are not recommended for cars) which expand the alphanumeric scroll display to 64 characters. Stock prices, scores and weather are possible uses, and they could be advertiser-supported, with a brief commercial message included in the scroll.

## Radios are ready

One of the best reasons to convert to RDS, though, has to be the support it has gotten from receiver manufacturers. The Winter Consumer Electronics Show in Las Vegas served as the introduction of the technology to the general public, with various receiver manufacturers displaying actual RDS radios.

In addition, eight Las Vegas FMs were broadcasting with RDS during the show; the city adds its FMs to the 45 stations already broadcasting RDS in the U.S. right now.

Car radio makers Delco and Ford, and major consumer electronics giants Matsushita, Sony, JVC, Kenwood, Pioneer, Alpine, Blaupunkt and Denon are among those ready to market RDS to the listening public.

continued on page 22 ►

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World Radio History

USAirplay

# Primer Published for Radio Wanna-bes

by Charles Taylor

**WASHINGTON** For broadcasters just getting their feet wet in the expanding global pool of radio broadcasting, a new textbook is available that may take some of the mystery out of a profusion of essential topics, from format selection and dayparting to self-promotion and the role of research.

"Radio...the Book," written by 30-year radio veteran Steve Warren, is tagged by the author as "a fun, practical programming manual and idea book for program directors and operations managers."

In it, Walker takes a basic and personal-

ized approach to building a career in radio, beginning with how to get your start in the business, to formatting and publicizing the station you eventually run.

## Programming philosophy

For experienced broadcasters, it might nudge forgotten practical morsels of programming philosophy—plus it's an entertaining, fairly quick read. Warren also recommends the book for college students and those who are associated with the industry but are not hands-on in programming: advertising agencies, station managers and radio station sales staff, for example.

"It synthesizes into the pages of the book all of the basic aspects of radio programming, either for people outside the business who want to get into it, or for people in the business who want to broaden their existing knowledge," Warren says.

Among the issues taken on by "Radio...the Book" is station image. A consistent, clear identity for listeners is mission number one, according to Warren. Develop and utilize slogans and ways of doing things so that people hear familiar programming elements every time they tune in, he recommends. "A station identity is the one thing that when people see it or hear it or think of the call letters of the radio station, they essentially (have) a snapshot of the station itself."

Ways to embody an identity include slogans, phrases and consistent terminology in newscasts and announcer material. All of these elements should be duplicated in outside advertising and promotion as well.

## An integral ingredient

Self-promotion is an integral ingredient of the successful station. Warren offers a number of pointers on getting your station identity on the streets—with little or no money, at that.

First, and perhaps most important, use your own airwaves to publicize your station. "A successful radio station is always talking about itself," Warren says. "Several times each hour, radio personalities, around the clock, need to be reinforcing in the listener's mind all the promotable aspects of the station," including programming features, outside promotions, contests or services the station performs.

Another economical way to publicize the station is to participate in (and sponsor on-air) events already taking place in the community. Once there, keep your station personnel in the spotlight with name tags and your news team noticeable with call letters on their microphones.

Promotion through other media also is encouraged. Options include print, television, outdoor (billboards, bus sides, bus benches and subway station boards) and direct mail.

Of course, in order to successfully promote your station, what an audience hears 24 hours a day must be worth listening to. Correct rotation of music ensures that the distinct kinds of music and artists within the format all are given their fair share.


"The preponderance of today's radio stations classify their music by era, exact year and chart positioning. None of these relates to the sound of the song," Warren says. "What does...are its sound qualities, which include tempo, instrumentation, male, female, group, vocalization and the subclassifications having to do with the music style." Time targets, dayparting and market research all play into the successful programming of the station.

The book goes on to tackle such radio station particulars as arranging meetings between air staff and programming persons, vacation policies and even studio manners. He also encloses a stack of sample operations forms.

Warren closes by advising, "Creativity, persistence and direction always contribute to radio station success. Internally, we deal with personalities, systems, budgets, temperaments and deadlines. Externally, we have to sell our 'act' to the audience in measurable numbers by paying attention to their needs, and by persuasion or cleverness."

"Radio...the Book" will be available for \$39.95 at the National Association of Broadcasters (NAB) show in Las Vegas, Nevada in April. Copies also are available from the author.

For information on "Radio...the Book," contact Steve Warren at 21-54 44th Drive, Long Island City, N.Y. 11101; telephone: 718-786-3703; fax: 718-786-3870, or circle Reader Service 31.



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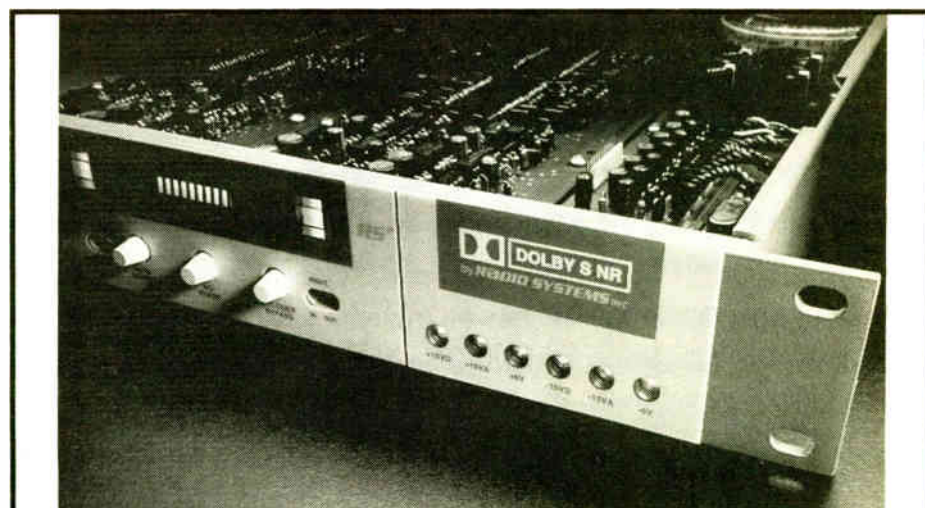
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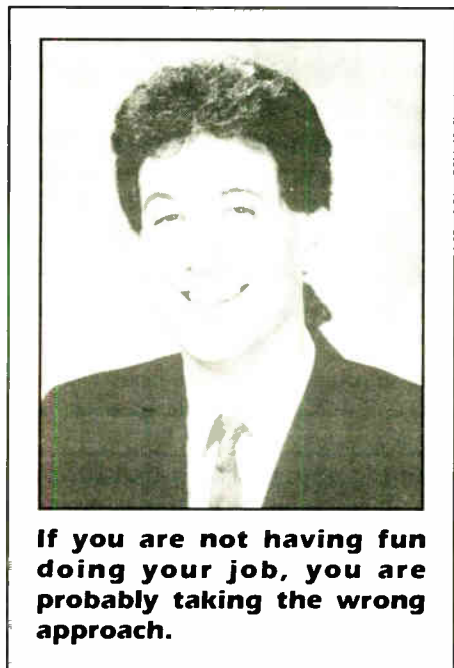


PROMO POWER

# Organization Is the Key to Success

by Mark Lapidus

**WASHINGTON** Who gets over 50 calls a day, juggles a dozen events and contests in various states of completion



**If you are not having fun doing your job, you are probably taking the wrong approach.**

sponsors so that at one glance you will know what to promote with on-air live liners and recorded promos.

If there is a salesperson involved in the activity, include his or her initials next to the listing so you'll know where to go with questions. Have at least three months worth of calendar prepared so that you will be able to gauge busy or empty periods and prevent scheduling conflicts.

Everybody at the station should receive an updated weekly copy of this calendar. Your salespeople should take it along on appointments so that they will know if the station is available for appearances, contests or promotions at any given time.

How do you compile this calendar? Any full-page monthly calendar that has a lot of daily space will work. You can write it out manually, use a typewriter with a small font, or, if you have a Macintosh computer, CE software has a great program called "CalendarMaker." Reach them at 515-224-1995. The more details you are able to fit into each day of the calendar, the more useful it will become to you and your staff.

If you don't have a dayplanner, stop reading right now and go get one. *There is no excuse not to have a dayplanner.*

Any type of dayplanner is OK as long as you have enough space each day to enter

the following: 1) your appointments; 2) the tasks you hope to accomplish for the day, and 3) names and telephone numbers of people you must call.

At the end of the day, look over tomorrow's date to see what you have scheduled and make necessary adjustments. Transfer anything you didn't do today to tomorrow's page. If you have transferred an activity more than once, ask yourself why you are procrastinating.

**Log every phone call**

*Keep a phone log.* Don't use your day-planner to keep track of the messages you have received. If you are part of an active station, you'll run out of room and you'll never have space enough for notes. The only numbers listed in your dayplanner should be for those people you need to call, not the numbers of people calling you.

continued on page 22 ►

UPLINK

## Services for Stations Offer Ease and Flexibility

by Karl Baehr

**ALBUQUERQUE, N.M.** Welcome to a new year of Uplink. The purpose of this column is to provide helpful information to satellite broadcasters. The responses we have received so far have been positive, and I thank you for that.

I would like to take this opportunity to thank the co-author of *Uplink* last year, Harry Nelson. As a network executive at SMN for nearly 10 years, Harry's input will continue to be valuable as we address a variety of topics this year.

**Products of note**

In this installment I would like to share a few new products and services I ran across last year that may be of interest.

**The Super Gospel Country Radio Network** offers a unique "Christian Country" format via satellite. The network began full time operations in August of 1992 and currently has 36 affiliate stations on line. The format features both Traditional and Contemporary Christian country music. This might be a nice AM compliment to an FM Country sister. Call Jim Black for more information at 800-877-1950.

The Skylight Satellite Network provides a 24-hour, "Inspirational MOR" music intensive format as well as a news service. Skylight is currently carried on approximately 150 stations and an additional 70 translators. For more information, contact Wayne Pederson at 612-631-5000.

**Xpedite Systems Inc.** provides a unique information distribution service called "FaxCast." FaxCast allows you to set up "lists"—which could be advertisers, agencies, reps, other stations, networks, trade publications, newspapers—and send faxes to these lists individually, or as a group. FaxCast has many customizing options ranging from complete "mailmerge" letter capability to a simple "Header" at the top of each page that will tell to whom the correspondence should be routed.

We use the service here at KBE as a means of keeping in touch with our clients, as well as the industry at large. Also, if you call Karin Seidel at Xpedite

and mention KBE, you will only be charged for usage, no activation fee or maintenance charges! Are we nice guys or what? Karin's number is 212-594-7979.

How would you like your own magazine for your station? "On The Air" magazine offers a unique promotional item to classical music stations. "On The Air" is published monthly and is customized with a 24-page insert for your station. The magazine can be a revenue generator. Local advertising can be sold for the insert section.

Your station can also sell subscriptions to your localized version and the magazine takes care of all the mailing chores for you! Our client KRTS "The Voice of the Arts in Houston" turned us on to these folks. For more information call Chris Mohr at 800-473-2224.

How many of you occasionally have questions regarding rating performance and specifically, diary returns? If you want to make sure that you are getting

continued on page 18 ►

and has to give three salespeople great ideas in the next 30 minutes? A radio station's promotion director. Are promotion directors well organized people? They had better be!

Most top-rated major market stations have full-time promotion directors. At many stations in small and medium markets, promotional activities are executed through the program director, sales manager and sometimes the owner.

Regardless of your promotion person's title, only planning and organization will help him or her succeed in the long run. Since we are now well into the first quarter, here are a few tips that will make 1993 a more productive year.

**Plan ahead**

*Use a calendar.* Devise a promotion calendar listing all of your station appearances, remote broadcasts and contests. Include any special program listings with

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Please circle only one entry for each category:	
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D. Combination AM/FM station	F. Recording Studio
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<b>II. Job Function</b>	
A. Ownership	G. Sales manager
B. General management	E. News operations
C. Engineering	F. Other (specify) _____
D. Programming/production	
<b>III. Purchasing Authority</b>	
1. Recommend	2. Specify
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# STATION SERVICES

News and Services for Business, Programming and Sales

## Actual Radio Measurement Service Expands

**ALBUQUERQUE, N.M.** Broadcasting by Design established quarterly surveys of its Actual Radio Measurement Service (ARM), in Dallas, Houston and Albuquerque. ARM, which began commercial operation last year, was originally developed by radio station owner and broadcast engineer George Chambers.

ARM survey units can detect the frequencies a car's radio is tuned to. Sample sizes are approximately 16,000 for a seven-day period.

For more information on ARM, contact Richie Faris at 505-888-1372; or circle Reader Service 40.

## Future Primitive Designs Radio-Related Miniatures

**N. HOLLYWOOD, Calif.** A line of decorative jewelry, in designs including miniature musical instruments, microphones and VU meters, is available from Future Primitive for use as station promotional items. The microphone replicas are authentic in detail, down to switches, XLR connectors, and mic stand brackets. The VU meter pin is also an authentic miniature recreation of a standard audio voltage unit meter.

Depending on the item, the designs are either stamped or cast from metal; color

is applied to the miniatures using either electroplating or vitreous enameling. The Future Primitive jewelry miniatures are available as pins, earring, keychains and necklaces.

For information, contact Susan Michelson at 818-766-3700; or circle Reader Service 168.

## NAB Publishes Revenue Workbook

**WASHINGTON** "Predicting Radio Station and Market Revenue" is available from the National Association of Broadcasters. The book, written by George Nadel Riven, CPA, of Miller Kaplan Arase & Co., explains how to generate reliable estimates of revenue.

The book explains two different methods of calculating radio market revenue potential, focusing on such variables as

demographics, other types of media, competition and seasonality.

For information, contact NAB Services at 800-368-5644; or circle Reader Service 75.

## Radio Broker Merges Company

**CHARLESTON, S.C.** Radio and television brokerage Gordon Rice Associates merged with business and real estate brokerage MLN Inc. The new company, MLN Inc., hopes to become a "one-stop shop" for those interested in investing in TV or radio.

The Gordon Rice Associates office located at Hilton Head Island, S.C., closed on Dec. 31, 1992.

For information, contact Kelley Lanigan at 803-577-2000; or circle Reader Service 17.

## Katz Radio Group Analyzes Hispanic Market

**NEW YORK** Katz Hispanic Radio released the 1992 update of its "Reaching the Hispanic Consumers Through Radio." The presentation was prompted by the 1990 Census results showing that the Hispanic segment of the population is growing eight times faster than all other segments.

Among the topics addressed in the presentation are: How to choose market; how to allot budgets, and a description of media consumption by the Hispanic population. The presentation is available at no cost to agencies, advertisers and Katz Hispanic radio clients.

For information, contact Janet Therrien at 212-424-6253; or circle Reader Service 22.

## Services Offer Ease of Usage

► continued from page 17  
proper credit in your market during a survey, you may want to contact Todd Doren at *Diary Experts*.

For the past 10 years, Todd has helped to make sure his clients are getting proper credit. To find out more call Todd directly at 609-547-3839.

We ran across a hard-drive audio storage system from *Kingdom Technology*

called the "Digital Audio System" or DAS that is pretty neat. DAS uses Digital Audio Labs record/playback boards and can handle several of these. According to Kingdom Technology President David Benoit, the compression program they have developed allows for very high quality audio reproduction.

## Feed management

Kingdom Technology also offers the "Station Controller" for satellite feed management, which can fully integrate with the DAS. Options include a "WVW" Clock that allows a station to manage multiple satellite network feeds and eliminates the need for a network tone decoder. For more information call David Benoit at 800-685-4843.

There are a zillion "motivational" programs, seminars, books tapes, etc., out there. Many are good, some are not. No matter what the program itself entails, there are in my opinion three main factors to be considered: 1) follow-up; 2) follow-up, and 3) follow-up.

We have found (and experienced) the "Bootcamp" offered by Walter Hailey's *Planned Marketing Associates (PMA)*.

PMA provides a unique environment,

qualified and sincere trainers who offer both an enjoyable and effective program that we do recommend. Plus, once you attend a bootcamp, PMA won't let you off the hook! You can expect follow-up phone calls, letters, the works. The message is, "We're here to help you make our systems work. How is it going, what can we do to help?" I like that. Call Donna Beeson at 800-749-7821.

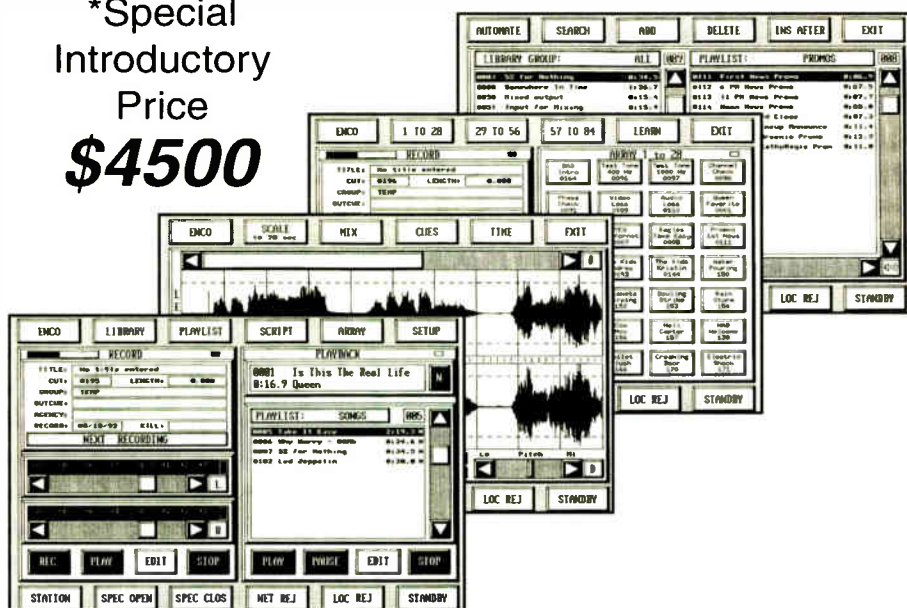
Next time I'll begin a two-part series looking at sales. I invite you to contact me with your station's sales success stories, sales or promotional campaigns that have worked well for your satellite station, questions, comments, or suggestions. Thanks again for a great first year!

□ □ □

*Karl Baehr is president of KBE "Broadcasting by Design," a radio consultancy that provides support services for satellite radio stations. The company also produces the Actual Radio Measurement (ARM) electronic survey system, and is involved in the development of Radio Tropico Internacional, a proposed tourist-oriented satellite radio network in Mexico. Baehr is a former radio programmer and air personality, currently pursuing a graduate degree in Mass Communication at the University of New Mexico. He can be reached at 505-828-0488.*

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**Jim & Deneen Lambley, Owners, KSDZ, Gordon, NE**

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**Gary Hawke, Owner/GM, KSYC/Y98, Yreka, CA**



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**READER SERVICE NO. 124**

## MARKETING &amp; MANAGEMENT

# Explaining the Basics of Marketing

by John Cummata

**ALGONQUIN, III.** Last month, we began the process of evolving your sales people into *marketing consultants*. This month, we'll take the next step, by beginning a series of lessons on just what marketing is and how it works. For starters, marketing is a lot more than just advertising or selling.

According to the American Management Association, "Marketing is the

**When all the marketing components are in harmony, the business will enjoy maximum success.**

process of planning and executing the conception, pricing, promotion, and distribution of ideas, goods, and services to create exchanges that satisfy individual and organization objectives."

In English that means that marketing involves everything from conceiving of a product or service, to developing and producing it, to packaging and pricing it, to advertising and selling it, all the way through to delivering it to the end user. In fact, it goes beyond that, because customer service, product exchange privileges, warranties and so on are all part of marketing.

## Taking off the blinders

When you are involved in selling time or space for a specific medium, it's easy to put the blinders on and see things only from the perspective of "what will convince this prospect to give me his or her money, and buy time or space from my company?" But approaching the prospect as a marketing consultant requires one to back away and see a bigger picture.

The marketing picture contains all facets of a business that can possibly be involved in moving whatever product or service the business sells to the marketplace that buys it.

Other pieces of the picture are: letterhead design; the way the receptionist answers the phone; the yellow pages ad; the displays in the windows (if the company is consumer retail); the way employees dress and behave (if they have customer contact); the name of the product or service; the packaging design; the community's opinion of the business; the business's responsiveness to customer questions and complaints; the product or service price compared to competition; the availability of the product or service throughout the marketplace; the ease of getting the product to the customer's location; payment terms, and more are all part of the marketing picture.

When all these marketing components are working in harmony, the business enjoys maximum success. The problem is that, for most business, these various marketing facets are delivering confusing and frequently cancelling messages to the marketplace.

## Help focus their marketing

One of the simplest ways for your sales people to begin functioning as marketing consultants to your advertising clients is for them to help your clients coordinate these facets of marketing, so their businesses deliver consistent and reinforcing messages to the marketplace.

Let's use a young women's apparel store as an example. Everything about the store should convey the same message to its target market. And every component of that message should be consistent with and reinforce other components of the message. To use advertising jargon, every component of the message leaves an *impression* on the target market, and the marketer gets maximum effect when these impressions reinforce each other.

Think of it like the *frequency* aspect of an advertising schedule. What this means is that the store must have a single marketing theme for its purpose, and everything it is and does should reflect that theme. Let's say that this store's theme is "Bringing the hottest new fashions from around the world to young suburban women 18-to-30, at moderate to upscale prices."

You'll notice that the theme actually defines both the product and the target market. Once the business's theme has been clearly defined, everything about that business must be consistent with its theme.

In the case of our store, its logo design must look young and trendy. The logo and type faces used with it must be consistent on the store's letterhead, its receipts, its newspaper ads, its yellow

pages ad, its bags and wrapping paper and anything else they print.

The logo or slogan must be used in radio and TV ads, and these ads must have the same young and trendy feel to them. The sales people working in the store must be young and trendy, and they should dress in the clothes they sell.

When they answer the phone, they should use the store's slogan, and they should convey a youthful energy. The layout of the store's windows and aisles should be young and trendy, and should include the same logo used in all print ads. It goes without saying that all the clothes they sell must match their theme, and the store's location should obviously be where there are plenty of young and trendy females with money.

As you can see, everything that could possibly make an impression on the store's target market must be consistent. That way, no matter which facet a prospective customer sees, it says the same thing to them. And after multiple impressions of the same message, the concept of "Young and Trendy" becomes synonymous with the store.

In writing this overview, I have simplified the examples, but you get the picture. Functioning as a marketing consultant will, in most cases, simply mean understanding the overall marketing process and using common sense.

Help clients step back and look at their total marketing strategy, rather than just concentrating on a single promotion. Help them see everything their business does from their customers' perspective.

And that's what we'll talk about next month. Focusing on the customer. Because that is the only guaranteed route to marketing success.

□□□

John Cummata is an independent Marketing and Management consultant, and the author of the Sales Machine database marketing course. He can be reached at 708-658-9107.

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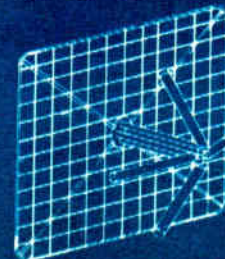
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# Reap the Financial Benefits of RDS

► continued from page 15

As for cost, at first, radios will be about 10-15 percent higher in cost than today's non-RDS radios. But that may get less expensive as chip production increases. The support of car manufacturers is a good sign that receivers start showing up in new models as early as this year.

Probably the strongest single incentive for a station to convert to RDS will come

traffic information, and if they are helping their Arbitron numbers by identifying themselves clearly on a display on the radio itself, your station isn't going to want to be the only one in town left out. So RDS acceptance may be rapid.

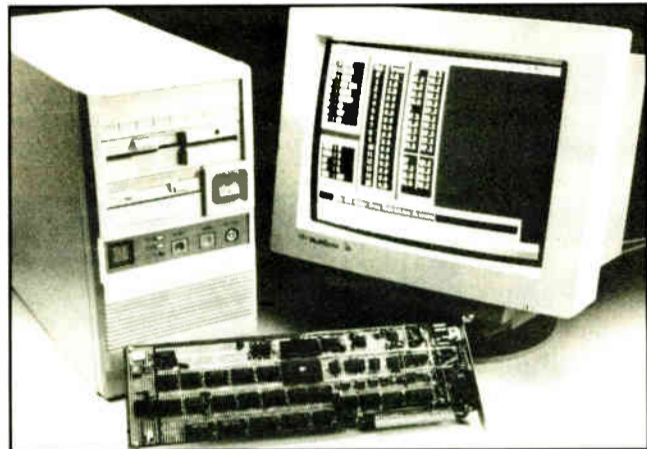
## Simple technology

The technology itself is relatively simple, and a number of companies have been busily marketing RDS transmission equipment. It's subcarrier technology with all the advantages of digital information.

A station basically needs to add an RDS encoder to its transmission chain, just like any other subcarrier generator. Much of the RDS transmission equipment available also includes various control functions and future applications.

RE America (216-871-7617) is offering two medium-priced RDS coders, the RE531 and RE533. The 531 costs around \$5,985 and the 533 about \$2,415.

Modulation Sciences (800-826-2603) is offering the RDS-1, a PC plug-in board for IBM-compatibles and software to



Modulation Sciences' RDS-1 system

about as the radios get into listeners' hands and cars and one or a few stations in a market start transmitting RDS.

If all your competitors are helping listeners tune to their frequencies by punching up a format, and if they are interrupting cassettes or CDs with important

support RDS functions. The software controls RDS functions and provides for paging, radiotext and future RDS applica-

## Extra revenue can come from leasing RDS paging capacity.

tions. The RDS-1 is priced at \$1,750.

Other companies manufacturing RDS transmission equipment include Rohde & Schwarz (301-459-8800), which offers both an encoder and decoder, and VGE

Electronics (44-424-446-888).

Simple and cost-effective conversion, a compatible transmission standard, the benefits of station format tuning, clear IDs and paging income plus a groundswell of support from car and home receiver manufacturers...rarely has a new broadcast technology debuted with as much going for it.

As a future footnote to RDS technology, it is among the systems under serious consideration by the FCC as replacement technology for the current emergency broadcast system as well, and has already been employed for other emergency uses (see RW, Dec. 23, 1992). Broadcasters may have only just begun to tap the RDS potential.

□ □ □

Judith Gross is a free-lance writer and former editor of RW. She can be reached at 516-599-4564.

# Organization for Success

► continued from page 17

Buy a loose-leaf notebook. Each day, write the date at the top of the page and then the name, phone number, time of day and message from the person who has called you. When you returned the call, check it off and put the time you returned the call next to the entry. Later, if someone says you never returned his call, you will be able to produce the exact time.

When you succeed in reaching your caller, make all of your notes about the call on the same page. This will eliminate scribbled notes and messages all over your desk. It is also great for easy reference.

If you have an assistant to whom you assign the task of returning calls, write his or her initials next to any call you have passed along. Your assistant should also keep a phone log so that you are both literally on the same page.

*Schedule quiet time.* This is the most difficult time to set aside, but every promotion person needs a few hours a day to crank out the paperwork, copy and creativity required. I used to call these office hours, but found the expression misleading because it really is the time you need to spend alone.

*Have regular meetings.* Every week, schedule one sales promotion meeting and one programming promotion meeting. The sales promotion meeting should be attended by you, your sales managers, general manager, program director, and

any salesperson who needs a promotional idea for a client.

Have the salespeople come in one at a time to explain their needs to the group and brainstorm on each issue. You will not eliminate the need to meet with salespeople individually during the rest of the week, but this meeting will place the bulk of your sales promotion planning requirements into one time slot.

The programming promotion meeting should be attended by you, the general manager and the program director. The focus of this meeting is to generate ideas that will create listening and a "buzz" about your station for the general public.

There was a time when these two types of meetings could be combined, but value-added promotions have come to occupy three times the staff energy that they did even two years ago.

*Have fun.* As Bruce Springsteen sang in Rosalita, "I ain't here on business baby, I'm only here for fun." In the promotion world, if you are not having fun doing your job, you are probably taking the wrong approach.

Next time, we will examine how non-profit groups can work for you.

□ □ □

Mark Lapidus is promotion director for Group W's WCPT(AM)-WCXR(FM) Washington. He can be reached at 510 King Street, Alexandria, VA 22314.

## Digital automation for station owners

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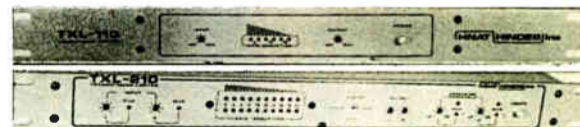


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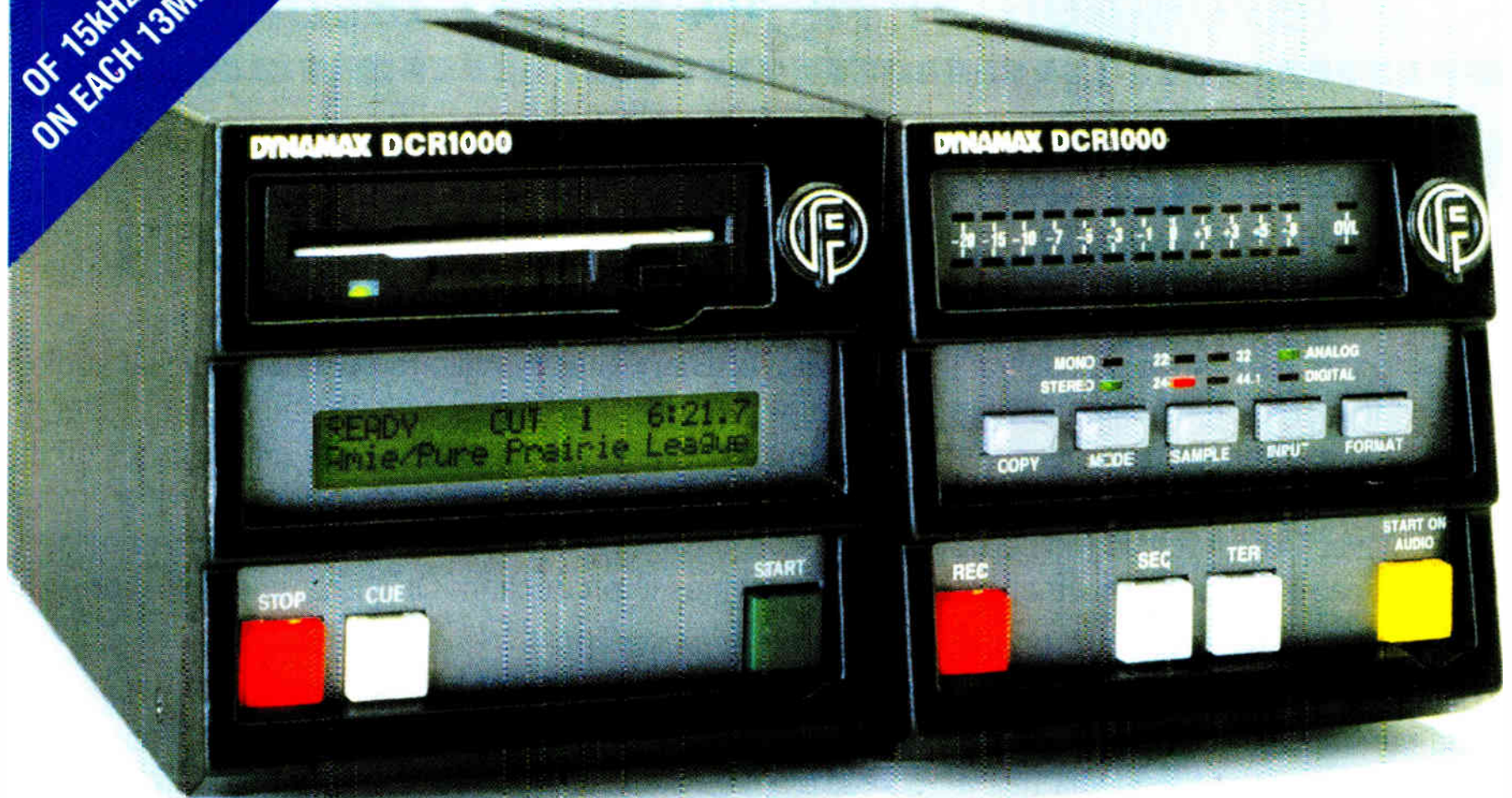
CALL TODAY...For more on the TXL-110 & TXL-210 capabilities.

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The new Dynamax DCR1000 is available now, and it's priced like an analog cart machine. You will be amazed by its versatility. Call Fidelipac for more details.



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# DIGILINK

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Introduced in April of last year, Digilink is a digital audio workstation that saves your station money. There is no more routine maintenance, it has a 15 year average life, *and* you have total automation capability for nights... weekends... or whenever you need it. It comes complete in a 5 1/4" high, rack mounted cabinet that converts ordinary analog audio to CD quality digital audio which is stored on a computer hard drive. It does this just like you would store a business letter on your home computer. Digilink can then call up and play any digital audio file in milliseconds off its internal hard drive. Basically, you can think of Digilink as a huge multideck cart machine or "rotary cart player" where you can line up and play thousands of carts our audio cuts sequentially. A single Digilink can therefore replace all of your cart machines in production, On Air, or in automation.

## **Digilink is a perfect cart or reel machine replacement...**

Digilink is the perfect replacement for magnetic tape based cart or reel machines. With Digilink, you can replace your cart machines with CD quality digital audio that requires no calibration, no maintenance, and the media has a 15 year average life. You can replace your reel to reel machines, razor blades, and tape with fast, nondestructive, CD quality, on screen waveform editing. You can cue virtually instantaneously. Digilink even costs less than comparable analog cart or reel machines. Digilink is the perfect audio record and play system for professional radio broadcast applications.

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## **Digilink is engineered and manufactured by Arrakis...**

Digilink is not simply a hardware package assembled from parts built by *other* computer manufacturers and run under our software. Arrakis is the *only* manufacturer to build nearly all parts of the digital system in-house. We build our own *Arrakis* DSP board, SCSI board, I-O board, switcher board, cabinet, and cabling. Because Arrakis builds the system and doesn't simply mark up someone else's hardware, Arrakis can offer you Digilink with broadcast features and performance unmatched by anyone *and* at a truly remarkable price !!!

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- CD Automation
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- Traffic and Billing Interface
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*all tests performed at 1:1 compression*

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Sampling System- 16 bit linear PCM, 2 channels  
 Sampling Rates- 44.1,32,22kHz, fixed filter on routing switcher  
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### Controller -

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 Printer Support- IBM compatible, parallel port

### Audio Performance- Digital Record playback

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

### Physical Specifications

Dimensions- 19" Rack mounted- 19"W x 5 1/4" (3RU)H x 16"D  
 Weight- 60lb's , Power- 110/220VAC, 50/60Hz, 100W

### Audio Performance- Routing Switcher

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 Freq. Response- (+)(-).1dB 20Hz-20kHz

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# Understanding Electro-Static Charges

This is the fifth in a 10-part series called *Fundamentals of AC*. Northern Virginia Community College will offer 12 CEUs (Continuing Education Units) to registered students who successfully complete an examination mailed at the conclusion of the course.

To register, contact the Community Education Office, Annandale Campus, 8333 Little River Turnpike, Annandale, Va. 22003, or call 703-323-3168 or 323-3528. The fee for the course is \$3.

by Ed Montgomery

Part V of X

**ANNANDALE, Va.** We have studied the properties of electric current and

magnetism and how inductance develops from the relationship between the two. Another electric field that also needs

consideration is the electro-static field.

An electro-static field is present when a voltage potential is present but no cur-

tors. A schematic diagram of a capacitor is illustrated in Fig. 1.

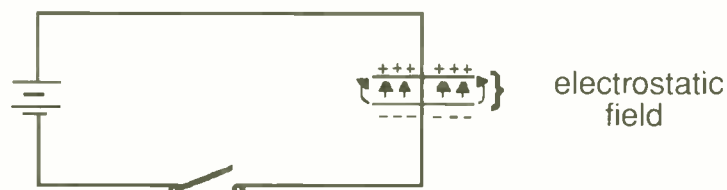
Essentially, the capacitor consists of two metallic plates separated by an insulator. This will be discussed in greater detail in a future lesson. The insulator, known as a dielectric, can be a number of materials, including air.

When an electro-static charge is produced, it will exhibit characteristics similar in nature to an electromagnetic field. Electro-static lines of force are generated between the positive and negative fields.

If the charge on the plates exceeds the ability of the dielectric, it will break down. An arc of electric energy will be produced and the capacitor will be destroyed.

This arc-over of electrical energy is precisely what happens when lightning is produced during a thunderstorm. During a storm, the air is the dielectric and the charge is stored in the clouds and on the earth.

Figure 2.



rent flow exists between the two charges. Electro-static charge is developed naturally during a thunderstorm when raindrops and dust rub against each other, causing ions to be created. An ion is an atom with an excess or deficiency of electrons, giving it a charge.

Static charge can also be produced by walking across a carpet or combing hair. You can also find it in electronic equipment. Dust will be attracted to areas where static charge is present.

## Capacitors

In electronics, devices that store and control electricity are known as capaci-

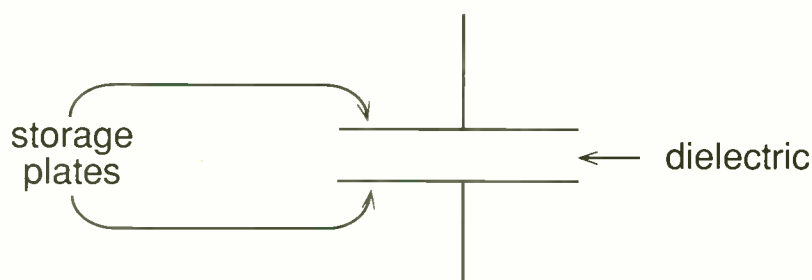
## How it works

It is often necessary to have a capacitor capable of storing a specific amount of electrical energy for future use. Capacitors are found in filter circuits, tone controls, and resonant circuits used to select specific frequencies.

Fig. 2 is an illustration of how a capacitor works. When  $S_1$  is closed, the positive and negative terminals of the battery are extended to the positive and negative storage plates of the capacitor. Electrons will flow out of the battery onto the plates until all of the space on the nega-

continued on page 31 ►

Figure 1.



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## BOTTOMLINE BROADCASTER

# A New Lease on Life for Used Gear

by Edwin Bukont

**GREENBELT, Md.** Every station, unless built new from the ground up, has old equipment that's been removed from service and is now gathering dust on a shelf. Although that gear may no longer be useable on-air, it may still be of value in meeting needs that your budget cannot accommodate.

Used gear can be divided into four categories: plain junk, salvageable equipment in need of major work, good equipment in need of minor work and good equipment in need of major work. Let's look at the categories and discuss ways of getting all the value you can from each one.

## Junk and salvageable gear

If you are running older "big ticket" items such as transmitters, consoles and tape machines, many parts may no longer be available, are very expensive or require a long lead time to acquire. Find out who else in town uses the same equipment. Do you have an excess of one part, but are lacking in others? Perhaps you can swap a few items and even out your stock.

Salvageable major equipment that has undergone significant repair or overhaul can be used by your station, traded or sold. This is especially true of transmitter power tubes. While not every tube can be rebuilt, if you have duds lying around, or are contemplating the purchase of a power tube, gather up the duds and ship them to your favorite rebuilder for evaluation and credit toward purchases.

You need not limit yourself to tubes used in your present gear. If your facility is 20, 30, 40 years old, or recently upgraded to another power class, you may still have spares and duds left over from previous transmitters no longer installed at your site. Send them in—someone else probably can use them and you can get a credit on your next rebuild purchase. This may also be a way of shaving significant

dollars off the cost of a spare tube.

Good equipment needing minor repair may serve your needs without further modification. This includes extending the life of equipment already in service but may involve some research and tinkering. A good bath with an appropriate cleaner on all contact surfaces can clean up many an "intermittent" in a tape machine.

I prefer the Chemtronics product "Gold Guard" (\$8.00) on all connector surfaces. Never, however, spray anything but compressed air into a switch mechanism that contains plastic parts or permanent lubrication—if you do, you will freeze it up. Also, be careful with a product called Cramolin; in some cases it can react with certain metals, build up oxidation and ultimately lead to intermittent connections.

A thorough cleaning, taking about three or four hours, can restore many tape machines to like-new condition. Turn off the power and unplug the AC cord.

Label all the connectors so you can put them back later. Using a marker, draw an "alignment" mark between the connector and chassis so that you don't get the polarity wrong when you reconnect it. Unplug everything, including the boards (you will have to slowly, but firmly, rock the boards to remove them). Spray away any dust with compressed air. Then spray all connectors, both on the board and the chassis, with the Gold Guard.

Let the machine sit a few minutes. Then, spray out the connectors with compressed air and wipe them clean with cotton swabs. Carefully re-install the boards and connectors. Check for proper seating of the torque motor brushes also.

Some equipment can be returned to work in your facility once modified or provided with retrofit interfaces. Several companies offer retrofit cards or overhaul service for consoles and cart machines that can significantly extend the life, and

often improve on the performance, of the products. Some such companies include Broadcast Devices Inc (BDI), Hall Electronics and Henry Engineering; there are many others.

## Making use of used gear

The first step in evaluating used equipment is to know what you have. Do you have an asset list of everything that your station owns? If so, use this as a guide to locate all the items that you should have. Check all the storage closets, the attic or the rented storage area for equipment that

may be hidden there.

If your station is part of a chain, some piece of equipment may have been loaned to another station. Try either to reclaim it or "sell" it to them, in exchange for credit towards your station's capital or operating account; this credit then can be used to cover the purchase of other equipment without asking to increase your budget.

Another angle is to trade existing gear if it cannot be sold or used as a budget credit. I recently traded several older cart decks I no longer needed for a telephone hybrid system. This trade was conducted through a used equipment vendor who had a package sale pending upon providing some cart decks. Three parties were satisfied: The vendor made money, and two stations got

continued on page 34 ►

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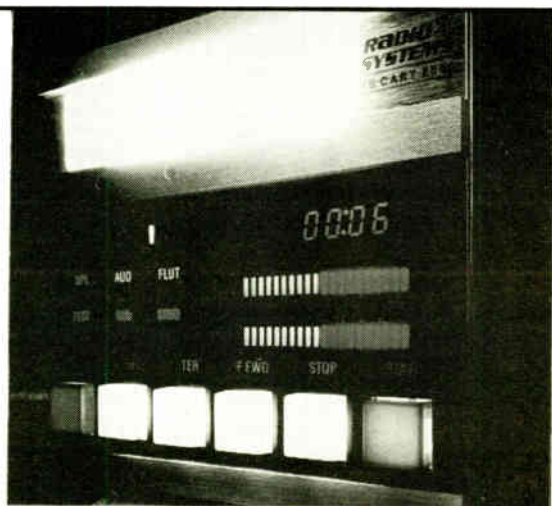
The high-performance CD-401 (\$849\*) incorporates TASCAM's award-winning ZD circuit to eliminate low level distortion and ensure sound quality that meets the most demanding standards. The CD-401's fader-start feature allows play to start automatically on fade-in and stop at the completion of a fade-out. The CD-401 is available with optional hardwired or wireless remote.

For more information, call or write TASCAM, the company whose Industrial Strength product line also includes cassette decks and mixers.

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## FEED LINE

# AM Skywaves: A Nightlife All Their Own

by W.C. Alexander

**DALLAS** It seems to me that a week doesn't go by when someone in our corporate office, a salesperson or manager at one of the stations, or a listener, doesn't ask me why AM coverage is generally so much worse at night. I have explained it every way I can think of, and still I get a lot of blank stares.

If I have this problem, I'm sure others must as well. Maybe by examining the factors that determine AM coverage we

can all be better prepared to relate an explanation to others.

For the less well-versed among us, let me first note the two components of AM signal propagation: skywave and groundwave. During daytime hours, skywaves of all AM frequencies are practically completely attenuated. All of the daytime coverage from a given station, then, is provided by groundwave. This coverage area is usually small (compared to the skywave coverage area), but it is relatively dependable.

At night, the groundwave still accounts for most of the signal received at nearby points, but the skywave energy—signals bounced off the ionosphere in the upper atmosphere—reaches very distant points which are way beyond the range of normal groundwave signals.

Close to the transmitter site at night, the skywave signal is relatively weak as compared to the groundwave, and the groundwave is what is primarily received. As you move farther and farther from the transmitter site, the ground-

wave weakens and the skywave becomes stronger. It is in this area that the groundwave and skywave signals interfere with one another, causing fading and distortion. As you continue to move farther away from the transmitter site, the skywave becomes stronger still, and a relatively high signal strength with occasional fadings is maintained up to a considerable distance.

## Vertical angles

The reason the nighttime groundwave and skywave signals behave in this way is that, as the distance from the transmitter site is increased, the skywave that reaches the receiver is actually energy radiated from increasingly lower vertical angles. One characteristic of most AM vertical radiators is that the radiated energy is greater at lower vertical angles. Another factor is that the skywave reaches a height of about 100 km at AM frequencies. As the horizontal distance from the transmitter increases by a large amount, the sides of the transmitter-ionosphere-receiver triangle increase by only a small amount, meaning that skywave must travel almost as far to reach receivers near the transmitter site as to reach those several hundred kilometers away.

Now, just because a station's skywave signals propagate a great distance at night doesn't mean that you will be able to listen to that stations from afar at night. Here is where interference becomes the limiting factor, wiping out any usable skywave signal that might exist at a given point for a particular station. If you have ever listened at night to a distant clear channel station (where there are few other stations on the channel to cause interference at night), however, you know that the skywave signal does provide service out to a great distance.

Consider that at a given point, there will be some skywave signal arriving from every station on a given frequency within a specified distance. The field strength voltages from each of these skywaves add in a root-sum-square (RSS) fashion to produce a night limit for that point. That night limit is nothing more than the signal strength from the desired station that it takes to overcome all the other interfering signals and provide a reliably listenable signal. Let's look at an example.

## The night limit

At Point A, the skywave signal from all the stations sharing the frequency is as follows:

Station A:	165 $\mu\text{V}/\text{m}$
Station B:	120 $\mu\text{V}/\text{m}$
Station C:	105 $\mu\text{V}/\text{m}$
Station D:	80 $\mu\text{V}/\text{m}$
Station E:	35 $\mu\text{V}/\text{m}$

To find the night limit for Point A on this particular frequency, we compute the additive effects of all contributing stations by solving for the RSS. Do this by squaring the skywave field strength from each station, add the squared values together, then take the square root. You should come up

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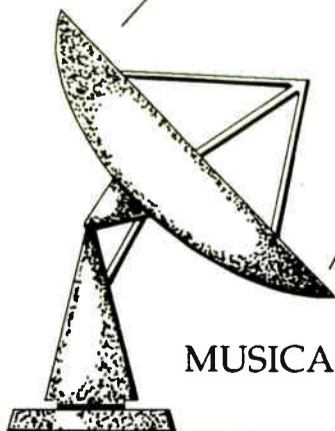
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# WORKBENCH

## An Easy Fix for Power Supply Woes

by John Bisset

**FALLS CHURCH, Va.** It's amazing how good old human ingenuity comes through when you're in a tight spot. Consider the satellite-formatted customer who has two Scientific Atlanta receivers and loses a power supply. Granted, SA has an exchange program—which, for the power supplies, ain't cheap—or you could try fixing the problem yourself. Either way, the station is without the use of the second demod...or are they?

The accompanying photo shows a very workable solution to the power supply failure problem. It was conceived by engineer Kevin Strom. Kevin decided to "steal" a little DC from the working supply, and couple it into the second set of SA electronics.

The AC power cord and fuse of the inoperative supply were disconnected and wires were jumpered from the "test voltage" jacks of the working supply to the inoperative supply as shown in the photo. Both demods operated this way for nearly a year, since the client didn't want to spend the money to repair the bad supply.

★★★

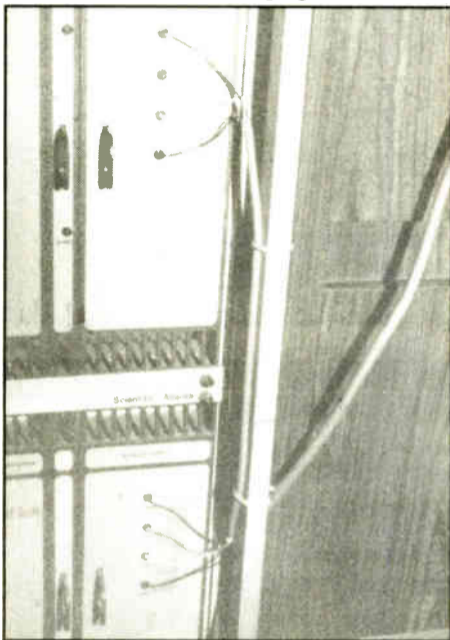
If your station programs Urban or dance music, you probably have experience with the Numark mixers that are so popular in "club" settings. Numark is now under new management, and have a new phone and address. To contact Numark, dial 401-437-9383. The company's fax number is 401-437-9386. To order parts, dial 805-257-6826.

The new Numark mailing address is

1445 Wampanoag Trail, East Providence, RI 02915. Thanks to WPGC CE Ed Bukont for the update.

★★★

Our column on rectifying telephone interference problems really woke you folks up! It should be encouraging to readers of



A short jumper wire couples operating voltages from a good power supply into the dead supply.

this column to know that you are not alone in fighting this problem—nor in trying to explain why a neighbor's \$19.99 "superphone" has, as one of its features, the ability to tune in your station all the time.

Veteran broadcast engineer and consul-

tant Jim Pinkham wrote to tell about his experiences with telephone RFI back in 1955. While working at KOOL-AM/TV in Phoenix, Jim lived two blocks from a 5 kW competitor. The telephone company technician installed a 0.0022 microfarad ( $\mu\text{F}$ ) paper cap across the terminals on the telephone network to which the transmitter (microphone) was connected.

This was a 500 series Western Electric telephone, which used passive network elements and a carbon transmitter or microphone. The RF was actually appearing across the carbon granules of the microphone, and the capacitor simply filtered at the source of the rectification. For many years, this solution worked quite well.

Jim notes that the RF pickup does not have to be on the line at all to still get interference. If the RF is being rectified across the transmitter button, filters on the line won't help. A capacitor at the network is the best solution.

The same fix will generally work on the older 302 series Western electric networks, which are also passive and without transistor amplification. The newer 2500 and 2554 series Touchtone sets also use the same network as the 500 series, and all employ the carbon transmitters. Both ITT and Stromberg-Carlson have equivalent model telephones manufactured under the Western Electric patents. These use the same network design, and can be filtered the same way.

Modern times have brought new problems. Carbon-transmitter RF detection cannot always be cured in transistorized telephones. If the RF field is not too extreme, a

capacitor across the carbon transmitter terminals of the Trimline Western Electric telephones may clear the interference.

However, there are conditions where the RF will saturate the transistors themselves; there is no capacitive filter that will solve the problem. To make matters worse, there is no RF shielding built into these phones. The bargain-basement imitations from offshore also are notoriously subject to RF interference; some of these phones use "capacitive" microphones which also defy filtration efforts.

Jim closed his letter with the encouragement that a recently installed 1990 vintage AT&T telephone was manufactured in China, and howled even inside a steel walled building at a multi-use site on top of a mountain in Colorado Springs. Jim borrowed a 500 series phone from a mobile facility that shared the same building and the howling was gone. The next day, Jim traded in the new Chinese-made AT&T phone for a re-built, re-conditioned, and re-painted 11-year-old 554 series wall set. It worked just fine!

Jim Pinkham can be contacted in Hudson, N.Y. at 518-822-9425.

□□□

*Editor's note: Field modifications to equipment may invalidate the manufacturer's warranty. Before attempting any repairs or modifications, consult the manufacturer for advice and guidance.*

*Always use the utmost care and follow good engineering practices when working with or around electrical equipment. RW will not assume responsibility for any loss or injury.*

*John Bisset is a principal with Multiphase Consulting, a contract engineering and projects company. He can be reached at 703-379-1665.*

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## DIGITAL DOMAIN

# Broadcast Uses for DCC and MiniDisc

by Mel Lambert

**STUDIO CITY, Calif.** The broadcast industry today has access to a vast arsenal of analog and digital technologies. Today we can extract outstanding performance from CD, tape, and hard disk-based playback systems, while a sensitivity to the needs of adequate acoustic designs ensures that sounds generated within the air and production studios reach the listener in the form we intended.

Traditionally, our industry has also absorbed and/or adapted a number of technologies that were originally devel-

oped for other markets. This symbiosis obviously has its advantages. For example, when compact disc players were first introduced a decade ago, stations could develop a ready familiarity with their operational parameters, simply by hooking up a low-cost consumer unit. Again, when consumer-grade DAT recorders appeared four or so years ago, they were almost immediately pressed into service for field recording, as well as high-quality record/playback in the studio.

I wonder, however, if two new consumer technologies are as appropriate to

our industry as some manufacturers might have us believe. Sony's Mini Disc (MD) and Philips' Digital Compact Cassette (DCC) have been heralded, quite correctly, as offering consumer users distinct quality advantages over the analog cassette decks they are designed to replace. I, however, have certain reservations about their wide-scale applicability for broadcasters.

### The data compression hitch

As is well known, both of these technologies make use of data compression, which allows pulse code modulat-

ed (PCM) data to be recorded onto media that has less storage capacity than CD or DAT recorders. In the case of MD, a powerful data compression scheme is used to pack the equivalent of a 70-odd minute CD into a far smaller volume—and also adds record functions for good measure. Philips' DCC, based on MUSICAM perceptual encoding techniques, utilizes a housing similar in size to the current analog cassette, plus bi-directional record/playback.

In terms of consumer requirements, I'm sure that Mini Disc and DCC have a great deal to offer. MD-based decks will be much smaller than today's portable CD players—allowing Walkman-sized units to be made available—while replay compatibility with existing analog cassettes will allow DCC decks to be used to replay a consumer's existing collection.

Having experienced the compromised replay quality of MD and DCC, I wonder if these technologies are really appropriate for broadcasters. Let's face it, the design criteria for both of these competing systems was to provide enhanced record/replay capabilities from a format that would not necessarily be judged by its sonic quality.

All bit-reduction systems will produce audible results; some more than others. The degree of data compression necessary to achieve an intended result often involves several compromises. Consumer users might not notice the differences (although by this time few potential users can be unaware of the sonic degradation involved); the same cannot be said for professional users.

Aside from the small size advantage of portable Mini Disc recorders, I am hard pressed to see any advantage that MD or DCC recorders could offer over current CD and DAT products. Also recall that both of these consumer formats will incorporate Serial Copy Management System (SCMS) circuits to prevent unauthorized dubbing of copyrighted material, such as commercial releases. As we transition to the all-digital broadcast facility of not too many minutes into the future, any element in the chain that requires a dip into the analog world is going to introduce a measurable amount of degradation.

### Multiple-stage degradation

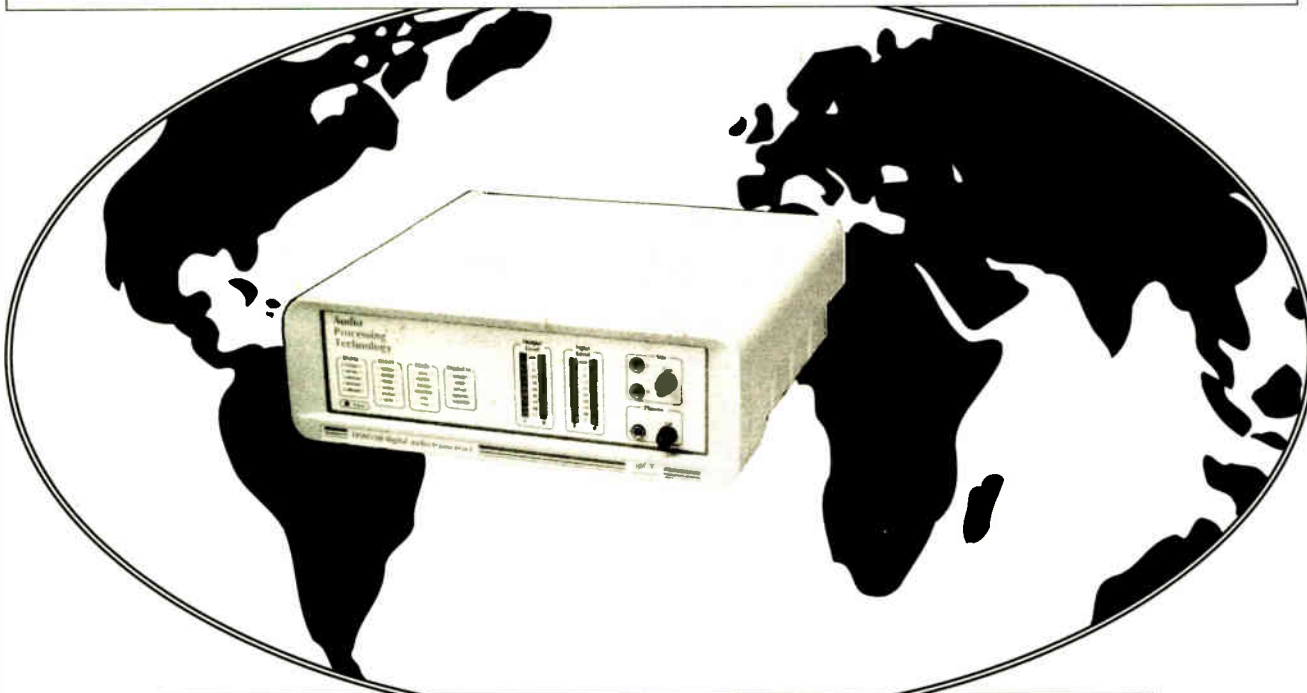
Digital compatibility aside, of far greater significance will be the impact of multiple stages of data compression. As I have pointed out in previous columns, perceptual encoders are extremely useful in the recording and transmission stages, but need to be used carefully. Some algorithms can produce noticeable artifacts on previously compressed material; post-compression signal processing, including equalization, will also degrade the signal in predictable ways.

In reality, these effects will be insignificant compared to the overall effect of the multiple record/replay generations. By their very nature, MD and DCC's compression algorithms are designed to prevent analog copying; they are so powerful that all we can reasonably expect to get away with is a single pass through the encode-decode cycle.

Think about it: If, as the record labels argue, too many consumers are copying CDs instead of buying them, why not adopt an encoding scheme that, by its

continued on page 34 ►

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Circle (54) On Reader Service Card

World Radio History

# Electro-Static Charges: A Primer

► continued from page 26

tive place for extra electrons is filled. A positive charge will be induced on the opposite plate.

The law of static charges states that like charges will repel each other. The build-

field is changing in its intensity. This is illustrated in Fig. 3.

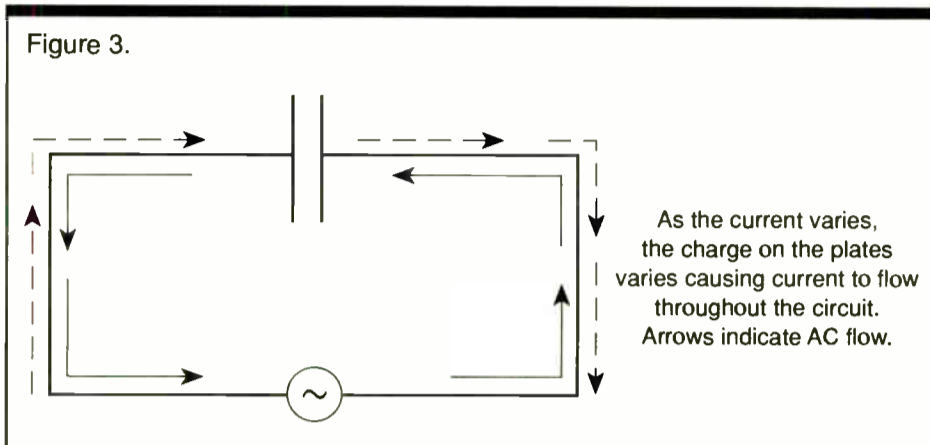
## Capacitance

The amount of energy, known as charge, stored in a capacitor is known as

the positive and negative voltage terminals is physically quite large. The total capacitance of capacitors connected in series is always less than the smallest capacitor in the circuit. The mathematical formula for calculating total capacitance in a series circuit is illustrated in Fig. 4.

In Fig. 5, three 6 nF capacitors connected in parallel. Parallel capacitors have all of their positive and negative plates connected directly across the battery terminal. This creates the effect of increasing the plate area. Total capacitance of capacitors connected in parallel is always the sum of the individual capacitors, as

Figure 3.



up of electrons on the negative plate will cause electrons to be repelled away from the positive plate and into the wire. A positive charge is generated through "electro-static" induction.

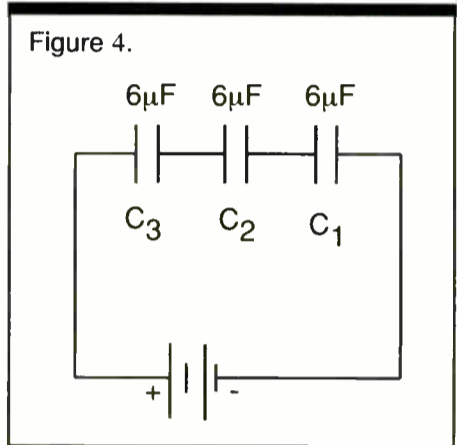
Once all of the available electrons have moved onto the negative plate and off the positive plate, all current flow stops. Capacitors will not all direct current to pass through them. However, if the current fluctuates, or if it is alternating current, the capacitor will permit current to pass through it because the electro-static

"capacitance" and is measured in farads. This is electronically defined as one volt producing one coulomb of charge; it will be discussed in greater detail in a future lesson.

Physical size of the plates is a factor that can determine the amount of charge a capacitor can hold. Other factors also determine capacitor size and will be discussed in the future.

Fig. 4 illustrates three 6 nF (six microfarad) capacitors connected in series. In this arrangement, the distance between

Figure 4.



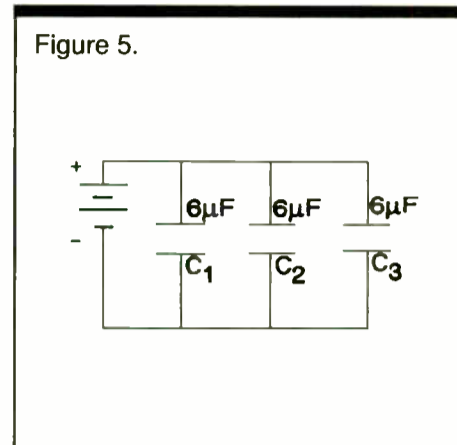
illustrated in Fig. 5.

The laws for total capacitance in series and parallel circuits are exactly opposite the laws for total inductance in series and

parallel circuits. In many ways, capacitors are the exact opposite of inductors. Capacitors will not pass a steady, direct current, but inductors will. Inductors tend to oppose any current variations, but capacitors will accept these variations and give the effect of passing current.

Further study of capacitors can be found in Chapter 20 of "Basic Electronics," by Bernard Grob, published by McGraw-Hill.

Figure 5.



**Answer to the problem in part IV:** A 6mH coil will have an inductive reactance of 188.4 ohms at an operating frequency of 5kHz.

□□□

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

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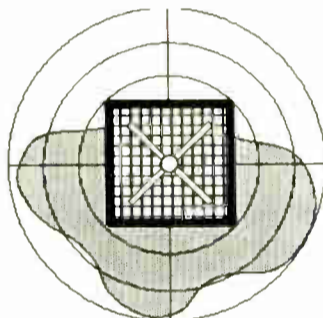
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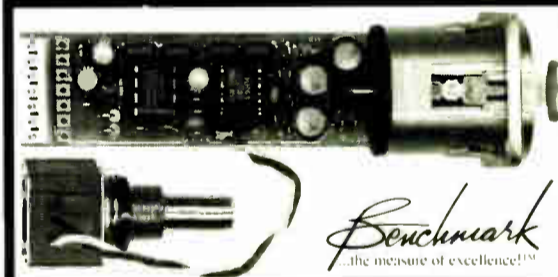
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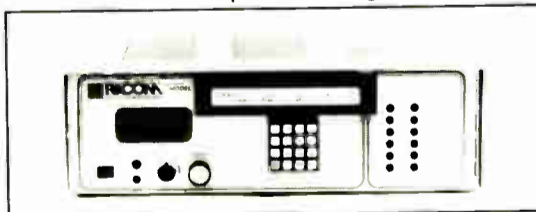
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## ECLECTIC ENGINEER

# Protect Your Station During Promotions

by Barry Mishkind

**TUCSON, Ariz.** Radio stations run contests for all sorts of reasons. But the bottom line goal is to get listeners to tune in and then stay around, providing a ratings boost and more traffic in the advertisers' stores.

The payoffs can range from a ticket to a local movie theater to cars, vacations, and the favorite of professional contest players, cash.

Professional players? Yes, there are a number of people who treat winning like a job. We'll have more to say about them later.

As the air date for the contest approaches, there are a number of important steps that need to be covered.

## Put it on paper

The first step is to get the rules of the contest down on paper. The rules must be broadcast and also made available to visitors who come to the office. Make them clear and understandable, but complete.

The rules should explain how you plan to pick the contestants; what they must do while speaking to the announcer; what actions constitute winning the contest; how often they can call or enter; who is definitely disqualified from winning; and the source of the prize and the mechanism for awarding it. Noting the assumption of agreement to use their voice is also worthwhile.

Once all this is completed, it's time for a conference with the staff, so they know what's coming and how to get it done. If there are multiple tape carts involved, ensure that the order of play is clear. And, having spares of the key carts ready in the control room may prevent a catastrophe in case of tape failure.

A key point here is to ensure total security. Staff members must not only be told not to tell their mates or friends anything about the contest, but to be alert not to pass on information either on purpose or by accident. Don't forget to remind them about professionals and their ingenuity; a super contest can be trashed very easily.

In some markets, professional contestants can make a good living. Using several radios and multiple phones and speed dialers, they listen and rapidly react to contests. One TV show interviewed a fellow that earned over \$20,000 a year that way. These folk can be quite inventive in devising tactics to get an edge.

For instance, some stations allow visitors. Can reminders about the contest or even winning answers be seen posted in the control room? How about the tape carts used in on-air production—would a visitor get clues from seeing them? A professional for whom you might be watching may pay someone else to visit the station and gather information while you're off guard.

## Phone security

If your plan is to have contestants call in, consider the phone system in the control room. Both the quantity of lines and the actual numbers of the phone lines should be treated with as much security as next week's playlist.

Security has to be even tighter than you might think. Last year, 30-40 employees of a major phone company were discovered to have used phone company records

to identify the contest lines. With that knowledge and other inside information, they were able to "take over" a contest giving \$1,000 a day, winning at will.

One way to combat this is to order more lines from the phone company than you need for any given contest, activating necessary ones at random. You might wish to change the number given on the air to slow down those that program dialers. If your phone system allows you to program the rotary order, change that, too, from time to time. This will also foil visitors who sneak a peek at the phone.

Do you think this is being paranoid? Not at all. One West Coast station had some noise in its phone system. Investigating, they found wires running from the phone demark to a hall closet. There, a rather sophisticated box with a rotary switch, lights, and a phone jack was found. The maker could watch the lights, see which line was selected by the DJ and place himself on that line, dumping the actual caller.

Unfortunately, by the time the closet was discovered, the user had abandoned it and surveillance failed to catch him. The station had no idea what contest(s) were compromised. But they did take immediate steps to secure the phone wires from the demark to the studio. It wouldn't hurt to have your engineering personnel check and ensure the security of your phone wiring.

## Documentation

As the contest progresses, several steps ought to be taken to document events, preventing problems from occurring down the road.

Documentation should be kept for each time the contest is run: when, by whom, which call number, name of contestant, result, etc. A database can be developed for quick retrieval and identification of previous winners or those who call before required waiting times pass.



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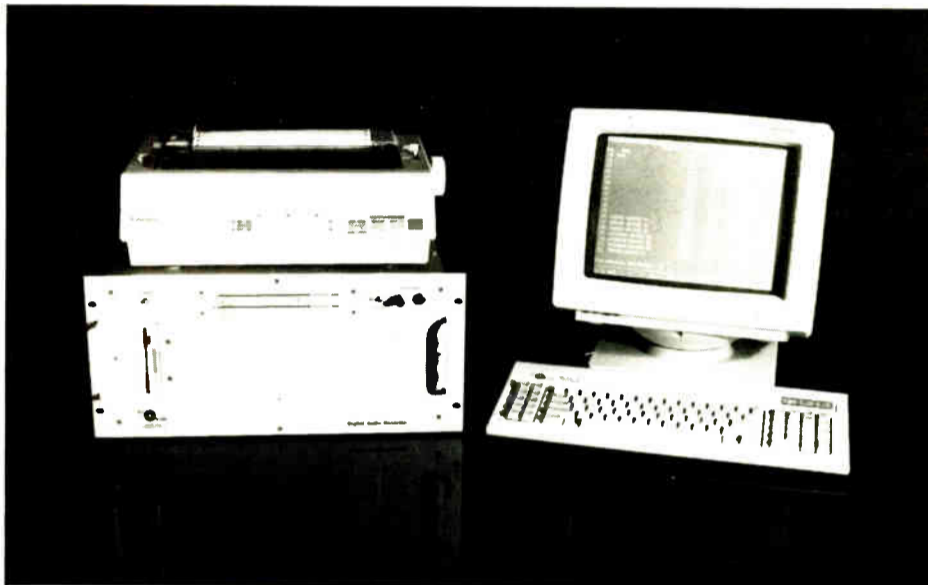
Another precaution that has saved stations from problems is to tape record the process. Not just the contestant, but everything that happens from the call for contestants to the end of play. For example, if someone claims they were the right caller, but dumped by the DJ, a log tape can verify what really happened.

Clearly, running a successful contest is not a haphazard affair. Sure, giving a pair of tickets away is no big deal, and many stations do just that all the time. But if

your plans include substantial prizes, a checklist of cautions can make the difference between a frustrating experience and an exciting, fun promotion that gives your station a distinctive image.

□ □ □

Barry Mishkind, aka RW's "Eclectic Engineer," can be reached at 2033 S. Augusta Place, Tucson, AZ 85710. Electronic addresses: BMISHKIND on MCI Mail, or "barry@coyote.datalog.com" on Internet (also via CompuServe).



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# A New Lease on Life for Used Gear

► continued from page 27  
what they needed within their budgets.

Once you know what you have, take stock of what it does, and what work it needs. Make a simple list of the items, their functions, their input and output levels, types of connections and wiring standards and what power supply is needed.

Some devices are a slave or accessory chassis that take power from a master unit. Without the master, the unit you have may be useless, unless you can substitute a power supply. This is especially true of small mixers and modular audio devices designed to plug into a "main-frame" of some sort.

## When in doubt, ask

The most valuable resource in pressing old gear into new service is the combined knowledge of the engineering community. For the price of dinner and an evening or afternoon well spent, attend your local Society of Broadcast Engineers meeting.

Any chapter will welcome the attendance of other station personnel in addition to the engineer. Someone in that room either knows the answer to your question or can at least give you a lead. Ask other engineers in your company or in your market. In one case, a phone call to another engineer in the market saved me three weeks of turn-around time when the manufacturer was uncooperative and insisted I return a piece of on-air equipment.

Another source of equipment or revenue from your old equipment is the "other station across town." For a recent studio re-fit project, I purchased two used patchbays in excellent condition for \$800 from a station in a neighboring

market. If I had purchased these patchbays new, I would have spent \$1,400. The \$600 saved went to upgrade speakers and a new power amp that would otherwise not have been available.

So what do you have that can be put to use? What can you sell or trade, locally or through a vendor, to get other equipment that you need? Think creatively; you may be surprised.

□□□

Editor's note: Field modifications to equipment may invalidate the manufac-

turer's warranty. Before attempting any repairs or modifications, consult the manufacturer for advice and guidance.

Always use the utmost care and follow good engineering practices when working with or around electrical equipment. **RW** will not assume responsibility for any loss or injury.

Edwin Bukont is the CE at WPGC-AM-FM, Morningside, Md. (Washington). He can be reached there at 6301 Ivy Lane, Suite 801, Greenbelt, MD 20770, or by phone: 301-441-3505, ext. 8213.

# Uses for DCC and MiniDisc

► continued from page 30

very operation, produces noticeable artifacts during "unauthorized" analog copying, with SCMS taking care of digital-to-digital dubbing? Since these proprietary coding techniques are working hard to reduce the number of bits required to produce a signal that can be recorded into just a few data bits (including masking analysis and other number-crunching tricks), performing the process a second time produces audible effects.

From the manufacturer's perspective, these now represent ideal digital consumer formats. But what is good for the home user may involve too many quality compromises for professional broadcasters. If we didn't already have access to viable alternatives—including CD for music playback and DAT for full-bandwidth record/replay—then it might well be a very different story for MD and DCC. As it is, I can see little benefit from either technology, aside from providing an inexpensive

by lower quality relay and record medium.

What the future holds, however, remains to be seen. I understand that a non-data compressed version of MD is currently being considered, which would allow up to seven to nine minutes of uncompressed material—plus graphics and other information—to be recorded in the same data area. MD-based applications such as cart-machine replacements, for example, immediately suggest themselves.

Perhaps the technology will re-emerge in a truly professional guise, utilizing one of the less obtrusive perceptual encoding schemes with which we are already familiar from our experiences with hard disk recorders, STLs, floppy-disk recorders and related media. Time, indeed, will tell.

□□□

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

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## OFFBEAT RADIO

# FCC License Fulfills a Boyhood Dream

by Dee McVicker

**OSSINING, N.Y.** In 1968, WDFH was a typical AM station run by a 10-year-old. Broadcast fare included a microphone and record player hooked up to a 100 mW phono oscillator, and on a good day its signal covered the block where young Marc Sophos had converted a corner of his bedroom into a radio station.

"It barely made it around the block, but we had fun. We played records for the neighbors and had a lot of fun with

it," recalled Sophos, now 34, who has watched his boyhood occupation fill the entire upstairs of his parents' home, and more recently, go from Part 15 operation to non-commercial licensing granted by the FCC.

Operating a licensed radio station had been Sophos' life-long dream, an aspiration that was finally realized Sept. 30, 1992, when the Commission issued a construction permit for WDFH.

Over 20 years in the making, the permit granted the station 200 W non-directional power at 90.3 on the FM

dial. It was licensed to the city of Ossining, N.Y., approximately 10 miles from the Sophos family's home in

**Over 20 years in the making, the permit granted the station 200 W non-directional power at 90.3 on the FM dial.**

Dobbs Ferry.

The CP, observed Sophos, is a rite of

passage for every engineer who has experimented with a low-powered radio station as a kid. Like so many radio

engineers fascinated with the physics of radio in his youth, Sophos eventually became a broadcast engineer by profession and zealously pursued his interest in the technology.

## Empire State gets in the way

His pursuit began in earnest in the ninth grade. Several years after starting his neighborhood station, Sophos approached

Dobbs Ferry High School's principal with the idea to build a station for his school.

Gaining immediate support, within a year funds were allocated by the school and a frequency search was conducted. But the search proved futile. Dobbs Ferry, New York, is located only 18 miles from the RF-pulsating Empire State Building, and the likelihood of broadcasting even a mere 10 W within the area was nil.

After another year of seeking alternative technologies to carry the now adopted call sign of WDFH—which stands for Dobbs Ferry High School—Sophos declared the effort over and returned the money to the school.

But he still remained unconvinced that WDFH's days were over. In the following years, he and other volunteers continued to operate WDFH sporadically from the Sophos home. By now his bedroom had been converted into the main studio, and another upstairs bedroom and an attic had taken up the slack for much of the production work for the station's now progressive rock format.

To support the station, Sophos often worked two or three odd jobs—not surprisingly, mostly radio jobs. "I've been primarily a radio engineer most of my life. The first job I had at another radio station was a small AM/FM across the county, and I did a little of everything," he said. Area stations WALK-AM/FM and WCTO-AM as well as university station WKAR-AM are a few of the radio stations Sophos lists on his resume.

Juggling work in between college studies and duties at WDFH, sometimes at the expense of only three hours

sleep a night, Sophos managed to satisfy his radio appetite and ultimately, finish his degree in law.

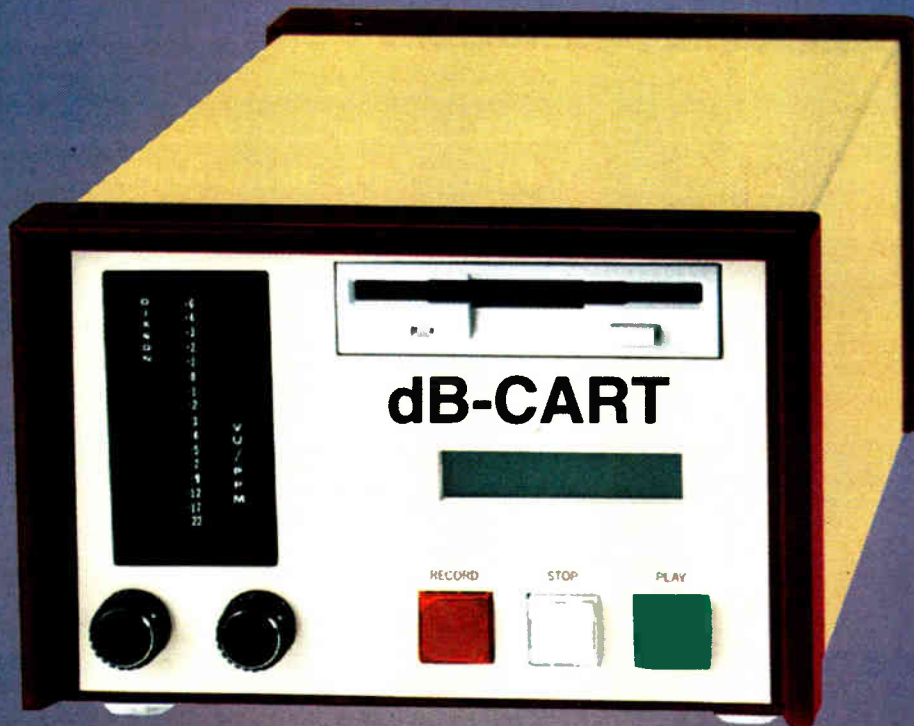
The hectic schedule paid off. In 1978, WDFH became the test center for an engineering experiment conducted by Michigan State University, where Sophos went to school, and was moved from the AM band to the FM band courtesy of carrier current. During this time, Sophos experimented extensively with low-powered FM transmission

continued on page 38 ►

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# FCC License Fulfills Boyhood Dream

► continued from page 36

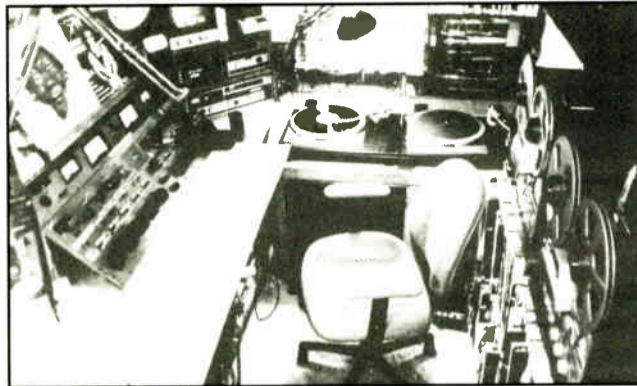
coupled into phone lines, electrical lines and other forms of carrier current distribution.

## Cable connection made

Then, in early 1980, Sophos reached an agreement with the local cable company to supply audio programming over one of its cable channels. A loop was installed at the house to connect the station to the cable facility, and in practically no time WDFH had expanded its audience to almost 10,000 listeners and had taken over the upstairs of Sophos'

parents' tudor-style home.

By now, state-of-the-art equipment such as RCA BC consoles had been acquired for three studios, and the sophistication of the operation was evident in every corner of the cramped quarters. A newsroom, consisting of a typewriter and microphones, had been squeezed into the fami-



Soon to be moved to a new location, the air studio of WDFH has gradually taken over the Sophos family home.

ly's attic and shared real estate with old clothes and other storables. The library, ultimately swelling to 4,000 records and 700 CDs, meanwhile grew out of nooks and crannies.

What little space remained Sophos used to fit in an automation system, a badly needed commodity for the now handful of volunteers who still held down day jobs or college studies. Innovative for its time, the system used a Commodore 64 personal computer as the brain and had a silence sensor and a fade circuit.

But although cable provided the volunteers with a sophisticated operation, it never replaced Sophos' dream to license the station. During his college tenure at Michigan State University, and later as a technician for university and commercial radio stations, Sophos spoke at length with broadcast consulting engineers in hopes of finding a way to broadcast within the New York City area.

## WDFH to move

Finally, in 1984, Sophos met up with a consultant who suggested moving the sta-

**WDFH became the test center for an engineering experiment conducted by Michigan State University, and was moved from the AM band to the FM band.**

tion 10 miles north of Dobbs Ferry to the river village of Ossining. Broadcasting at the low end of the dial, WDFH had a fighting chance of becoming licensed as a non-commercial, educational station. Sophos filed the application.

After the application stalled for several years, Sophos realized his dream on Sept. 30 and was granted the call sign WDFH on Nov. 5, 1992.

Coming a long way from the little 100 mW station that entertained the neighborhood, WDFH will be moving out of the Sophos family home into new studios by early summer 1993. Funding for the station will continue to come from Sophos, who recently passed the bar and plans to specialize in communications law; equipment donations from radio stations are expected to make up the bulk of studio and transmission needs.

"It's been great," said Sophos enthusiastically. "The commercial stations have been very supportive in getting equipment for us." Several station engineers have also offered to help build the station, a courtesy Sophos feels reflects the discipline's love of radio. "A lot of people that have grown up to become engineers were really into radio as a kid, and some even had a little radio station when they were kids," he said.

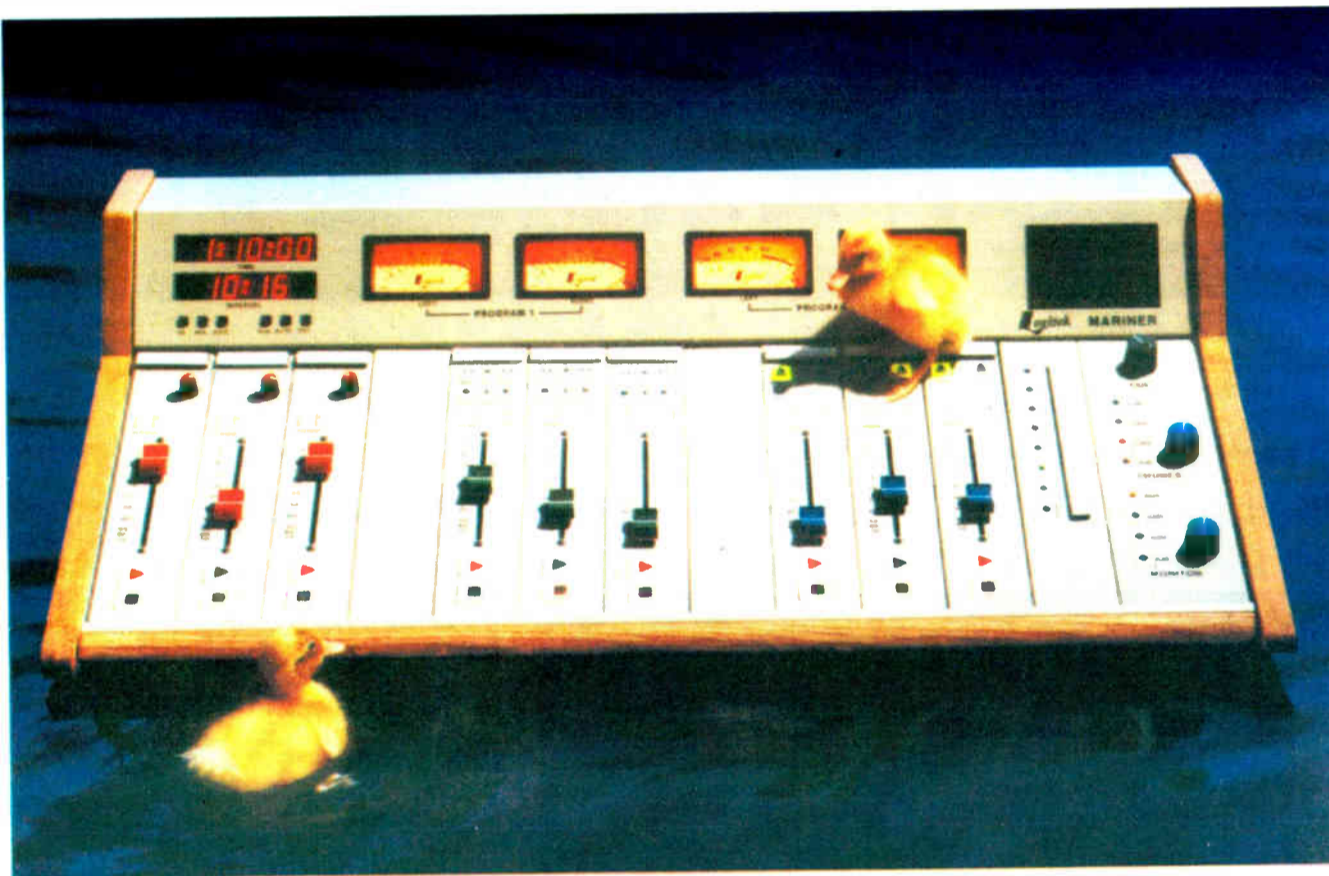
As one who has taken this childhood dream and made it a reality, Sophos plans to pursue his next adventure into radio with as much zest as in his youth.

□ □ □

To contact Marc Sophos or donate equipment to WDFH, call 914-693-3963. Regular RW contributor and industry free-lance writer Dee McVicker can be reached at 602-545-7363.

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World Radio History

# Understanding Nighttime AM Skywave Characteristics

► continued from page 28 with approximately 245 mV/m.

Now, consider that for co-channel signals, it takes about a 20:1 desired-to-undesired ratio to produce a listenable signal. Multiply 245 mV/m by 20 and you will see that it will take a field strength of more than 4.9 mV/m from the desired station to overcome all the interference from other stations' skywaves.

So far, we have only included co-channel undesired signals in this example. If there are adjacent channel stations present, their skywave signals should be added in RSS fashion at a 2:1 ratio. This will make the RSS night limit even higher.

(Before I go on, it should be noted that, in the real world, every other station's signal arriving at a given point contributes to the RSS night limit at that point. Considering the skywave and residual groundwave signals from every station on a frequency and both adjacent channels would make RSS night limit calculations for the purposes of allocation studies unnecessarily complex and burdensome. Therefore, the FCC allows us to reject those signals that contribute less than 25 percent of the RSS night limit at a given point.)

So at night, we have what would seem to be a bonus in that our signal gets a free ride on the "ionospheric railroad" to distant points. The bad news is that every other station's signal gets the same free ride coming the other way. Most stations must reduce the radiation at night to limit the amount of skywave signal that is produced in some other station's coverage area. Couple lower power with increased interference, and it becomes clear as to why coverage is usually a lot worse at night.

I have been asked what would happen if we did not reduce power or switch patterns at night. This takes the reduced

radiation out of the picture and leaves only the interference to consider. I have made some listening tests during the experimental period in the past doing just that. I have found that of the two factors (interference and reduced radiation), interference is by far the biggest problem. In listening tests I have conducted in the middle of the night, I've found that power didn't make that much difference.

### Time of the season

The last question that I want to address here is that of seasonal variation.

"There's something wrong, I'm telling you! Last December, we were able to listen all the way out to the junction. Now, the signal is hash clear back by the mall!"

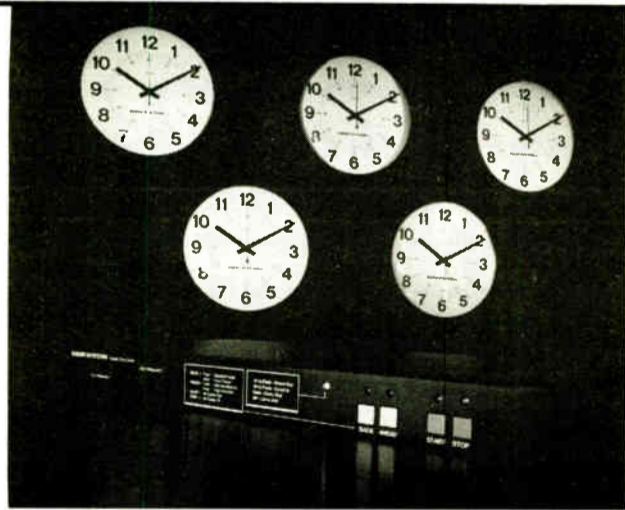
Have you ever heard something similar? I sure have. The transmitter and antenna system check out OK, so what is the problem?

The ionosphere changes from day to day, and from year to year, based on a (somewhat) predictable pattern sometimes called the "11-year cycle." The amount of ultraviolet light and other ionizing radiation originating from the sun varies according to this cycle, and if graphically analyzed over a long period of time, it can be shown that the amount of interference at a given point does, too.

My answer to the person that insists something is wrong because "last year, it was better than this" is usually that next year, it will be worse or better. Get used to it. It's just one of the things that makes AM radio exciting and different.

□ □ □

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



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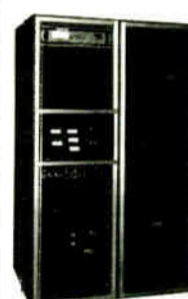


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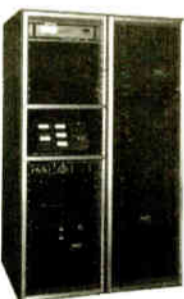
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## INSIGHT ON RULES

# Technical Violations Can Cost You

by Harold Hallikainen

**SAN LUIS OBISPO, Calif.** I just read of the FCC fining KSLX of Los Angeles \$105,000 for 12 Howard Stern broadcasts in October and November 1991. While not quite as large, I've also received a copy of an FCC Notice of Apparent Liability (NAL) for \$32,750, for technical violations at an AM directional station.

This appears to be another case of an AM that's just barely on the air, trying to pay the bills with almost no income. Compare the cost of keeping a 500 W five-tower directional AM going to the

cost of a class A FM. Which is more likely to have more listeners? Are small AM stations going to survive? Should they? We'll discuss this NAL in the hopes of keeping you out of trouble.

### Keep those towers lit!

The station was cited for not making a timely notification to the FAA concerning a defective flasher for the top beacon of one tower. The FCC knows that tower lights are going to fail. For this reason, they require a daily inspection of the lights and FAA notification immediately on observation of any improper functioning of any top

light or any flashing light (17.48(a)).

Because a beacon has two light bulbs in it, you should be able to generally observe the failure of one lamp before the second fails, keeping the tower lit. Any improper functioning would include the failure of one of the two bulbs or the flash rate not being within spec (12 to 40 flashes per minute). This station was cited for reporting the defective flasher to the FAA a little over a week after it was observed.

The station was also cited for having one lamp of a two-lamp beacon extinguished on two towers. These failures should have been logged (17.49), reported to the FAA (17.48(a)), and repaired as soon as practicable (17.56(a)).

The station was also cited for having a board missing in a wooden fence around a tower, permitting unauthorized access to the tower. This could result in RF burns or exposure to RF above the ANSI limits.

The station was cited for not having base current ammeters available for all five towers, as required by 73.58(a). Because directional stations have antenna monitors, and the performance of the DA can be easily checked on this monitor, it's easy to forget that 73.62(a) requires both the antenna monitor and base current ratios to be kept within five percent of licensed.

It appears that the station logs showed excessive fields at the monitor points for two months. Part 73.61(b) requires a partial proof when the licensee suspects the field may be exceeding the authorization. Two months of high monitor point values should be suspect.

At the time of the inspection, the antenna monitor did not work. Part 73.62(a) requires directional stations to have working antenna monitors, while 73.62(b) makes provision for the monitor to be out for up to 120 days pending its repair or replacement.

The station had been advised five years earlier that two monitor point locations needed to be changed for the safety of those making the measurements. This probably falls under the "no longer accessible for use" provision of 73.158(a). Further, due to construction, the route to the monitor points specified on the license was no longer valid. Part 73.158(b) requires a corrected station license be requested and the new route description to be posted with the station license.

The inspector had the station being monitored transmit an EBS test. The decoder at the station being inspected failed to properly unmute the speaker.

Failure to maintain an operable EBS receiver is a violation of part 73.932(a). Note that the FCC does make provision for the EBS receiver to be repaired.

Part 73.932(d) allows a station to continue operation without EBS equipment pending its repair for 60 days, providing appropriate entries are made in the station log. The weekly EBS test reception confirms that the receiver and decoder are operating properly. The defective receiver or decoder should have been caught by the chief operator's weekly log review (as required by 73.1870(c)(3)). Further, 73.931(d) requires a station to check networks, wire services, and/or the EBS receiver prior to starting operation to insure the station is not "signing on into an emergency." I'd suggest that even 24-hour stations make a daily check of the EBS receiver. Is there audio?

The station also was cited for not having

any EBS test receptions logged in the station log for a month and having no explanation as to why those entries were not made. Again, this should have been caught by the chief operator log review.

The NAL says that equipment performance measurements (EPM) required by 73.1590 and made prior to June 27, 1990 were not available. The station was cited for violation of 73.1225(c)(1), which requires the station to make the measurements required by 73.1590 available to a representative of the FCC.

However, part 73.44(e) exempts stations using the NRSC-1 audio pre-emphasis and filter from performing these measurements (unless requested by the FCC) for the period of June 30, 1990 until June 30, 1994. Part 73.1590(d) specifies that EPM data will be retained for two years. If we assume the station typically completed EPM measurements in June of each year, and discontinued those measurements in 1990, the last set of measurements would have been in June 1989. The two-year retention period would expire in June 1991. The station was inspected in September 1991, so quite possibly they were not required to have any EPM on file.

### Location of station logs

The NAL notes that, at the time of inspection, the chief operator stated that the most recent field strength measurements were maintained at his residence and not readily available. The station was cited for violation of 73.1225(c)(5). The FCC Rules do not specify where the logs are to be maintained, but they do require various records be made available on request of a representative of the FCC.

The station also was cited for several rule violations caused by its operation at 162 percent of its authorized power for a month. First, it's a violation of 73.1560(a)(1), which sets the limits on power. Second, it's a violation of 73.1560(a)(2), because the station was not immediately shut down when operating in other than the required operating "mode." Third, the station was cited for violation of 73.1860(c), since the operators apparently made no attempt to adjust the power to an authorized level. This section requires the operators to be properly trained in the operation of the station. This would include knowledge of the limits on various transmission system parameters and how to make adjustments to those parameters.

The station was operating under an expired STA authorizing operation with parameters at variance. The station was cited for violation of 73.1635(a).

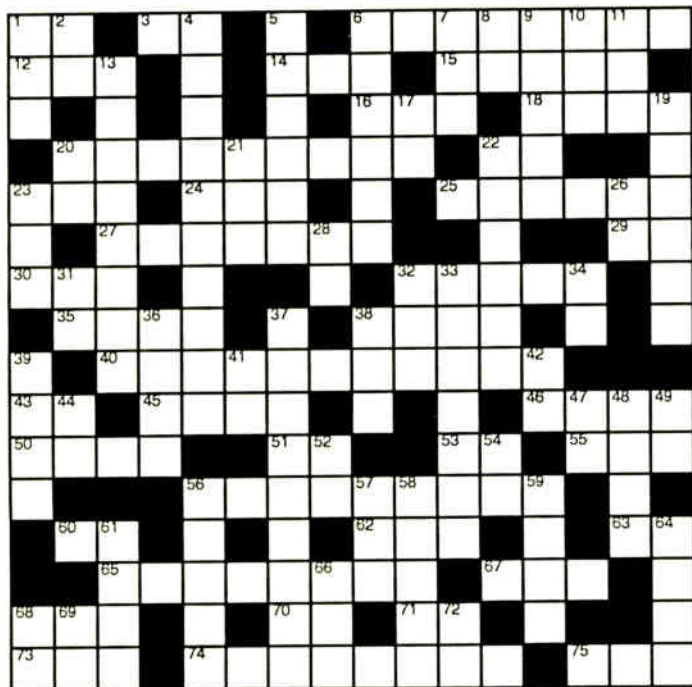
Monitor point measurements during the inspection showed fields exceeding those authorized by 44 percent to 576 percent. The station logs further documented excessive monitor point fields for at least two months. The station was cited for violation of the terms of its license.

Next month, we'll continue our discussion of the FCC Self Inspection Reports. I'd be interested in getting copies of any FCC violation notices you may have. It's always interesting to see how the FCC is enforcing the rules. 'Til then, keep it legal!

□ □ □

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

## This Month's Crossword



by Steve Walker

solution in next issue of RW

### Across

1. Non-direct current
3. You're reading it
6. Goes around
12. "Simply the best"
14. Audio processing
15. Not seldom
16. Clock people
18. Operator
20. Only works one way
22. Part Number
23. Flightless bird
24. Large container
25. With little difficulty
27. \_\_\_\_\_ Development Group
29. Place where
30. Many
32. Cease
35. Dog's name
38. Absent without leave
40. "Clean as your audio"
43. Short for "What did you say?"
45. See to
46. Accomplishment
50. \_\_\_\_\_ Straits
51. Former
53. Not required
55. Get free of
56. Removing unwanted components
60. What you need before you build
62. Fox live TV show
63. Latin "and"
65. Connector tools
67. Abbr. for one or more radiating elements
68. Copy
70. Naval yes
71. Green Acres character
73. Often used interchangeably with BAUD
74. Station owner
75. Ampex tape deck designation

### Down

1. Do something
2. Volume measure, metric
4. Console Manuf; breadrock
5. Writer
6. Censors
7. Wrote *The Raven*
8. Audio frequencies
9. What a phaser set on low does
10. His, Fr.
11. Compass point
13. Pertaining to sound
17. Coyote state
19. Time; cadence
20. Evening
21. Groove
22. Money for airplay
23. Current-mode logic
26. Jerry Lee Lewis home state
28. Milliwatt
31. Relating to
32. Own, *Scottish*
33. Pertaining to plants
34. Transmit
36. To lavish affection
37. The old gray cart and the new DCR-1000
38. Engineer's group
39. Light emitting diodes
41. Davy Crockett home state
42. 30-300 kHz band
44. Hello
47. Emergency room (abbrv)
48. Helper
49. Football score, abbrv.
52. Old PC model
54. Nurse
56. Extra benefit
57. To make a mistake
58. Popular gift flowers
59. Hereditary factor
61. Polychlorinated biphenyls
64. Rip
66. Seeing orb
68. Sound pressure level measure
69. Direction
72. AudioVAULT digital audio



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RCA MI 11204 line, tube, J Munn, Oroville Radio, POB 1340, Oroville CA 95965. 916-533-3700.

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ERI 37 CP 6-bay FM w/300 W heaters, 100.7 MHz; Andrew 84147 3" heliax, 80' piece, new. P Phillips, WMGI, POB 3190, Terre Haute IN 47803. 812-533-2141.

Myat 3 1/8" switch, 3-port, new, \$500; 1-3 1/8" female N reducer, new, \$100. M Mayhugh, 304-485-7354.

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Rohn SSV self-spt 60'. J Vine, Vine Comms, 2845 Airway Ave, Kingman AZ 86401.

4-8 bays on 91.7; 400' of 1 5/8" line; FM antenna, pref Shively, M Taylor, KENO, 700 Spencer Dr, Neosho MO 64850. 605-224-1240.

Shively/ERI 6/7-bay tunable to 95.1 & STL w/dishes. M Grubbs, KATG, POB 1047, Luling TX 78648. 210-875-2555.

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Orban 672A stereo EQ, dual chnl, 8-band quasi para, nds minor work in left chnl. J Green, J Green Ltd, 1078 Barbara Ct, N Bellmore NY 11710. 516-221-1344.

CRL Dynafex DX-2 sngl-ended noise reduc, downward expander, lk new w/manual, BO; Hughes AK-100 Sound Retriever stereo enhancer/synth, sound retrieval, new, BO. T Alexander, WDOK, 1 Radio Ln, Cleveland OH 44114. 216-696-0123.

Soundcraftsman (2) SG-2205-800 graphic EQs, \$75 ea; (3) Pultec EQP-1A3 EQs, \$95 ea. D Vernier, KUNI, Univ No IA, Cedar Falls IA 50614. 319-273-6400.

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TEAC Dolby B noise encoder-decoder w/manual, working. 305-887-5329.

Dolby B ext proc for casset duplication, box/rack mount. M Sokkol, JMS Prods, 121 E Baltimore St, Hagerstown MD 21740.

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Shafer 903, \$1950. S McGrath, WGNV, 429 Little Britian, New Windsor NY 12558.

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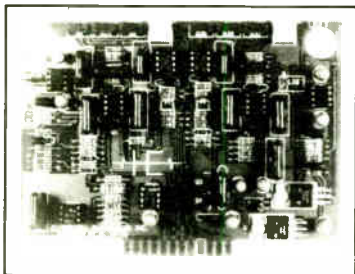
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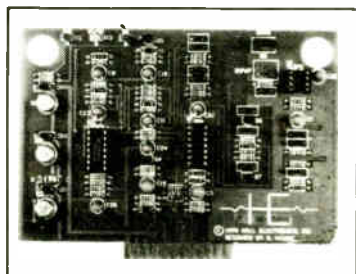
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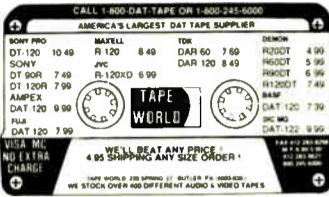
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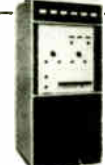
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Empire Mdl 98 tonearm for Mdl 398-598, satin/gold/chrome, mint cond. J Morinelli, 215-789-5472.

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Chyron IIIB char gener, disk drive, kybd, \$750 + s&h. J Davis, KRKB, 500 Media Pl, Sacramento CA 95815.

Sony AC-2400 & AC-3400 power splys, new. Best Offer trade. J Roper, Imperial Sound, 383 N Studio St, Terre Haute IN 47803.

Sony VO56600 3/4" (2), R/P, \$100 ea; (5) VP7000, 3/4" players, \$900 ea; (7) RM500 ram ctrls, \$100 ea/ (7) RMM rack mount kits, \$150 ea; VP2010, \$500. H Larson, TV15, 615 Tank Farm Rd, San Luis Obispo CA 93401. 805-544-1515.

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Sony RM-400 U-Matic edit control unit with both cables, gd cond, \$150 + shipping & handling; Pana WV-600P special effects gener, wipes, s itches, dissolves, good condition, \$75 + shipping & handling. G Kirby, Gray Fox Video, 13613 US 36, Marysville OH 43040. 614-261-8871.

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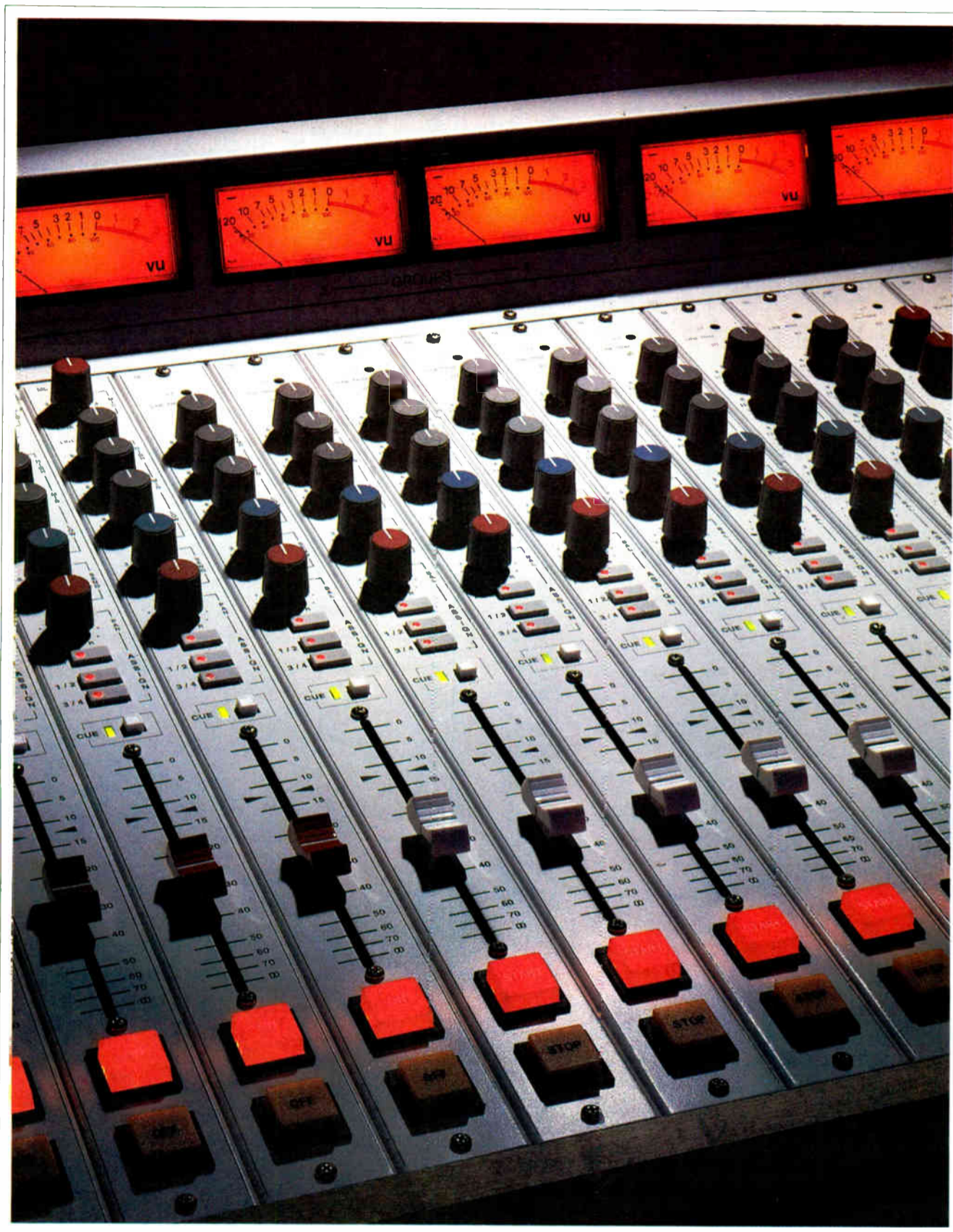
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