

YEAR IN REVIEW

Technology, Regulation Bloom in '92

by Alex Zavistovich

WASHINGTON Developments in broadcasting, both technological and regulatory, occurred rapidly throughout 1992.

Certainly, some of the regulatory changes can be attributed to election-year considerations, as elected and appointed officials worked to improve their public records, or to push through their own political agendas.

On the technological front, the flurry of innovations is harder to explain. In some cases—AM and EBS improvements and digital audio broadcasting, for example—it certainly could be argued that the developments are the culmination of work initiated years earlier.

Regardless, 1992 proved an interesting year for the industry. Following is a synopsis of some of the top stories of the year, as determined by RW's editorial staff.

Digital audio broadcasting

Digital audio broadcasting (or, as continued on page 11 ►

RBDS to Get Big Push at CES

by John Gatski

LAS VEGAS A major RBDS (Radio Broadcast Data System) display/demonstration is planned for the Winter Consumer Electronics Show (WCES) in Las Vegas June 7-10.

The event coincides with the official adoption of the National Radio Systems Committee (NRSC) RBDS standard, a standard based on the European RDS technology, which allows text transmission, automatic station selection by format and other features.

Plans include a separate display by several major receiver manufacturers as well as other displays at the various booths and suites. Companies expected to display RBDS receivers (which may carry RDS logos, however) will include Delco, Denon, Onkyo, Panasonic, Sony, Blaupunkt, Kenwood, Pioneer, Yamaha and Alpine. Most receiver manufacturers already produce RDS radios for the European market, and minimal modifications are needed to make them meet the new U.S. standard.

As many as five FM stations will be transmitting the 57 kHz RBDS data stream to highlight the capabilities of RBDS, according to RE of America, a major manufacturer of RDS encoding equipment. (Approximately 35 U.S. sta-

tions already have RBDS encoders online.)

"This is a major event. I call it opening the floodgates," said John Casey, sales engineer for RE America's Broadcast Division.

With DAB still in the future, RBDS is radio from an "entirely new perspective," according to Casey.

The public relations value of the RBDS event at WCES cannot be underestimated, according to WCES's spon-

sor, the Electronic Industries Association (EIA).

Because RBDS is a broadcaster-dependent technology, the electronics industry is planning to produce RBDS receivers and promote them to create radio station interest.

With the RBDS display at WCES, there will be no more "chicken or the egg" dilemma for broadcasters on deciding whether to add new technology. continued on page 7 ►

Santa's Helper:

Bruce Mager, owner of Waves in New York City, sells vintage radios—which would make great Christmas gifts. See p. 10



KPLA(AM) Airs Chinese News

by Nancy Reist

SACRAMENTO, Calif. Commuters driving home through Sacramento's afternoon traffic can now listen live to tomorrow's news from the People's Republic of China.

In October, KPLA-AM began broadcasting a half-hour live feed from China Radio International, formerly Radio Beijing. The broadcasts are in English and start with five minutes of news, followed by three to four minutes of commentary about China. The rest of the program consists of features covering topics ranging from cooking to business and travel.

Though the broadcasts come from the Chinese government, KPLA General Manager Jack Gardner said that for the most part they are quite objective. "It's not really designed to be political. It's news and information about what's going on in China—what the official government viewpoint is on current events and international relations."

Live from Beijing

"So sure, that's their viewpoint, but the advantage is that it gives Americans an unfiltered read on what they're saying," Gardner explained. "Our media twist and distort so much stuff that you don't know

what they are saying or how they are saying it. That's why for years I've been listening to shortwave."

Shortwave radio has never been as popular in the U.S. as it is in other parts of the world. There are various theories to explain this phenomenon. One is that most U.S. listeners won't tolerate the fluctuating fidelity of shortwave broadcasts. Gardner said he is very pleased with the signal quality of KPLA's new program.

He said China Radio International sends the feed over the telephone, using a single-line Comrex LXT unit.

Gardner explained that the familiar lag we associate with long-distance calls is not a problem in this context. "There's a little satellite delay on a two-way conversation, but this is one-way. They will talk to us at the setup to set levels and so on. After that, it's one-way transmission because we're not interrupting. So whatever delay is there is not noticeable."

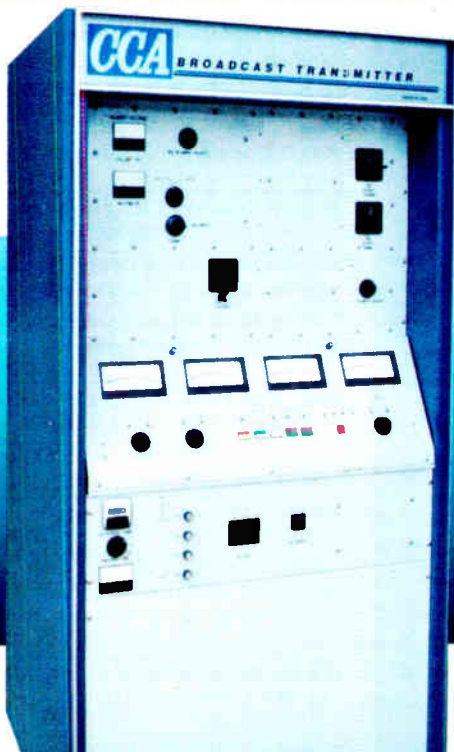
Long-time fan

Gardner has a long-standing interest in international broadcasting. He began listening to shortwave radio as a kid and is one of three owners of a new AM-FM commercial station in Moscow. He had continued on page 3 ►

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NEWSWATCH

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BLUE RIDGE SUMMIT, Pa. The General Radio Telephone Operators License Study Guide, Third Edition is now available from TAB McGraw Hill.

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Denon Goes With Mini Disc

NEW YORK Denon of America is firmly in the Mini Disc (MD) camp,

based on activities and comments made at a recent technology display.

Denon of America President Robert Heiblim said the company will introduce a play-only portable at the Winter Consumer Electronics Show (WCES), and will produce a portable recorder in 1993. Other companies also plan to show MD components.

Heiblim said the Mini Disc, developed by Sony, is technically superior than its rival, the Philips-developed Digital Compact Cassette (DCC). The recordable MD is a 2.5-inch disc that can be optically recorded once; the play-only 2.5-inch disc is played like a CD.

Like DCC, MD uses a digital audio compression scheme to allow 70 minutes of 20 kHz audio to be recorded on such small media. MD also has near-instantaneous track access and a "buffer" memory that eliminates skipping by reading 10 seconds ahead.

Sony has said the MD technology has potential for professional use—perhaps as a replacement for a cart machine.

SCAs at Radio 7

MOSCOW Russia's first commercial radio station, Radio 7, is using digital SCAs to beam information to area news services.

Because of the badly outdated phone systems in Moscow, news services such as Federal News Service and the Associated Press needed an alternative way to get news into the Moscow bureaus.

By using an SCA on Radio 7, incoming information can be relayed to the station by phone line or satellite, then beamed to the services via the SCA.

continued on next page ►

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NAB Urges "Directional" Restrictions

WASHINGTON The NAB has urged the FCC to overturn a staff decision that "encourages" greater use of FM directional antennas and, consequently, increases interference in the FM band.

"Many broadcasters assert (that) directional antennas provide unreliable protection against interference," the NAB said. "NAB fears eliminating the 8-kilometer short spacing rule, which restricts the use of directional antennas, will actually lead to more interference for stations slotted nearby on the FM dial and encourage more crowding..."

Vespoli Promoted at Scientific Atlanta

ATLANTA Jorge Vespoli recently was promoted to president of Scientific Atlanta's satellite communications division.

Vespoli, a seven-year veteran of Scientific Atlanta, formerly served as vice president, systems engineering for the company's Network Systems Group, which contains the satellite communications division.

IDB Launches New Service

LOS ANGELES IDB Broadcast has introduced a new audio distribution ser-

vice: Ku-band FM Squared.

According to the company, the service reaches virtually all of North America using a single dedicated transponder on the Canadian Anik E-1 satellite.

IDB said the Anik offers greater coverage and higher power levels than the Satcom K-2 or SBS-6 satellites, which

are commonly used for audio distribution in the U.S.

San Diego Police Nab Illegal Beatles DJ

SAN DIEGO An amateur technician-class licensee was sentenced to three

years probation and 250 hours of community services for jamming a San Diego Police Department frequency, according to the FCC.

Roy L. Eyman II was sentenced Oct. 22. His punishment stemmed from a September 1991 incident when a broadcast of Beatles music disrupted a San Diego police frequency. Eyman was discovered, however, by a police sergeant, who used a field strength meter to trace the illegal signal to Eyman's car.

Besides the community service and probation, Eyman was ordered to remove all public safety frequencies from his amateur equipment.

Intraplex Multiplexer Bought by Westwood One

LITTLETON, Mass. Westwood One has purchased an Intraplex Variable Rate Multiplexer 3800 VRM to backhaul programming between Mutual Broadcasting Systems and NBC Radio studios in Arlington, Va.; and between Talknet studio in New York City and Westwood One Radio Network in Culver City, Calif.

The digital audio transmission system will carry twelve 7.5 kHz and four 15 kHz audio program channels as well as Netwriter, Cueing and 56 kilobit per second (kbps) high speed computer applications.

KPLA(AM) Airs Chinese News

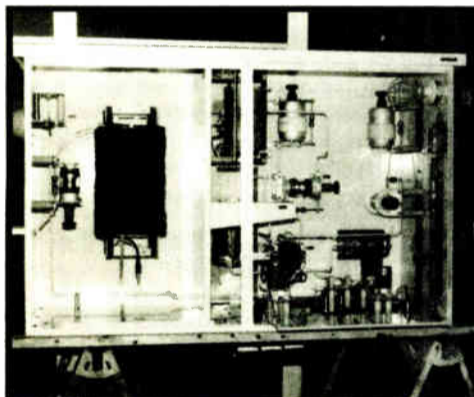
► continued from page 1

hoped to launch an international news hour on KPLA, featuring unedited news produced in other countries—a sort of radio version of CNN's World Report. So far, that hasn't panned out, but he said he expects to eventually expand KPLA's English language foreign programming.

Though both KPLA and China Radio International have the right to sell spots, currently the program doesn't include advertising. But the Chinese pay for the feed and the air time, and Gardner has received many calls from interested listeners, so he is enthusiastic about the new addition to KPLA's programming.

More feedback desired

Furthermore, Gardner says he enjoys listening to China Radio International himself. "It's very well done. They're really working extremely hard on putting forth a really top-notch broadcast to the best of their ability. That's a major breakthrough, that their professionals are able to reach a mainstream audience here, because shortwave listening is not that popular in the States."



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...And to All, a Good Night

by Alex Zavistovich

WASHINGTON 'Twas the night before Christmas, when all through the stations/The GMs and PDs had run out of patience/Ad spots had been sold by the salesmen with care/But ice on the tower gave them naught but dead air...

Season's greetings. I owe profuse apologies to Clement Clark Moore for my warped rendition of his classic holiday poem, but it was a good way to introduce you to RW's year-end special issue.

It's unfortunately true that radio people—and CEs in particular—keep track of yearly holidays by the changes in weather that may force their stations off the air: Easter is Rainy Season, Memorial Day and the Fourth of July are Lightning Season, Columbus Day is Son of Rainy Season...and Christmas, of course, is the dreaded Snow and Ice Season.

That's one reason to read Tom Osenkowsky's primer on preventing ice build-up on your tower. If you've never experienced a tower collapse either from the weight of accumulated ice on the guy wires or on the tower itself, consider yourself lucky. It's not a pretty picture, and it means a lot of down time, lost revenue and late nights at the station that would be better spent with visions of sugar-plums dancing in your head.

Whether you're an engineer or a manager, Tom's advice just may keep you indoors with a mug of egg nog this year, instead of trying to come up with a way to send your signal out on the world's longest horizontal radiator.

★ ★ ★

Other features from our writers in this issue are equally important, both for surviving the winter season and the year ahead. Howard Enstrom offers advice on maintaining low power FM translator facilities, Harry Cole gives you some tips on preparing your public inspection file

for next year, and Barry Mishkind suggests a couple of readily available computer software packages that will help you get your accounts in order, ready for tax time.



There are also some fond memories of things past and a Christmas wish list from Al Peterson, New Year's resolutions from John Bisset's *Workbench*, and hints from Tom Vernon on eliminating RF interference. Ty Ford offers his views on eliminating "killer clichés" from your ad copy (some good year-'round advice), and we get a peek under the tent at the modular studios of the Premiere Radio Networks, courtesy of Dee McVicker. All that, and news and Buyers Guide, too.

Just consider it our little holiday gift to you.

★ ★ ★

A couple of issues ago in this column, I was bemoaning the quagmire of acronyms and abbreviations your average radio person has to wade through in the course of doing business every day. I was particularly irritated by the FCC's latest addition to the problem—DARS, or "digital audio radio service."

Try as I might, I just haven't been able to force down that particular mouthful of alphabet soup. I mean, it's not as if DAB, DAR, DRB, BSS and who-knows-what-else didn't already do the job.

Then I got a bit of insight I thought might interest you.

A friend of mine at the FCC suggested that the reason the Commission coined the term DARS may be out of reluctance to call the technology "broadcasting." There even may be an undercurrent of opinion at the Commission not to regulate it as a radio broadcast service.

You see, entrepreneurs in this fledgling technology have proposed a variety of money-making ideas associated with digital audio, including messages, paging and subscription-based entertainment services. It is possible the Commission will want to give themselves some flexibility in regulating the emerging technology.

In fact, according to my source, it's even possible that the FCC may consider making digital audio a *common carrier* issue, rather than a mass media concern.

Remember, it wouldn't be the first time something like this has been proposed. During Mark Fowler's reign at the FCC, the Commission deemed that subscription TV was not broadcasting. Multipoint services became a common carrier issue. Even subcarrier services, which provide programming comparable to that available through conventional radio, were freed from complying with the strictures of broadcast radio regulations. Similarly, if digital audio service in the U.S. becomes subscription-based, it likewise could be free from such controls.

Still, there's more to the issue of (all right, I'll say it) *DARS* than there ever was in pay TV, multipoint or SCA services. In-band, on-channel digital audio broadcasting plays a part in all this. If its developers realize their hopes, the Mass Media Bureau will still have to be involved, because the service will reside in the existing FM and AM frequencies.

Granted, control over some aspects of the technology may be taken up by other arms of the Commission if we end up with a hybrid satellite-terrestrial system, which may be why the phrase "digital audio radio service" sounds like a good way to hedge the FCC's bets.

★ ★ ★

I've had to come up with a whole new category to describe this next item. Let's call it, "Thanks for the Recognition, but Couldn't the Name Use Some Work?"

Apparently, Cleveland, Ohio's Telos Systems is one of the latest recipients of the inscrutably-titled Weatherhead Upstart Award. Fortunately, I was able to get someone to unravel the mystery of that name. The award is co-sponsored by the Weatherhead School of Management of Case Western Reserve University; Enterprise Development, Inc.; Kemper Securities Group, Inc.; and Cleveland Enterprise Magazine. It is given in recognition of the 100 fastest-growing companies in northeast Ohio.

Congratulations to Telos—not bad for a company that was born on a kitchen table less than 10 years ago. And it isn't every day that someone calls you an upstart and you thank him for it.

By the way, I was put on hold while waiting to get someone to crack this code for me. Instead of the canned music you're usually subjected to while on hold, I was surprised to hear Telos playing "Both Ends Burning," by Roxy Music. Don't tell me Cleveland's not cool.

That's it for now. Tune in next time, and ho-ho-ho,

Alex



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International response

Dear RW,

When you named your publication **Radio World** you weren't kidding. Recently, I ran a For Sale listing for an AM stereo exciter and I not only received several inquiries from the United States, but from Ireland, Sweden and the Philippines as well.

William O. Barry, Owner
WAMB-AM-FM
Nashville, Tenn.

A super new AM radio

Dear RW,

I'm sure many of you are aware of the sad state of many AM receivers on the market for the past 20 years or so. That's why when a good AM radio finally appears, it deserves some press coverage.

I'm talking about GE's Superadio III. It has a tuned RF stage along with four IFs, for really super sensitivity. Along with those gain stages, it has an almost eight-inch ferrite rod antenna inside with excellent null characteristics. There is also a provision to hook up an external AM antenna. It is powered by six "D" cells or AC.

The sound is terrific! It has a 6 1/2-inch woofer and a two-inch tweeter. It has separate bass and treble controls. Unique is an "AM Accent" switch which selects maximum selectivity in the "normal" position, or best audio response in the "wide" mode. The only thing missing is AM stereo.

I've seen it priced around \$50. Oh, by the way, it also has FM.

Hal Schardin
Technical Supervisor
WCCO Radio
Minneapolis, Minn.

Reading double

Dear RW,

I have a question that I would like you to answer.

Back in May of 1992, you printed a letter that I wrote to RW. The letter

was printed much like I wrote it, without the P.S. that I had added. This I understand.

However, I don't understand why there was an opening added to my letter. They were not my words: "The broadcasting industry is changing so rapidly and going downhill so quickly that I hardly know where to begin. For now I'll try to limit my comments to two areas."

I have no problem with this being added to my letter, even if I didn't write it. Also, I don't believe that broadcasting is going downhill that fast.

Then, in the Aug. 5, 1992 issue of RW, I saw a letter that was from Terry Skelton that started off just like my letter. Check the copies if you don't believe me, it was just like my letter at the start.

My question, Mr. Editor, is this: What happened here? Did:

a) Mr. Skelton and I have the same thought?

b) Our brains come from the same source?

c) Mr. Skelton copy my letter at the start, then move to his own work? Can I therefore sue him and win a big buck settlement and get out of broadcasting forever (since we now know that it's going downhill so fast, I don't know where to start or stop)?

d) Somebody on your staff write these words in high school and need to see them in print from time to time—and, by the way, should really seek help?

My pick is d. Please, Mr. Editor, let me know what happened. My life will never be the same unless I know.

Jerry White
Pelham, Ga.

Editor replies: On this particular pop quiz, Mr. White and I both flunked. The correct answer is: e) None of the above. What happened is that our over-worked administrative assistant inadvertently input the opening to Mr. Skelton's letter twice—once in the correct place and once in Mr. White's letter. Because the letters ran in different issues, we failed to catch the error. My apologies.

The Versa Count report

Dear RW,

I just read the letter from Paul Latsof inquiring about where Al Williams of Versa Count™ fame may be reached (RW, Oct. 21, 1992). As far as I know, Al is still at the same phone number and address he has had for the last 15 years: 553 N. Lively Blvd., Elk Grove Village, IL 60007. The phone number is still 708-593-0970, and as of Nov. 10, it was still in service. The only thing that has changed over the last 10 year, besides the passing on of the company's innovative chief design engineer and co-founder, is the primary company name. It is now known as Scientific Data International, Inc. Last time I was there, I learned SDI specialized in low cost satellite receivers for OEM products.

For those who need copies of the V-322 exciter, I have a fresh copy which I procured from Al himself a couple of years ago. However, I only have a copy of the

Is Change Ahead?

The word seemingly on everyone's lips in this election year was "change." As we prepare to enter 1993, a question needs to be answered: What changes will the broadcast industry face?

Technologically speaking, the evidence is already there. This year saw the first on-air demonstration of in-band, on-channel digital audio radio service (DARS). The FCC's overhaul of AM technical criteria was completed (five years after it was initiated). In

near record time the industry expedited a voluntary standard for the radio broadcast data system (RBDS), and the Commission has instituted an examination of the emergency broadcast system.

So the technological future of the industry has, to some degree, already been revealed. Add to that the reputation Vice President-elect Albert Gore has for embracing new technologies, and broadcasting seems poised for substantial advances over the next four years.

The new administration also may usher in an era of regulatory change. If President-elect Bill Clinton stays true to form as a Democrat, the country may see a shift from deregulation to re-regulation—an increase in government oversight of industry, including radio. Broadcasters may see a turning away from the "marketplace" decision-making philosophy employed by the Commission for more than a decade.

Not only charged with carrying out the new president's vision of change in the future, the Commission itself is facing changes. Both Chairman Al Sikes and Commissioner Sherrie Marshall are expected to be replaced by appointees from the Clinton administration. Rumors abound regarding their replacements, and some scenarios depict a Commission more racially balanced than in past years. Perhaps the empowering of minorities—a cry heard throughout 1992 in song, on film and in the streets—will be manifested in the government by the new FCC.

Finally, on a more basic level, economic indicators promise relief from the recessionary woes that have plagued the U.S. for more than two years. The Radio Advertising Bureau has reported an increase in national spot sales, even going so far as to call the trend a "recovery"—which is good news for all broadcasters, regardless of race or creed.

Technology. Reform. Empowerment. Recovery. These words of change point to new directions for broadcasters and all America. Whether these changes take place, and how the country makes use of them, will be decided in time. For now, the potential is exciting enough.

—RW

latest generation of the unit. Earlier exciters, as I remember, have a slightly different PA section and/or VCO. Copies can be made available to those who need one at a nominal cost for copying and shipping, COD. Please fax me a request at 708-439-1464 only. No verbal phone calls please!

Additionally, Al may still have some inventory of the PA and IPA transistors left. I suspect that some of the more esoteric or proprietary components may no longer be available, however, I can not be sure, as I haven't talked to Al in almost two years. But you never know until you ask. I do not have any spare parts!

I have a somewhat special affection for Versa Count. Two of my closest high school friends assisted at Versa Count in the development of what may consider the first high quality (for that period of time) low-cost exciter and distribution amplifier series commercially available outside of the big manufacturers in the early 1980s. My two friends now work for Motorola as design engineers themselves. Al and Versa Count gave them their first taste of practical RF experience fresh from *high school*. Commendable, to say the least!

Several years ago, Al had prototypes constructed of a full line of broadcast transmission equipment, including AM and FM modulation monitors, STLs, a new exciter and low power PA, and some super high powered audio power amps. Al, however, saw a pending collapse in the industry during the late '80s and decided not to market the line, as he was sure he would lose money. Good decision? I think so...

Finally, Al is a hard person to reach. He rarely returns calls unless absolutely necessary when he is not in town (country), which is most of the time. Good luck...

Michael G. McCarthy, N9EAO
Owner
McCarthy Radio Engineering
Mt. Prospect, Ill.

Inspiration from SkyLight

Dear RW,

Thank you for your excellent publication. I rely on RW to keep me posted on the emerging trends in broadcasting. I appreciated the article in the Nov. 4 issue, entitled, "Format Providers Grow in Numbers."

I wanted to make you aware of the SkyLight Satellite Network out of Minneapolis-St. Paul. We are currently serving 150 stations and 70 translators, with a hosted Inspirational music format along with Standard News. This is a music-intensive format that draws heavy listenership among the 25-45 demographic. The format is generic, so it's designed to sound like the programming is coming from the local station and not an imported signal.

SkyLight Satellite Network has found a niche as an Inspirational music network.

Thank you again for your great publication. It's a great service to broadcasting.

Wayne Pederson
Executive Director
SkyLight Satellite Network
St. Paul, Minn.

Correction

"Fifty Facts About FM Translators," in *Low Power Lowdown* in RW's Nov. 25, 1992 issue contained an incomplete fact. Item 39 should read: "If a primary station is non-commercial educational (NCE), its translators may operate on any of the 100 FM channels. Satellite-fed systems, however, are restricted to use of a reserved channel (201-220). If use of any of these channels would cause TV channel 6 interference, an FCC rule waiver is required in order to operate such a translator on a commercial channel (221-300)."

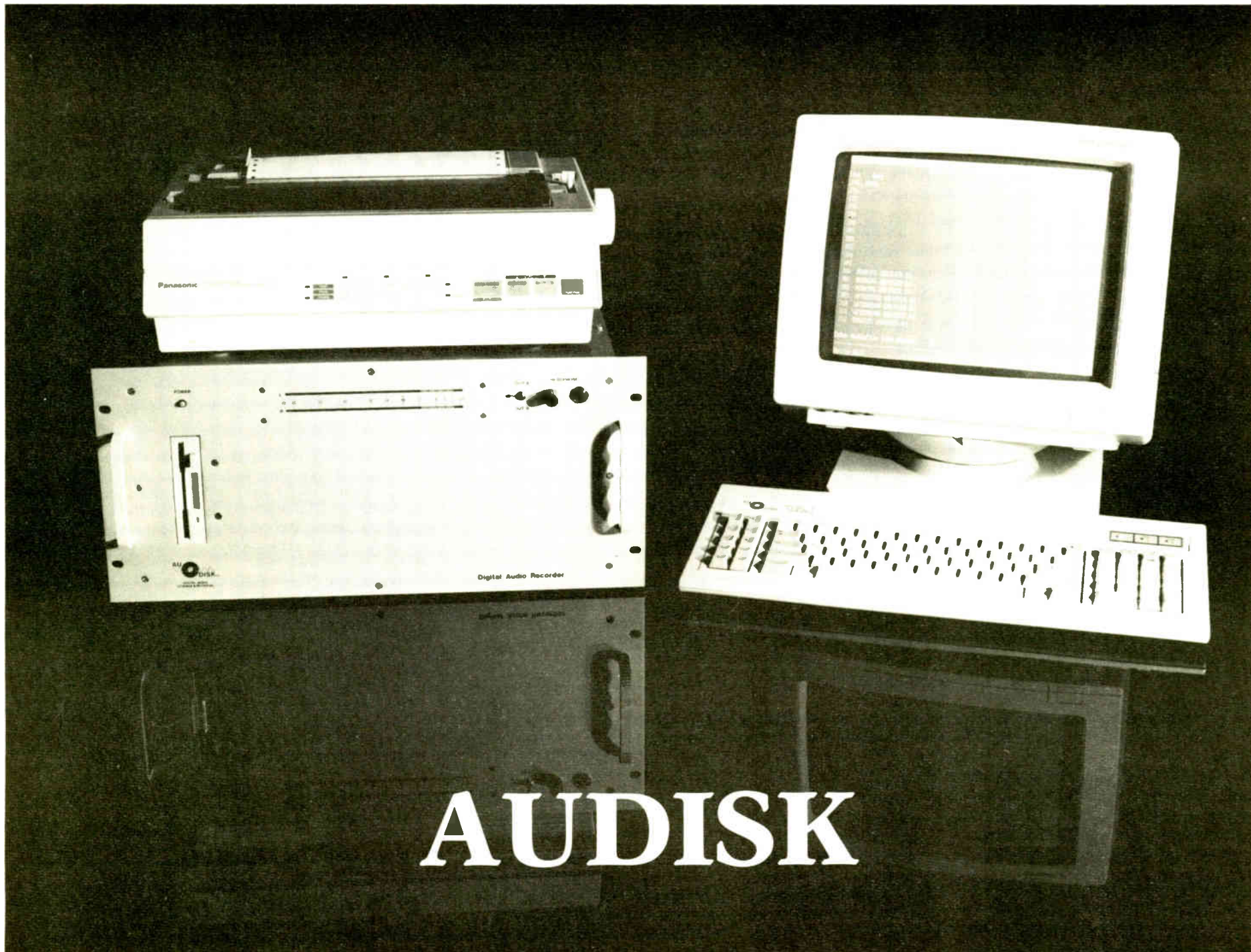
Radio World

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"Call me, I'm interested." Circle (17)

"Send me literature." Circle (122)

Texas County Converts to RDS EBS

by Dee McVicker

JEFFERSON COUNTY, Texas If ever there were an area that requires an effective emergency alerting system, it is Jefferson County.

Located approximately 90 miles from the Gulf of Mexico, the community is rated second in the country for hurricane warnings and holds the record for having the highest concentration of petroleum and chemical plants in the United States.

Here, where a chemical leak from one of several major industrial plants could endanger 350,000 lives, is the test site for what could be the first EBS (Emergency Broadcast System) and alert system to link the White House with all U.S. radio, television and cable stations within minutes of a national disaster.

The community plans to fully implement the Radio Data System (RDS) or RBDS (Radio Broadcast Data System, based on the recently approved national receiver standard), by early 1993.

At no out-of-pocket expense, all radio and TV stations in Jefferson County agreed to participate in the new system, which was funded by the petrochemical industry to comply with the federal Superfund Authorization Recovery Act (SARA) Title 3. SARA Title 3 was enacted soon after the 1984 Bhopal, India gas leak disaster that killed 5,000 people.

The future of EBS

RDS proponents believe Jefferson County will be a proving ground for the versatile technology.

"This system has the ability to grow. You can literally go from Jefferson County to all around the nation," said Ed Gearhardt, plant manager for Elf Atochem Northamerica, one of 12 major petroleum companies to fund the \$3 million system for Jefferson County.

RBDS Gets Big Push at Winter CES

► continued from page 1

gies such as AM stereo, Casey explained.

(The "chicken or the egg" theory was cited as a reason for AM stereo's lackluster success in the absence of a standard. Some believed that the receiver industry did not make stereo receivers because they were waiting for more broadcasters to transmit in stereo. Others said the broadcasting industry refrained from adding stereo until more receivers were made.)

With RBDS, that scenario will not happen, Casey said, because the receivers will be there.

Casey believes that the station search by format and text display of call letters and frequency will satisfy consumers and broadcasters.

To create awareness and to promote RBDS, an RBDS session also is scheduled at WCES to explain the qualities of RBDS to consumer retailers and the press.

The radio-based RDS alerting system was developed by SAGE Alerting Systems of Stanford, Conn. It is a spin-off of a system first implemented in West Germany for the purpose of alerting for a major war. The system also is being studied by the FCC and at least one U.S. Senator.

Sen. Ernest Hollings (D-S.C.), chairman of the Senate's subcommittee on communications legislature, has expressed an interest in a federally funded, nationwide EBS using RDS.

"He (Hollings) has been very enthusiastic about this technology and in fact has said that once we get an FCC standard, he will go to Congress and try to get the funding for the whole program," Sage President Gerry LeBow said.

The FCC is now considering new technologies to replace the old two-tone system with a more modern technology that is less prone to system failures, and it is likely to include RDS. The Commission is expected to rule in favor of an EBS standard as early as summer 1993, pending a notice of proposed rulemaking (NPRM) specifying a system technically and operationally compatible to all cable, television and radio stations in the nation.

According to Dr. Helena Mitchell, the FCC's chief of EBS, the Commission is looking at a system based on a combination of the National Weather Service's WRSAME system and RDS, both of which are included in the Jefferson County system.

Emergency and media centers

The SAGE I system for Jefferson County is comprised of a network of computer terminals at five emergency actuation centers, one mobile actuation center, 12 petrochemical plants, and all radio, television and cable facilities in the county.

Communication between petrochemical terminals and actuation centers is done via VHF frequency while communication between actuation centers and media is done via 450 MHz links. Each link has two

channels, one for audio and another for data, and each is networked according to zone.

"We have it (divided) into three zones: north, mid and south county," said Dick Nugent, coordinator of emergency management for Jefferson County. "So all the industries in the south zone, their computerized systems in their plants, will talk to one actuation center (which will) activate and capture radio, television.

"If we have something that jumps one zone to another, it can go county-wide," he said. Nugent also plans to equip his car with the SAGE I system, so he can access the network while driving.

The National Weather Service links to Jefferson County's SAGE I via WRSAME code. To distribute the weather service information to homes and businesses, LeBow said: "We take the WRSAME codes, translate them into RDS and send them out RDS."

The SAGE I RDS systems uses a 57 kHz subcarrier from the area's primary emergency FM station to activate RDS receivers in nursing homes, shopping centers, hospitals, movie theaters, and automobiles, including police cars, and to turn on pagers, electronic road signs, electronic mail systems and sirens.

Through the use of RDS technology, LeBow said, "We can turn on a receiver at 2:00 in the morning in Jefferson County to tell you there's a gas leak in your neighborhood." Moreover, he said, the system can alert high-risk groups with specific information. "We can turn on a (RDS) radio in a nursing home, and tell people to turn off their respirators because there's a chlorine release."

Comprehensive coverage

Police and fire mobile units are equipped with RDS receivers, as well as RDS pagers programmed with LCD displays of area maps, to take instruction and disseminate information as required.

The SAGE I system also uses RDS as a

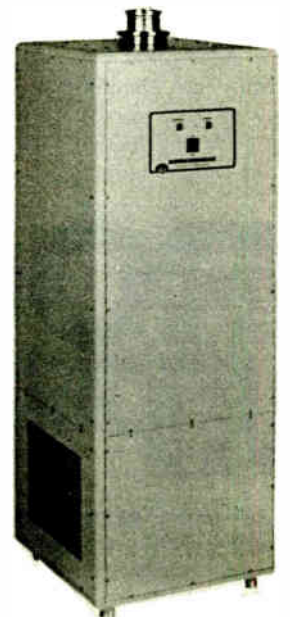
communications link between the primary CPCS-1 FM station and other radio, television and cable stations in the county, as well as to carry video messages for overlay onto television or cable home viewing—an important function required by television station KFDM to reach its hearing-impaired viewers.

"(We'll be able to) crawl text, make an audio announcement, and do a combination of audio and video," KFDM-TV General Manager Larry Beaulieu said.

Another function of the system important to broadcasters is its flexibility in disseminating emergency information to the public. According to LeBow, SAGE I is the only system being considered by the FCC that provides override capability to exclude media operators, such as DJs, from the burdensome task of disseminating

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RCS Wins Damages in Copyright Suit

by Frank Beacham

SCARSDALE, N.Y. A U.S. District Court judge has ordered Sacramento radio station KWOD to pay \$100,000 in damages to Radio Computing Services, Inc. (RCS) on the basis of copyright infringement for the illegal use of computer software.

The court ruled that Ed Stolz, owner and operator of KWOD, improperly used the RCS music scheduling program, Selector, by copying the disks and illegally obtaining access codes to use them. The ruling, resulting from a civil trial held in Sacramento, found KWOD liable to RCS, of Scarsdale, N.Y., for fraud, wiretap, trade secret appropriation and unfair business practice.

U.S. District Court Judge David Levi awarded RCS in excess of \$100,000 including punitive damages, and held that RCS could also collect court costs and its attorneys fees. Attorneys for RCS have petitioned the court for \$235,000 in attorney fees.

"By obtaining Selector without RCS's authorization, by copying it onto disks at KWOD, and by using the Selector system at KWOD, Stolz violated RCS's exclusive rights," the judge wrote in his decision.

Unauthorized access

Stolz, the judge ruled, pressured his program director into obtaining an unauthorized copy of the Selector software program. The program director convinced an 18-year-old former colleague at another

radio station to copy the Selector disks of that station for KWOD's use.

The Selector program has no copy protection, but requires a new access code whenever the disks are loaded into a new system and at 90-day leasing intervals. KWOD's Stolz participated in a ruse to obtain an unauthorized access code from RCS, the court said.

Stolz told *RW* that he will appeal what he called "a flawed decision" by Judge Levi. "There is irregularity with respect to the conduct regarding this particular judge," Stolz said. "It will be strenuously pursued on appeal."

The station owner, however, offered no specific allegations against the judge.

Stolz said a former program director at KWOD evaluated several music software systems, including Selector, but he was personally unaware of any illegal use of the RCS software. He called the lawsuit a "strong-arm tactic" by RCS, and said his station has been legally using Powerplay music scheduling software by Micropower Corp. since 1988, before the piracy allegations.

Lee Facto, general manager at RCS, said his company learned of the unauthorized use of the music scheduling software when a former KWOD employee moved to another client station and mentioned to his new boss that he had worked with Selector software at KWOD.

"The program director said, 'I don't think they are supposed to be using

Selector,' and called us," Facto said. "That's how we found out."

The illegal use of software designed for the radio industry "is not a huge problem," Facto said, but the KWOD case "just stuck out so much that we figured we had to take some action."

Isolated problem

A survey of U.S. software companies found few complaints about radio station theft of their computer programs. However, the president of one prominent American software company said he recently discovered that his company's European sales

representative was paying one of his American employees to ship stolen computer code and software for illegal sale in Europe. The executive said the matter is now under investigation by the FBI.

Most computer software theft, however, is hard to pinpoint, according to software companies. "There's a little bit of illegal copying that goes on," said Corey Deltz, designer of Airware, a program that aids in radio show preparation. "But it's real hard to keep track of."

"We go on the honor system," Deltz continued. "I'd say generally most people are very honest. If you have a good product, most people feel good about paying for it. Most people who pay for a product don't necessarily want to give it to somebody else who hasn't."

Texas County Switches to RDS

► continued from page 7

information during times of crisis.

"You're never going to turn a disc jockey into an emergency alerting communicator. That's not what he's paid for. (He's there) to bring in ratings, have fun, and play music. He's not there to tell you the world is coming to an end," Lebow said.

Providing media operators do not interrupt the system after a countdown period of several seconds, local emergency operators can take over programming of the station to broadcast pre-programmed messages during times of emergencies. Station program switchers are routed to the SAGE I system for this purpose.

Override is possible

In some cases, however, it may be in the best interest of radio and television stations to override the system, which station operators can easily do by activating the SAGE I's override function.

This capability is important in deciding which reports to air from the National Weather Service. Because weather warnings are not an exact science, Beaulieu explained, "all of a sudden, on a passive basis, all kinds of weather alerts (could come) through that we feel are invalid. We

have the option to override these if we choose."

But even with this flexibility there are safeguards built into the system. "If we choose not to carry (the emergency alert message), and throw the (interrupt) switch, the frequency agile (RDS) alert receivers, which were tuned to my station, will switch to a backup station that will carry the message," said Patrick Parks, chief engineer of KYKR-FM/KLVI-AM, the CPCS-1 station for the area.

Backup stations selected to carry the RDS service for Jefferson county are KAYD-FM, KKMY-FM and KQXY-FM. The four primary RDS stations, as well as the other 12 AM and FM stations, three television stations and two cable stations in the county are to be equipped with Celwave RPU antennas and IBM computer terminals, to bridge communications between media and emergency centers and to broadcast messages over the air within 90 seconds of a disaster.

Although stations in Jefferson County still observe existing EBS standards for compliance with existing FCC rules, SAGE Alerting Systems hopes that the old EBS will soon be replaced with SAGE I nationwide.

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 **PIONEER**

Give Me That Old-Time Radio

by Frank Beacham

NEW YORK Yes, Virginia, Santa operates a very special toy factory for those nostalgic souls among us who still believe in the magic of radio.

Wanting to beat the extreme cold weather of the North Pole and to be located in America's "Radio City," Santa decided to open his special factory in a small store front in lower Manhattan. He calls the place

"Waves," and assigned a couple of former elves named Bruce and Charlotte Mager to run it.

Waves will instantly set the heart pounding of anyone who is captivated by the history of radio. From the late 1800s, the store carries vintage telegraph equipment. Early phonographs from the turn of the century line the walls.

There are crystal sets, "bread-board" radios, early "portables," magnificent consoles, classic

cathedrals and plastic table models transformed by time into *objets d'art*.

Something for everybody

For buffs of esoteric audio memorabilia, Waves features rare and classic microphones, early TV sets, telephones, antique light bulbs, electric fans and "software" such as Edison cylinders and 78 RPM phonograph records. Advertising material and signs span the century

with pitches for Radio Arts, Crosley, Majestic, Emerson, Philco, GE, RCA, Westinghouse, Motorola, Sylvania, Stromberg-Carlson and many others.

Bruce says. There are radios which look like books (titled "Start the Music"), musical instruments and entertainers (the Charlie McCarthy radio). There's even an early Philco

Some customers visit Waves to purchase radios for better AM reception than they can receive with most of today's models.

Adding to the exoticism of Waves are dozens of novelty receivers. "If it looks out of place, it's probably a radio,"

"clock radio" (no wake-up features) which resembles a table top version of a grandfather clock.

Santa, working in strange ways, seems to have picked the Magers out of thin air to run his radio toy shop. It happened during a trip to Vermont 17 years ago. Bruce, then a cab driver, and his wife were vacationing in Vermont.

"We saw an old radio. It was like something we had never seen before. It just kind of clicked," Bruce recalls. "It was a 1933 Zenith table model. The price was one dollar, and we could afford it!"

This seemingly innocent purchase led to many more like it. Within no time the couple was selling vintage radios part time in antique shops and malls in the New York area. Business was so brisk that the Magers—with the help of Santa, of course—decided to open Waves in Manhattan. That was 14 years ago.

From collectors to listeners

Today, Waves has customers throughout the world. "We get serious collectors, people who are nostalgic about a radio they used to have, interior decorators, collectors of art deco radios and technicians who want something to work on," Bruce says. "It's amazing how many different reasons there are that people want these things."

Most local customers purchase small radios due to the minuscule living spaces in New York City, Bruce says, but some Midwestern customers have "barns full" of radios shipped from the store. Ditto for deep-pocketed European buyers.

Gone are the days of radios costing only a dollar. At Waves, radio prices start as low as \$35 and can extend to \$10,000 for extremely rare models.

Phonographs can reach \$2,500 and old microphones range from \$50 for common models to \$800 for a classic RCA 77 or 44 series.

Microphones are especially hot these days, Bruce says. Some go to collectors but many are purchased for decorative purposes by broadcasting and audio industry professionals. "Old mic flags with station or network call letters are extremely desirable," Bruce says. He adds, with a laugh, "I think all the people who worked at the stations clipped (the flags) for themselves. You can see where the

continued on page 13 ►



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Technology, Regulation Highlight Radio in 1992

► continued from page 1

the FCC now calls it, digital audio radio service—"DARS") began picking up speed right after the new year. The World Administrative Radio Conference (WARC 92), held in Torremolinos, Spain in February, saw the U.S. at odds with its traditional allies. The divisive element was the unpopular U.S. position of an S-band DARS allocation.

This position saw formal support from the FCC in late fall, with the introduction of a notice of proposed rulemaking (NPRM) and further notice of inquiry (FNOI). The NPRM announced the Commission's intent to reallocate the lower portion of the S-band for DARS development, with current users to be accommodated at the upper end of the band. The FNOI reaffirmed the FCC's interest in the development of in-band solutions to digital audio broadcasting.

Between WARC 92 and the FCC's proceedings, still more inroads were made in realizing the promise of digital broadcasting. The Electronic Industries Association (EIA) instituted a standard-setting group, which intends to evaluate and test systems by mid-1993. The EIA standard-setting process, however, was not without its problems, including a complaint from the NAB that broadcaster interests were under-represented in the planned voting procedure.

Further, problems encountered by independent entrepreneurs in finding financial backing for their DARS systems were compounded by the rapidly-approaching EIA deadline.

One proponent, however, the Gannett/CBS/Group W consortium known as USA Digital Radio, has demonstrated great progress in the development of its in-band, on-channel system, known as Project Acorn. At the NAB Radio Show in New Orleans, USA Digital demonstrated both FM and AM versions of its system. The consortium heads attribute the successes of Project Acorn's development to a processing chip created by the military.

The chip, dubbed "ACT," or "acoustic charge transport," is reportedly more powerful than a bank of Cray computers.

Concerns plague SBE

1992 was not kind to the Society of Broadcast Engineers (SBE). The organization faced open rebellion from several of the larger chapters earlier this year, with calls for a dues strike and hints at secession coloring the worst moments.

Chapters claimed that the national leaders were not making good decisions on behalf of the membership, including site selection for the national conventions, an unpublicized dues increase, and what they perceived as a general unresponsiveness of the board of directors to the concerns of the society's members. A grass-roots movement dubbed "SOS" ("Save Our Society") was even established by Los Angeles chapter chair Sandra Woodruff to address these concerns.

Since the NAB spring show, communication with the chapters by the board of directors has improved, but individual chapter members said the board still has more to accomplish. Specifically, the members want the SBE board to stabilize the national show situation.

SBE officials reportedly are trying to work out an agreement with the NAB that would give the SBE control of the technical sessions at the NAB spring show. Under the terms of the agreement, the national convention (which has been plagued by low attendance figures and last year reportedly lost as much as \$90,000) could be eliminated.

Ownership limits under fire

In an effort to abandon a "one-size-fits-all" approach to radio, FCC Chairman Al Sikes pushed hard in 1992 to raise the limit on the number of stations one entity could own, from 12 AM and 12 FM to 30 AM and 30 FM stations.

The March decision provoked congressional and industry outrage, with some calling the decision "dangerous." Even among FCC members dissent was vocal, as Commissioner Andrew Barrett, in a precedent-setting outburst at the FCC open meeting, claimed his first knowledge of the 30-30 ceiling came from reading a trade news story. Barrett complained that the ownership limit, among other problems, had no minority set-aside provision.

After months of internal and external debate, the FCC bowed to congressional and industry pressure and curbed the limits during its August meeting—to 18 AMs and 18 FMs per entity, with the limit going up to 20 per service in two years.

Along with the revised national ownership limits, groups will now be able to own up to two FMs and two AMs in markets with more than 15 stations. In markets with fewer than 15 stations, a group can own three stations—as long as no more than two are in the same service. The three station minimum in the smaller markets applies if the total is less than half of all the stations in the market.

The revised ownership rules were applauded by both industry and congressional leaders.

FCC scrutinizes EBS

This year saw the FCC focusing more closely on the Emergency Broadcast System (EBS), including a demonstration at the Commission on Dec. 11 of several technologies put forth as possible replacements for the ailing alerting system.

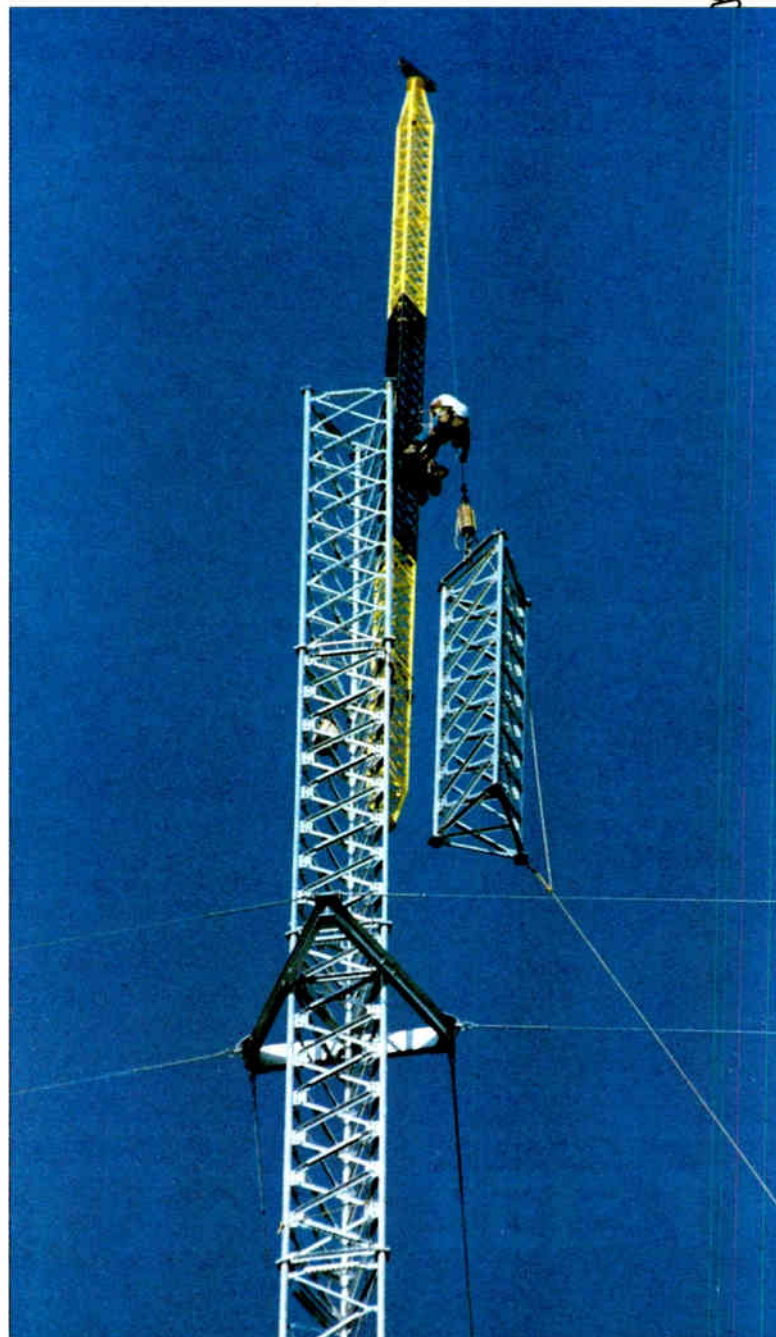
Following a series of natural catastrophes—the San Francisco earthquake, Hurricane Bob, the Oakland Hills fire—during which EBS was either not implemented or failed to perform adequately, the Commission initiated two notices of inquiry. The first of these looked at whether the system should be revamped; the second considered whether EBS should be scrapped altogether.

After much debate on the issues, and with the appointment of Dr. Helena Mitchell to the post of EBS coordinator, the FCC in 1992 combined its two dockets into one. Although the Commission is not expected to issue a decision on how national emergency alerting will be implemented until mid-1993, some speculate that the successor system will utilize features of the National Weather Service's WRSAME system and the SAGE 1 technology from Sage Alerting Systems. Other systems participating in the process include

continued on page 13 ►

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Circle (133) On Reader Service Card
World Radio History

Technology, Regulation Dominate 1992

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California's EDIS and ICEBS from Colorado.

AM improvement

Further developments in technology taking place this year involved AM improvement. Five years after it was opened, the FCC finally closed its infamous Docket 87-267: the overhaul of AM's technical criteria.

In addition to recommendations for improving power calculations and interference criteria, the FCC decision in the docket created guidelines for moving stations to the expanded band, granting first consideration to stations causing the greatest interference and special preference to AM stereo broadcasters. By mid-December, however, the Commission had not made any decisions on when the expanded band would be opened to broadcasters.

The FCC preference for AM stereo broad-

casters was not the only push the technology received, however. A bill introduced by former South Dakota Senator Larry Pressler was passed into law in October, requiring the FCC to select an AM stereo standard within 60 days of the initiation of a proceeding by the Commission. The law flies in the face of FCC Chairman Al Sikes' refusal to abandon the marketplace philosophy, which some industry observers say hampered AM stereo's development in the U.S. The effect of the new law, however, remains in question.

Finally, the NAB's Radio Show in New Orleans saw the official debut of the Denon TU-680NAB, the so-called "super tuner" in

development since 1988. Boasting a wider AM bandwidth and carrying the NAB's AMAX certification mark and a C-QUAM AM stereo decoder, the tuner also features an enhanced FM section.

New RF guidelines

For years, the issue of exposure to radiofrequency radiation (RFR) has been a health concern, both to tower climbers and the general public. This year, the Institute of Electrical and Electronics Engineers (IEEE) developed a two-tiered standard, IEEE C95.1, to replace the time-averaged exposure standard established by the American National Standards Institute (ANSI).

Detractors of the proposed standard, including the San Francisco-based consulting engineering firm of Hammett & Edison, maintain that the standard—which suggests differing absorption rates for induced body current—is deficient in two areas. First, the cutoff point for body current stops at 100 MHz, or the middle of the FM band, creating an additional compliance burden for stations falling below that point. Also, the standard makes reference to absorption rates for "an adult of average height and weight," without further specification, and without considering variables such as protective clothing.

Deleterious health effects from prolonged exposure to non-ionizing radiation such as RFR have never been proven conclusively. However, several lawsuits have been

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Give Me That Old-Time Radio

► continued from page 10

flags were screwed in but you can never find them on the mic."

Better than today's radios

In an irony of modern technology, some customers visit Waves to purchase radios for better AM reception than they can receive with most of today's models.

"People who buy radios from us for listening prefer the imported models from the 1950s: the Telefunks and Blaupunkts. One reason is the crystal clear AM reception and the other is they have good FM sections, which many of the early portables didn't have," Bruce says. Prices from these radios range between \$125 and \$350.

Another big part of business at Waves is repair and restoration of vintage radios. "We repair old radios with tubes, not solid state. We repair phonos from the windup models through those made in the 1950s. We restore telephones, but we shy away from old TVs and we don't restore microphones," Bruce says.

Waves does furniture restoration for pieces it will sell in the shop, but not for customer-owned equipment. However, it carries items such as tubes, knobs, grill cloth and do-it-yourself wiring diagrams.

Because of its vast collection, Waves has become a popular source for movie and theater prop rentals. Equipment from the store has appeared in "The Cotton Club"; "Brighton Beach Memoirs"; several Woody Allen films, including "Radio Days"; "A League of Their Own" and the current "Malcolm X."

After all these years, the Magers are still hooked on radio nostalgia. Bruce specializes in collecting crystal sets for his personal collection at home. But for the store, he prizes the attractive over the rare. "Classic, attractive radios in good condition are what most of our customers want," he says.

As for his unique profession of running one of the world's great toy stores, Bruce has a matter of fact philosophy: "It's a hell of a lot better than driving a cab."

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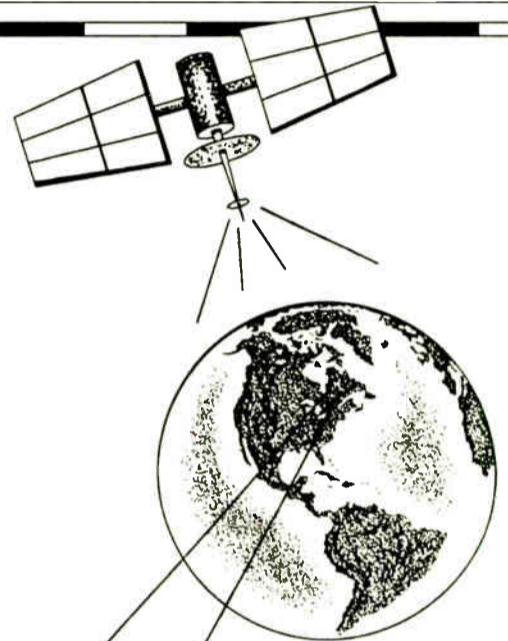
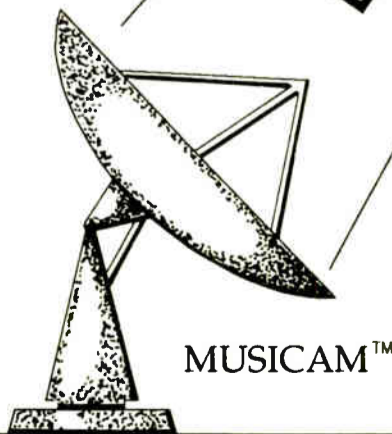
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Preventing Ice Build-Up on Towers

by Tom Osenkowsky

BROOKFIELD, Conn. With the winter season upon us, every chief engineer should consider the effects of ice on an FM transmitting antenna. If the antenna is not mounted at the highest location on a tower, there exists a possibility of falling ice damage.

Ice can accumulate on the tower itself, guy cables, and on antennas located above your own. A shield can be placed above FM antennas to deflect falling pieces of ice, provided they are sufficiently small. Care must be taken not to place a metal shield too close to the uppermost antenna bay, with resulting pattern distortion.

Routine checking

I prefer to have annual tower inspections performed in the fall. The lightning season is (hopefully) over, so it's a good time to replace tower lamps and check the FM antenna(s) for lightning damage. It is also a good time to have the tower man check for proper operation of the antenna *anti-icers*, if they are used.

Notice that I didn't use the familiar term *de-icers*. Heating elements on FM antennas are most effective when they serve to heat the antenna above the freezing point, preventing ice from forming in the first place.

Anti-icers that are manually activated after the fact will seldom melt a heavy

load of accumulated ice on an antenna. If your system uses automatic temperature/humidity sensors, they should be checked for proper operation during the inspection.

If your antenna has radomes, the tower man should check them for any cracks or signs of corona. The "weep holes" on the bottom of the radome should be checked to see whether they are clogged. Insects love to plug the holes up when they build nests inside the radomes. Condensing water can build up inside the radome, creating an arc from the radiating portion of the bay to the radome.

While the tower man is performing the

inspection, it is also very helpful to spot-check the radiation of each antenna element. Some riggers use a fluorescent lamp to do this. The lamp is placed a certain distance from each element and checked for brilliance.

If no beam tilt or null-fill is used in the antenna system, the same brilliance should occur on each element at the same distance. A simple homemade FIM (diode, milliammeter, capacitor and small pickup loop) can serve the same purpose. You must ensure that all RFR guidelines are followed for the safety of the tower man whenever he is in proximity to the antenna(s).

VSWR on the rise

One major problem that ice can create is excessive voltage standing wave ratio (VSWR) presented to the transmitter. Modern FM transmitters have built-in VSWR foldback circuits which automatically lower power until a safe operating point is reached. In some instances, however, VSWR foldback may not be enough. Transmitters not equipped with VSWR foldback must be monitored carefully during icing conditions.

Ice can also cause conduction between loose hardware around the antenna. Have the tower man check for loose or hot hardware.

In the summer of 1988 I installed two Harris FM5K transmitters for 98Q in Danbury, Conn. That winter, I noticed on two occasions the main transmitter

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1992: The Year in Review

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filed in past years against RF companies by people attributing a variety of illnesses, including leukemia, to RFR exposure. Some municipalities have created local standards far more rigorous than the ANSI guideline.

RBDS success story

One of the amazing success stories of 1992, from a standard-setting perspective, was the adoption of a Radio Broadcast Data Systems (RBDS) standard.

RBDS is the U.S. version of the European-developed RDS technology, a 57 kHz digital subcarrier data stream that

communicates with RDS radio receivers. Capabilities include text display, automatic station selection by format (via a broadcaster-transmitted code), automatic emergency alerts, and numerous other features.

The National Radio Systems Committee (NRSC) received overwhelmingly favorable comments from the final RBDS standard ballots in November, making it all but official.

The voluntary receiver standard process was wrapped up in just slightly more than a year, and probably would have occurred sooner. But there was some delay early in the year when the NAB objected to the standard because it seemed to benefit only FM and not AM—especially the station selection by format feature. The NAB threatened to pull its support from the proposed NRSC standard.

The problem with trying to accommodate AM was that an effective, working RBDS technology for AM was not available to study and incorporate into the standard. A compromise was reached, however, when the NRSC decided to incorporate ID Logic B into the standard. Unlike RBDS (or RDS) for FM, which is

broadcaster-dependent, ID Logic relies on an internal program for format scanning. It must be updated periodically by the user.

By the end of the year, however, receiver manufacturers had not yet embraced the idea of adding ID Logic B to RBDS radios because of cost and a perceived lack of interest by consumers.


Spot sale happy ending

Some of the happiest news of the year came toward the end: evidence of an upswing in the economy. The Radio Advertising Bureau announced increases in national spot sales of two percent in September and three percent in October. The reports came as welcome relief from the dismal litany of flat or even slightly downward national figures over most of the past two years.

Although local advertising sales had been inching upwards for most of 1992, industry observers concede that national sales are the best indicator of economic recovery. The improvement in these figures at year end indicates a possible light at the end of the recessionary tunnel.


□ □ □

Managing Editor Lucia Cobo and News Editor John Gatski contributed to this report.




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LOWPOWER LOWDOWN

Take Proper Care of Your Low Power Translators

by Howard Enstrom

MOUNT DORA, Fla. Low power FM translators may be classified as a "secondary service," but they deserve the same first-class planning and installation as full-service stations. Summer's heat and rain, or winter's cold and ice all affect broadcasting facilities and signal propagation.

AM's lower frequency wave energy is less attenuated when transversing higher electrical conductivity terrain. The fertile, black soil of parts of the north central U.S. has an estimated conductivity as high as 30 milliohms, while sandy parts of Florida and Maine have but 1 milliohm—really lousy for AM coverage. Terrain that is soaked by rain or melted snow offers only a slight temporary improvement for ground-wave reception. AM reception improves during winter for another reason—lower atmospheric noises, or "static."

VHF FM signals also behave differently in the wintertime, based on geographical locations. If reception is by terrain reflection, changes in its electrical conductivity affect its reflectivity. If moisture-laden foliage absorbs some

wave energy and converts it to heat energy—just with clouds and moist upper atmosphere, conceivably—a steep barren ridge covered with snow is more effective in refracting a signal back toward earth, than if it were forested, especially during summer.

Temperature concerns

Phenomenal "ducting" and "coastal troop," signal-bouncing from upper air because of heat variations between land and bodies of water, is altered by wintertime, changing reception and interference of long-haul FM signals.

If summer's heat is bad for the health of electronic equipment, it's because of insufficient ventilation. There's no scientific basis for thinking a component is too hot, just because it feels so to the human touch, as with the engine in your car. The heat is simply wasted energy in equipment operating at less than 100 percent efficiency.

What about a translator, or any other equipment, installed in a very frigid environment? Typical low-end temperature specs read minus 40 degrees Celsius. Mountaintop sites and Cut Bank, Mont. probably know about that.

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Preventing Tower Icing

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tripped off due to a plate overload during an ice storm. Looking at the operating log, it was evident that the last plate current was abnormally high at 1.6 amps (1.2 amps is normal). The plate current was rising too fast before the VSWR foldback was able to reduce power.

When ice accumulates on an FM antenna, the impedance presented to the transmission line changes as does the antenna's resonant frequency. Most FM antennas leave the factory tuned slightly high of carrier frequency. Ice usually lowers the antenna's resonant frequency. Thus, when ice builds up on the antenna, it passes through resonance and continues reducing downward in frequency.

Most FM transmission lines are quite long. Recall from simple transmission line theory that a loss-less line will have the same input VSWR as the load VSWR in a mismatched condition.

Real world VSWR

In a lossy line, such as we have in the real world of FM and TV, the VSWR measured at the antenna terminals might be very different than that measured at the transmitter input flange. This is why most professional FM antenna systems are field tuned after initial installation. Consider that the transmission line has an amount of phase rotation, as does the inside piping and the transmitter output

network. The impedance presented to the PA plate is influenced by all of these.

I came up with a very simple solution to 98Q's problem—use a hacksaw! By reasoning that the PA plate impedance is going down with the accumulation of ice (hence the PA plate current goes up), there is an opposite effect of a quarter wavelength away on a Smith chart representation of the transmission and matching system.

At the time of the new transmitter site installation, I left 20 feet of slack in the main FM line just in case any problems arose. Having this convenience, I cut off approximately 30 inches of transmission line and reattached the end connector.

During the next ice storm, the PA plate current *decreased* and the transmitter was much happier. The initial VSWR on a normal day was 1.08. Trimming a quarter wave on the transmission line caused this to increase to 1.10. This VSWR is caused by the high point tuning I mentioned earlier. This also serves to prove that a lossy line does indeed have different input and load VSWRs.

Moral of the story: Never underestimate the power of ice, and more so never underestimate the value of your annual tower inspection.

□ □ □

Tom Osenkowsky is a regular RW contributor.

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STATION SKETCHES

Symptoms and Suppression Of RF-Based Interference

by Tom Vernon

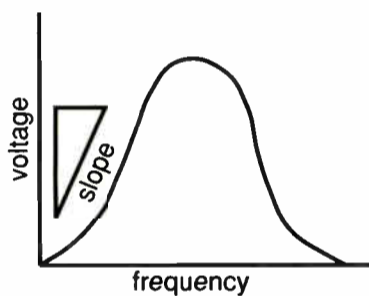
HARRISBURG, Pa. Like the skies over urban areas, the airwaves in many communities are growing increasingly crowded. Stations coming on the air, signals from cellular phones, cordless phones, utility stations and computer hash are all audible on the communications receiver. Bad news if you are maintaining audio facilities because there are more signals that can enter your equipment and cause RFI, or radio frequency interference.

This month, *Station Sketches* examines symptoms of RFI and ways of suppressing it.

Sources of RFI

Interfering signals may come from AM, FM, TV or other RF sources. Computers may also generate whistles and buzzes that can find their way into your equipment. Symptoms are different depending on the frequency range and the type of modulation involved.

Figure 1.



FM to AM conversion via slope detector. AM signal is later detected to appear as audio.

AM carriers may enter equipment, be detected, and appear as an additional audio signal in your system. If the signal is from your own station, it may appear as a buzz or raspiness. It may be just slight enough to degrade equipment

place when the frequency variations ride the slope of the resonant curve. This AM signal is subsequently detected as before. Slope detection is illustrated in Fig. 1.

The most common form of TV RFI is sync buzz. This 60 Hz signal is the AM

The first step in eliminating RFI is ensuring there is a low impedance ground system.

frame rate sync pulse. Careful listening will distinguish this from ordinary hum. Since the TV signal is made up of FM and AM components, the types of problems that are possible are more complex.

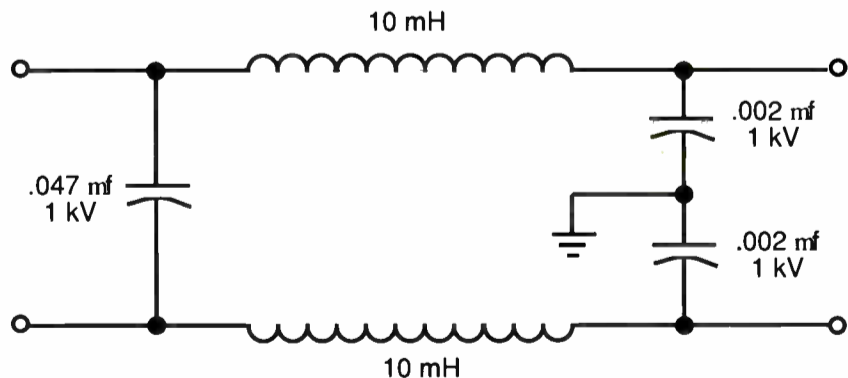
No matter what the source, there is a two-step process involved in the creation of all RFI. First the interfering signal enters the audio equipment, second it is detected by a non-linear element—frequently transistor junctions. Thus it follows that eliminating RFI involves preventing the RF signal from being transferred to the audio system, and preventing it from being detected.

Eliminate RFI

The first step in eliminating RFI is ensuring there is a low impedance ground system. This is not the same as a ground that will pass inspection by the local electrician. A low impedance ground system involves 1- or 2-inch copper strap, or at the least, 14 gauge or larger wire connecting equipment to a good earth ground in a star configuration.

Several articles describing good grounding techniques have appeared in trade publications during the last two

Figure 2.



Simple AC line filter that can be constructed to block RF. Be sure to install after the fuse.

noise and distortion specs, or it may be so strong that affected amplifiers are completely swamped and no audio can get through.

Strong FM signals may manifest themselves as increased noise or distortion, or sometimes as additional audio signals. This usually happens when lengths of cable are resonant close to the interfering frequency, and are in effect tuned stubs. An FM-to-AM conversion takes

years. Since subsequent measures involve bypassing RF to ground with capacitors, the integrity of the ground must be first established. This is most important with AM RFI problems.

It is important to ensure equipment chassis are RF tight. Often equipment that is tweaked or serviced regularly is left with the cover removed or fastened with two screws. Before proceeding

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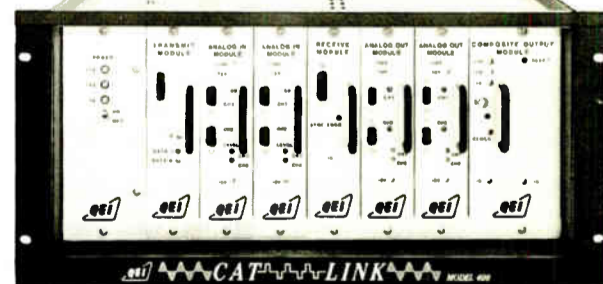
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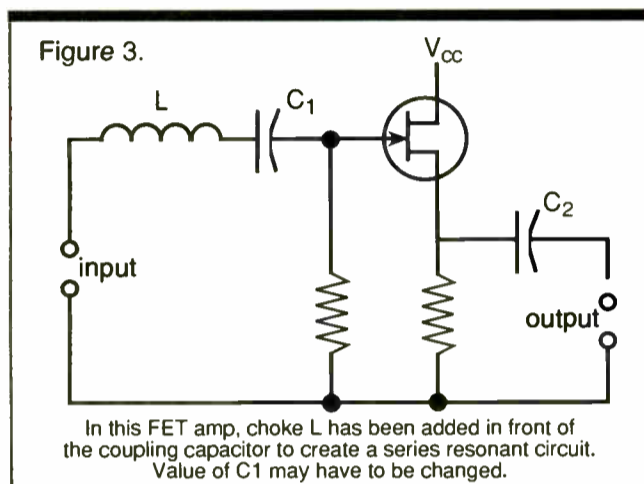
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Curbing the Effects of RFI

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with more drastic measures, secure the cabinet with screws and lockwashers as it came from the factory and see what happens. Rack doors and console lids may benefit from a braided copper strap connecting them to the chassis. Hinges are not adequate grounds at RF frequencies.

Usually the source for offending RF can be identified by opening up pots in the console individually. Sometimes the signal will radiate into other wiring and it will be necessary to remove wires one at a time where they enter the console. How the shields are grounded needs to be examined.



Usually the best practice is to connect grounds at the console end, and leave the other end floating, but sometimes individual variations can solve a persistent RF problem. Sometimes shortening or lengthening a cable can solve the problem, because this changes the resonant frequency. Remember that cables a few feet long will be resonant in the 40-220 MHz range.

If you must lengthen a cable, the excess is best secured by folding wire back and forth on itself, and securing it with cable ties. Never coil surplus cable into a loop, as this may create an effi-

cient loop antenna, causing more RFI problems.

If all else fails

OK, so what if none of this works? In some locations it is hard to find a cable length that is not resonant close to some occupied frequency. The next step involves bypassing the affected leads to ground with capacitors. The trick here is to select a value that does not affect high frequency audio response, but acts like a short circuit at AM broadcast frequencies and above.

For 600 ohm lines, values between .001 and .002 work best. Low inductance capacitors such as disc ceramics are preferred. Remember to keep lead lengths as short as possible to avoid unwanted resonances. If installing bypass capacitors reduces the problem, they should be left in place, but be sure to do a frequency response run. Out of tolerance disc capacitors are not unheard of, and low values will affect HF response.

Persistent problems may be solved with a combination of bypass capacitors and series inductors. The most practical way to handle this is with RF beads. These slip over wires and are transparent below 1 MHz, but become lossy chokes above that frequency. Because of

AM carriers may enter equipment, be detected, and appear as an additional audio signal in your system.

their size and DC resistance, series chokes are not practical at AM frequencies.

If your investigation clears audio and control lines as suspected entry points for RF, the AC power line might need treatment. Fig. 2 shows an AC power line filter that can be easily constructed. The values shown will provide ample



Radio Hall of Fame

In Chicago, Nov. 16, 1992, Bruce DuMont, president and founder of the Museum of Broadcast Communications and chairman of the Radio Hall of Fame steering committee (left), congratulates the 1992 Radio Hall of Fame inductees: Leonard Goldenson, ABC radio pioneer (second from left); Country artist Porter Wagoner, representing "The Grand Ole Opry" (center); J.P. McCarthy, WJR(AM) Detroit morning personality (second from right); and Casey Kasem, host of the syndicated music countdown shows, "Casey's Top 40" and "Casey's Countdown." 1992 Radio Hall of Fame inductee Don Ameche, best known in radio for his co-starring role in "The Bickersons," was not able to attend the November 15 ceremony. The induction ceremony was broadcast live from the Museum of Broadcast Communications in the Chicago Cultural Center, and aired on more than 45 radio stations across the country.

attenuation up to 100 MHz. Be sure to select chokes with sufficient current capacity to handle the load.

It's also wise to construct the filter in an aluminum minibox, to prevent unwanted radiation inside the chassis. Alternately, commercial line filters can be purchased. These may often be found

capacitor across the transistor terminals is the easiest solution. The value is frequency sensitive, but 100 pf is a good jumping-off point.

Add some resistance

If RFI remains, adding a small resistor in series with the input lead should help; 680 ohms is a good value with which to start. Alternately, it may be possible to remove the transistor from the circuit board, and install a ferrite bead over the input signal lead. This may be the base, emitter, or collector, depending on circuit configuration.

For some circuits, a series resonant circuit is easier to install. Fig. 3 shows an inductor added to the input of an FET amplifier. The value of coupling capacitor C1 may have to be changed. Component values and additional information may be found in references such as the Radio Amateur's Handbook or the Radio Handbook.

Other junctions must be considered when investigating RF interference problems. Terminal strips and corroded connectors can also be troublesome. Be sure all connections are clean and tight. One often overlooked entry point is crimped spade lugs. Over the years, corrosion can build up between the wire and lug, especially if they are made of dissimilar metals.

These problems are easily detected by gently pulling in cables and listening for a change in interference levels. It may be necessary to remove the old lug and solder a new one in its place to rid yourself of the problem.

RF interference problems may be difficult to troubleshoot, and the final solution may reveal multiple sources of interference into the same system. A patient and methodical approach, eliminating both RF entry and subsequent rectification will triumph in the end.

□□□
Tom Vernon divides his time between consulting and completion of a Ph.D. He can be reached at 717-367-5595.

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Take Proper Care of Your Translator

► continued from page 16

However discomfiting to humans, apparently solid state components get along well because electrical conductivity, hence efficiency, improves at lower temperatures. No anti-freeze necessary.

Critically-tuned circuits, including cavity resonators and filters, are fabricated from metal, which has a positive temperature coefficient of expansion. So, a cold environment does tend to detune such devices. But since these are not loss-less devices, energy lost in the form of heat helps stability.

No one is likely to be overly concerned about a minute efficiency loss at an isolat-

ed station during the bitterest cold weather. What does matter is being dead in the water when a transmission line bullet blows, or an antenna is lost because of ice loads and wind.

The only rugged translator antennas out there are the full power type with radomes or heaters. Other, lighter types can be destroyed by falling chunks of ice. Heavy ice buildup can cause elements and booms to loosen, then swing like a pendulum in the wind before breaking altogether.

My policy in designing antenna systems for higher risk sites is to use the latest amount of hardware to achieve the required pattern and effective radiated

power (ERP). The cost for higher total power output (TPO) and line may be more than justified by savings in tower leasing space and antenna replacement costs.

Broken parts

When something in a receive antenna circuit is lost—and remember, it might be the primary station—a properly adjusted muting will shut the translator off, so that listeners won't hear anything—or some other FM station. If the antenna is shot, maybe a cheap Radio Shack temporary can be slung up until a permanent replacement is made.

One might do the same for the transmit

antenna. Caution should be used if a directional antenna protects another station. I recommend contacting the area FCC field engineering office first.

A translator can limp along with broken elements while nobody knows or complains about reception. The RF load changes, voltage standing wave ratio (VSWR) increases, so the translator automatically reduces power to protect itself. Someone interested enough to "A/B" the translator reception at some point might then say something.

It's just a good idea to make regular inspections, visually and electrically. That's when it's nice to have a maintenance log, to compare VSWR and other readings. Many years ago, at a high power station, I felt good about my station's antenna VSWR always being down to 1:1.15. But the fact is, a ratio of 1:1.5 is quite acceptable.

All the things one can do to deal with weather-induced damage are fine. But obviously, doing things right during installation is worth the extra time and effort. In extreme cold, things get brittle and break. I like to see RF connectors tape-wrapped, then coated with a silicon compound. That way, wind can't make a flag out of the tape end, and the whole works is better waterproofed.

Transmission lines must never be allowed to whip about in wind. They won't if secured at frequent intervals, along booms, masts and the tower structure. They should be carefully formed into a drip-loop before entrance to a building or shack, so rain and melted ice can fall harmlessly, instead of following the line into equipment. And, the hole should be sealed with a compound.

Electrical swings

When consumer demand for more electric power increases during cold weather, power companies do some fancy grid-switching to distribute loads. High voltage transients ride the lines, enough to damage unprotected solid state equipment. A good many equipment casualties are caused by just such surges, usually to the power supply.

It's false economy to try to save about \$150 by using cheap AC surge protectors that lag in response time and ability to dissipate transient energy.

When a translator goes off the air, there may be no urgency to restore operation right way. But if the site is very remote or isolated, and you go to a lot of effort to get there, why not take enough gear, including a good lantern and battery-operated FM radio, to analyze the problem?

Trouble-shooting procedures are standard. Inspect, feel, smell, check AC power, RF load conditions, compare meter readings, verify presence of primary signal input, etc. Localize the problem. And don't disconnect some other guy's AC power or coaxial cables.

DC resistance measurements between line center conductors to sheath can tell a lot. A portable signal generator, RF wattmeter and dummy load used with switched antennas can, too. If a translator is OK, but not the amplifier, go out to warm up your engine. Then feed the antenna "barefoot," remove the amplifier, and head for the barn.

□ □ □

Howard L. Enstrom is a broadcast engineering consultant and president of FM Technology Associates, Inc. The firm specializes in FM translator frequency searches, engineering and FCC application work. He may be reached at 904-383-3682, or by FAX at 904-393-4077.

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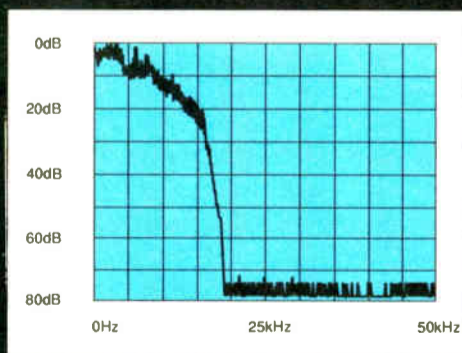
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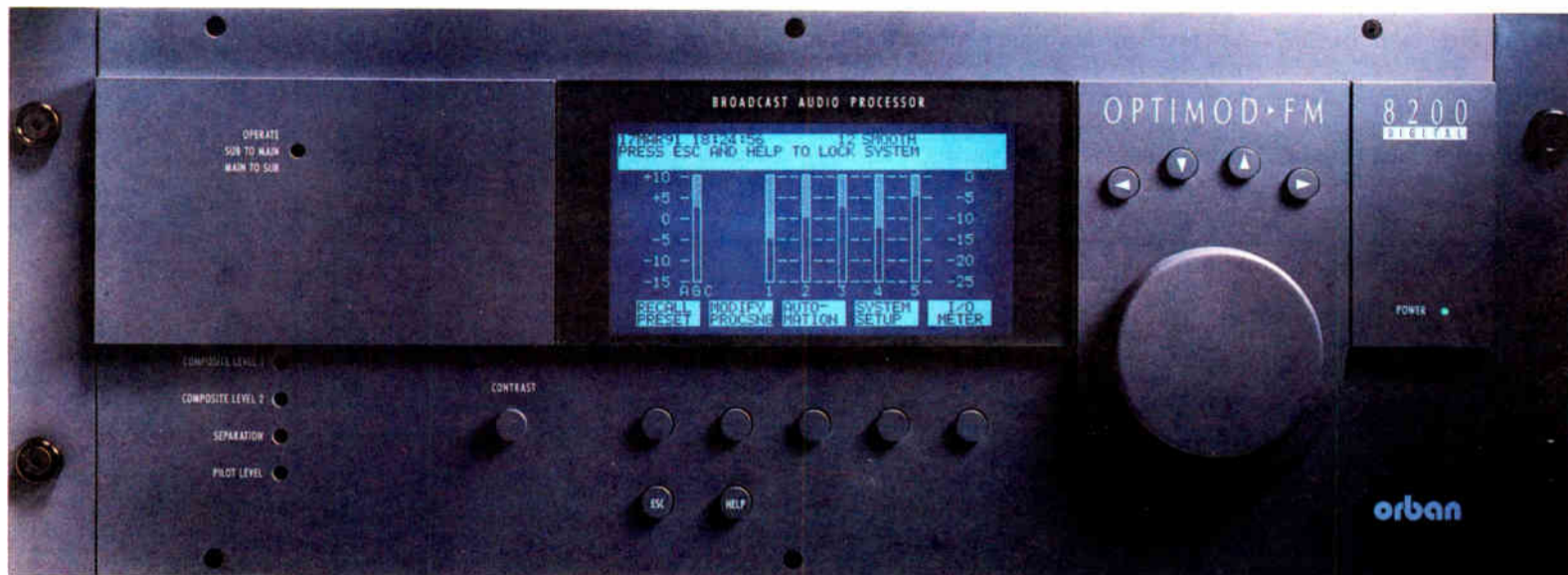


Power spectral density at the 4000's output using "maximum peak hold" measurement. (5kHz/div. horizontal; 10dB/div. vertical)

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propels the 8200 to new levels of performance. OPTIMOD-FM 8200 is a true digital audio processor. The audio is digitized and all control functions are digital.

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Evolution of Tower Lighting Devices

by Richard Schutt

BALDWINVILLE, N.Y. Prior to the 1970s, the flashing and monitoring of the lighting used on radio and TV towers and other tall structures to prevent aircraft collisions was accomplished by use of electromechanical devices. Companies such as Crouse-Hinds and Hughey & Philips, Inc. provided products that met the requirements of the day.

The flashers used were a combination of a synchronous motor driving one or more cams operating switches that in turn flashed the beacon lights.

The alarm relay, used to determine whether a lamp had failed, was an electromechanical relay. Its coil was so designed that with two lamps the relay would be pulled in. With the loss of one lamp, the relay would drop out and an alarm circuit energized.

A problem of reliability

Although these controls met the necessary function, they were troublesome. The motor-driven flashers were constantly in need of repair: The switches required replacement, the motors would burn out due to jamming. Wear, arcing, dirt, misadjustment, etc., all dealt their blows to

these electromechanical flashers.

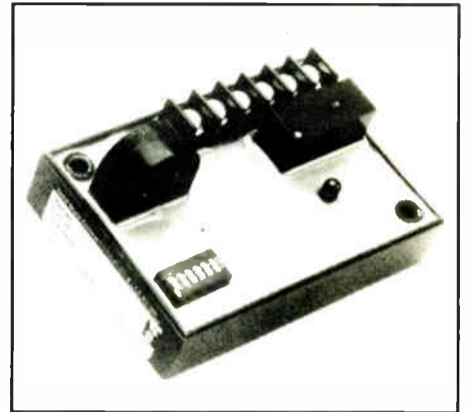
The alarm relays were an additional problem. The accuracy of their ability to sense a failed lamp was directly related to spring tension.

To calibrate these relays, the factory would adjust the spring. Not a very good approach. Just through normal shipping and handling the calibration could change. Throw in the tolerances of voltage, load, and temperature and the relay calibration could not be trusted. A better monitoring method was needed.

The 1970s brought about change. Crouse-Hinds and Hughey & Philips began offering solid state flashers.

Benefits included no moving parts to arc, wear, and eventually fail—some had encapsulated circuitry to protect against moisture, dirt, and shock. Further, the solid state flashers are small and easy-to-use (no adjustments), and the output to the lamps, being solid state, could be of the zero voltage switching type that reduces line noise and can increase the lamp life up to 10 times.

These flashers have already proved their longevity. For example, KVOS-TV in East Sound, Wash. installed a solid state flasher in 1974; reportedly, it is still operating. Further, the station has never



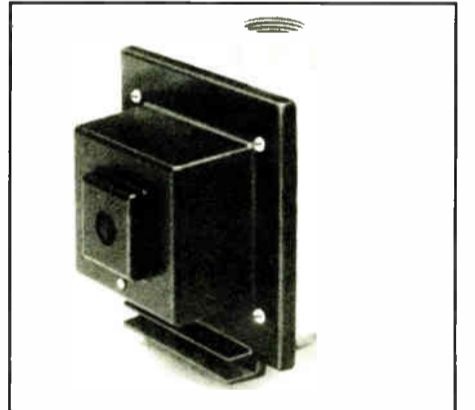
Alarm relay incorporating electronic circuit and output relay (SSAC)

experienced a lamp failure, although the lamps are still replaced periodically.

Decade of improvements

Other developments have been made in the last 10 years. New current sensing modules allow for accurate detection of up to one out of four lamps. Photo 1 shows an alarm relay that incorporates an encapsulated electronic circuit and output relay. This is a universal product whereby switches are set for the number of lamps (1 to 4) and wattage (116 or 620 watts).

An LED indicates there is a fault. There are two outputs: a spare light output and



Photoelectric Control (Crouse-Hinds)

an isolated SPDT alarm output. The actual sensing is accomplished via a toroid, whereby the wire going to the lamp(s) is passed through the hole of the toroid.

Other applications being answered by new products are solid state photoelectric controls, shorted flasher alarms, sequential flashing, and load balancing. Most suppliers offer these items on a component level as well as a complete prewired control system (see photo 2).

SSAC Inc. offers a sensor that detects lamp failures on AM towers by sensing the current on the line side of the isolation transformers. It will be able to detect the failure of one out of two beacon lamps (620 W) and one out of two, three, or four side lights (116 W) at the same time by monitoring the input line to the transformer.

Of course, we must all pay particular continued on page 26 ►



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WORKBENCH

Engineering New Year's Resolutions

by John Bisset

FALLS CHURCH, Va. As 1992 winds to a close, thoughts progress to compiling a list of New Year's Resolutions. How can we as engineering department managers do our job better? With the necessary tools, of course.

Start with that FCC inspection you endured. Too often you learn that the FCC inspection time is too late to solve problems. Wind River Broadcast Center can help you be better prepared. They've compiled a three volume FCC management system that greatly aids in complying with rules and in training operators.

Called the "Broadcaster's Bigbook Project" the volumes are available individually, or in a set, and are useful for both commercial and public stations (Fig. 1).

Volume One is the Control Room Management System. This volume covers everything the operator must know or do to legally and properly operate the station.

Volume Two consists of the most recent FCC regulations affecting broadcasters, along with a 200-page dictionary of broadcast terms and practices.

Volume Three is a complete 21-section Public Inspection File Management System. It covers all applicable FCC paperwork, and includes a copy of "The Public and Broadcasting...", a publication that the FCC requires every station to have in its public file.

Given that control room operations (including EBS) and public file management are high on the list of the inspector, stations weak in these areas may benefit from this organized approach. Each volume costs \$79, but all three volumes can be purchased for \$219. For more information, circle Reader Service 53.

★ ★ ★

While we're on the subject of compliance, take a look at your tower light management system. You may have received a letter from the FCC with an Obstruction Light Outage Report attached. The FAA has reported numerous cases of confusing outage information (usually relayed by uninformed operators).

The Obstruction Light Outage Report is a systematic form that you can fill out ahead of time. If you don't have a copy, you can design your own.

The form has blanks for the name of the local FAA Flight Service Center and its number, a place for the initials of the

FAA specialist you speak to, date, and time. It also has room for a description of the problem (top beacon out, mid beacon out, all lights out, or other).

There are also blanks for the latitude and longitude (which can be obtained from the station license), the tower height, and the type of structure (in this case, a tower).

The name of the nearest airport, its distance from the tower site and direction also will be required.

The idea behind the form is that you, as the engineer, fill in all the pertinent data, and post the form in the control room. When a failure occurs, the operator simply reads this information to the FAA Specialist, logs the date and time, and passes the completed form on to you for follow-up.

★ ★ ★

Some time ago, we discussed solutions to interference caused by broadcast stations. Most of our suggestions were aimed at AM-induced interference. FM can be another story. When the interference occurs at the same frequency as the desired signal, or so close that conventional filters are impractical, interference phase cancellation may be the only practical answer.

Microwave Filter Company has put together an Interference Phase Cancellation handbook which summarizes the theory of phase cancellation, describes the more common interference problems, and summarizes a number of solutions. The handbook is applicable not only for FM, but also for CATV, TVRO, and microwave installations. For your free copy, circle Reader Service 165.

★ ★ ★

Larry Albert from Murray State University echoes a problem that a lot of stations experience—pilfered equipment. In a non-profit setting, where a hundred volunteers come and go each month producing and airing their own programs, keeping things locked down can be difficult. Larry found that the most common items to disappear were consumer radios, scanners, or portable cassette machines.

His solution was to make the unit as unattractive as possible. Branding the plastic case with a soldering iron has been a cheap and effective way of keeping possession of equipment. The tip of the iron can be used to make a group of dots—just like a dot matrix printer—and form the station call letters.

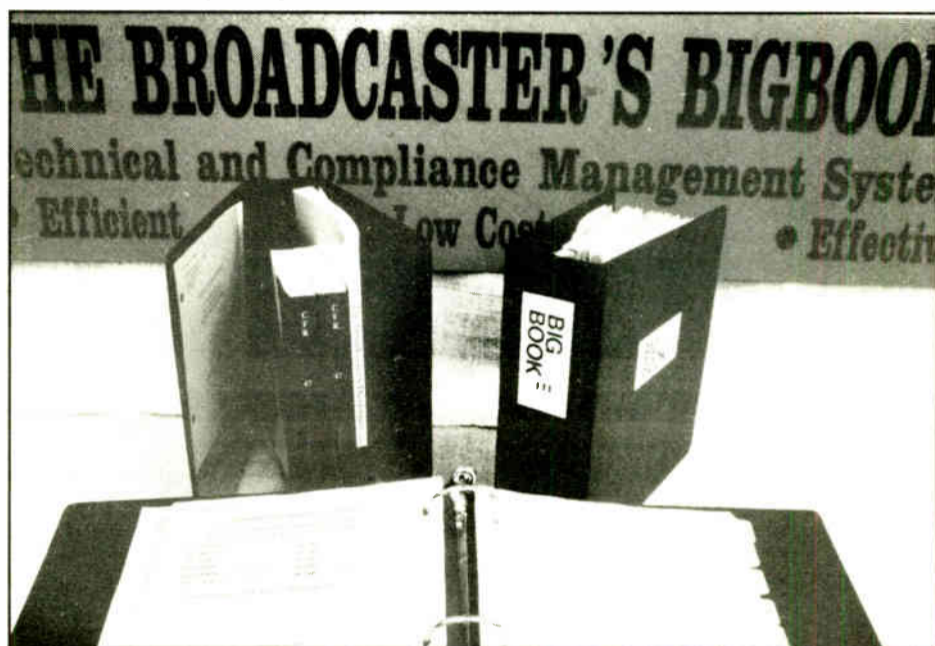
Branding the call letters in an obvious

place helped, too. Larry cautions, however, that plastic melts and flows at a much lower temperature than solder, so use care. If you've got an old iron that doesn't heat well, put it to use.

If you don't want to deface your equipment to deter theft, you might consider what

dered about those strange audio patterns swirling about. Tektronix helps take the mystery out of reading Lissajous patterns in a four page application note, "Stereo Audio Measurements Using the 760A Stereo Audio Monitor."

In addition to the X-Y display, amplitude is presented on three bargraphs. The 760A is a useful piece of studio test gear, but if Santa forgot to bring you one this



The Broadcaster's Bigbook guides you through FCC compliance.

another broadcaster showed me. He designed a program form that his board operators fill out each time a brokered show client leaves the studio. It's a bit of a headache for the board op, since he has to quickly "inventory" studio items; but it ensures that things like carts, bulk erasers, or headphones don't "accidentally" walk off.

★ ★ ★

If you've set an oscilloscope to read in the stereo X-Y mode, you may have won-

year, request the application notes anyway. In it you will find Lissajous pattern interpretation, pictures of clipped waveforms and how to determine energy distribution. If you'd like a copy, circle Reader Service 119.

□ □ □

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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Background Picture: Model 5552 microwave absorbers reduce interference that diffracts into the TVRO.

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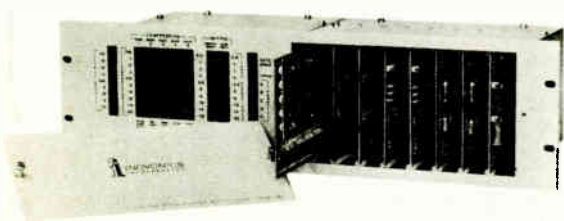
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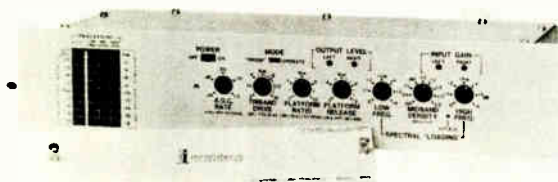
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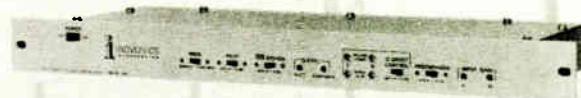
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Full-featured Stereo-Gen. boasts 70dB separation. Includes metering, remote control, built-in Composite Processor, baseband phase and EQ adjustments. FMX[®] System available as a plug-in option.



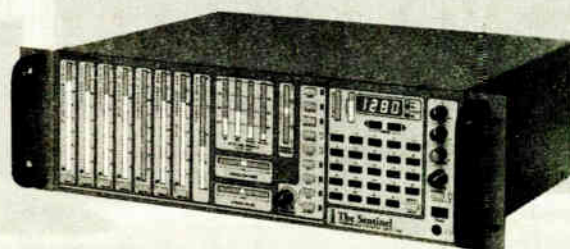
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A no-frills digital-synthesis Stereo-Gen. with a clean, strong sound. FMX[®] available as a plug-in option.



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Circle (96) On Reader Service Card



KEYBOARD CONNECTION

Get Your Books in Order Quick-ly

by Barry Mishkind

TUCSON, Ariz. As a broadcast professional, you are probably intensely focused on your job. You understand the equipment and the dynamics of radio. You even understand and tolerate most of the paperwork requested by our friends in Washington. But when it comes to dealing with the financial stuff, how much do you really know?

Logging income and collecting the receipts for expenses is at best a pain; at worst it can cost us a bundle at tax time. And keeping mileage records is just plain annoying. In fact, probably the major winter project we all dread is gathering together all the financial papers for the year and preparing for the visit to the tax accountant.

The good news is that the computer sitting on your desk can make things easier, even for this tax year. And now is an excellent time to get a head start on next year's paperwork on the theory that when you do it as you go, it isn't quite as bad a mess at the end of the year.

Automating

Let's look at a couple of programs to semi-automate the process. They'll save you a lot of time each year in trying to put everything in its place. Not only will you feel more confident delivering a compact list of numbers to your accountant, but you'll save his time. That translates to lower fees; likely enough to more than pay for the program.

First, let's talk about Quicken™ and QuickBooks™ from Intuit. These very modestly priced programs have developed an impressive array of features that go far beyond simply replacing your checkbook with a computer.

For many years, I used a spreadsheet to keep track of my checks and the account balances. It seemed relatively easy to enter them all in order and get the usually unwelcome answer as to my balance. So what is it about Quicken that makes it worthwhile?

To start off, Quicken is designed to separate

your income and expenses easily by category, as you enter the information. This allows you to develop needed summaries to make the tax return as painless as possible.

Using a visual metaphor of a checkbook, information is entered just as you have been

The Financial Planning Calculators help you do "what if?" planning for everything from investments to loan payments to retirement accounts. You can even set it to download and track stock prices from Prodigy™.

Quicken Version 6 for DOS and Quicken

These programs have an impressive array of features that go far beyond replacing your checkbook with a computer.

accustomed. Quicken can then tell you what checks to write, print them for you, or totally eliminate paper by paying them electronically. All you need is a modem.

Have more than one checking account? No problem. Quicken can manipulate up to 255 checking, credit card, and cash accounts so no matter how you receive or pay money, the data can be tracked.

Options available allow you to decide what to show on the reports, either using preset forms, or by designing a custom report.

Helpful features

Among many helpful enhancements to Quicken are QuickFill, IntelliCharge, Quicken Graphs and Financial Planning Calculators. Together, they give you a very rapid and complete picture of your finances. For instance, the 35 types of graphs can be set up to track and display any or all of your income or expense categories.

QuickFill is a memory feature that remembers every place you got or spent money. As you start typing, QuickFill offers to fill in the entire line for you. This saves lots of typing errors and helps keep deposits in the income area and payments on the expense side.

IntelliCharge is a credit card package that augments your monthly statement with one on diskette or via modem. Your purchases and payments are then updated in a matter of seconds, even categorized to augment the other information in your financial and tax reports.

2.0 for Windows are companion programs from Intuit. As you would expect, the Windows version has better graphics, icons to use with your mouse, and enhanced type font selection. However, they're essentially the same program; you can work on the same data with either one.

While Quicken will handle business expense categories, QuickBooks is focused a bit more for business uses, adding invoicing and accounts payable and receivable functions for tracking these areas. Like Quicken, it uses easy to follow visual metaphors to guide you through the processes. You can reach Intuit for information at 800-624-8742.

Middle ground

As good as Quicken or QuickBooks are, some users need more sophistication in their bookkeeping. Smaller stations, however, often can't afford industry specific software. A middle ground is the DacEasy 4.3 series of financial programs. These can be bought singly or in combination to fit the needs of any business, from contract engineer to recording studio to radio station.

For example, the Accounting program will do everything normally associated with bookkeeping from general ledger to sales analysis. It and the other programs, Payroll and Point of Sale, link and share information. Yet each stands alone, so if you start with Payroll, for example, you can add

Accounting at any time.

Because the programs are linked and interactive, they save time and effort in data entry. Furthermore, they can use the same pre-printed checks for accounts payable or payroll. By mixing and matching them, you'll set up an accounting system that works for you.

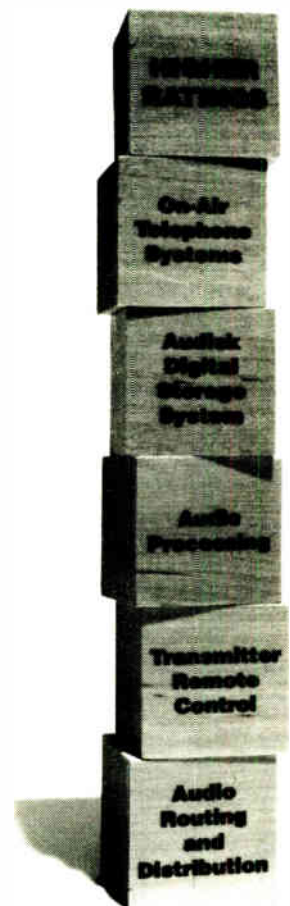
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□ □ □

Barry Mishkind, aka RW's "Eclectic Engineer," can be reached at 602-296-3797, or on FidoNet at 1:300/11.3 or "barry@coyote.datalog.com" on Internet.

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COLE'S LAW

Update Your Station's Public Inspection File

by Harry Cole

WASHINGTON As the year (and the Reagan/Bush era) close down around us, it may be useful to try to figure out what radio stations should be doing to keep their noses clean in this transitional phase. The regulatory scene has changed dramatically over the last decade, and continues to change even now.

Recent enforcement

With that in mind, you should probably be concerned about your local Public Inspection File. Rules governing the Public Inspection File are some of the

few which have remained largely untouched by deregulation.

Ironically, the most noticeable change has been that the Commission has in recent months started enforcing the rules. Previously, there appeared to be little if any inclination to issue fines for any shortcomings in a station's file. Recently, however, the FCC issued fines in the \$5,000-\$7,500 range for violations of the public file rule. It is likely cheaper to keep your file in order than to pay that kind of fine.

On a related note, you should also be careful to comply with the rules which require certain reports (like ownership and annual employment reports) to be filed with the FCC. Such reports are generally also required to be included in your Public Inspection File.

Keep a close watch on your tower situation. By this I mean (a) your tower lights and (b) the RF environment around the tower. This is one of those areas that goes beyond the FCC's normal concerns about spectrum regulation. Here the FCC (and other agencies, like the Federal Aviation Administration and the Occupational Safety and Health Administration) are interested in more practical issues of public health and safety.

Failure to keep your tower lights on (and failure to monitor regularly to ensure that they are on) could lead to an aviation disaster. Perhaps less dramatically, excessive RF in the vicinity of the tower could have equally disastrous ramifications.

More and more fines have been issued regarding tower lights (failure to properly light towers carries a baseline fine of \$20,000), and the Commission's processing staff has become increasingly concerned about potential RF problems. These areas will probably continue to be sources of administrative concern.

Potentially obscene and indecent broadcasts have garnered much attention. It is difficult to predict where the new admin-

istration may go in this area, but it's very clear where the current administration is heading. If the ongoing efforts to issue six-figure fines to stations carrying Howard Stern persist, you can expect to see similar FCC action against less well-known announcers.

Stern approach

The Commission would be crazy to beat up exclusively on one announcer (to the tune of hundreds of thousands of dollars), and not go after anyone else at all. Thus, if the anti-Stern juggernaut continues, you might want to pay attention to your own air staff to make sure that they aren't the next in line on the FCC hot seat.

Of course, it is possible that the new administration will take a different, more tolerant view of supposedly indecent broadcasts. But Congress has continually sought to require regulation of such programming, so the mere change in a president may not be enough to stop this particular movement in its tracks.

The rules on locally-oriented nonentertainment programming have not changed much over the last decade or so, but the FCC's enforcement of them has been less than wholehearted. But then, how does an agency enforce a requirement when that same agency has made sure that it almost never has any information from which it

continued on page 28 ►



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Evolution of Tower Lighting

► continued from page 22

attention to the ever changing requirements of the FAA. On this subject, I asked Bob Mosher, EE, consultant to Crouse-Hinds Airport Lighting Products to comment.

Regulatory update

According to Mosher, the FAA establishes standards for Obstruction Lighting and Marking, with specific regulations under periodic review, to ensure that tall structures are properly marked and lighted. To achieve recommended aircraft warning light systems, both the lighting fixtures, with their specified lamps for correct candela output, and the method of control in these lighting systems must conform to system performance as prescribed in the FAA Advisory Circulars.

Merely attaching a control device to the electrical system that powers the obstruction lighting is not an assured manner for correct light control. It must be defined as to what the control device is designed to do. The controller should do more than just flash beacon lamps and main-

tain steady burning side-lights. Proper monitoring as to what light conditions prevail on a structure is now mandatory.

Fortunately, there is obstruction lighting equipment available that reflects the latest in technology for maintaining an obstruction lighting system to fulfill FAA/FCC regulations for total system control.

Tower lighting controllers comprised of solid state alarm relays and control devices are obtainable for both presently lighted towers, as well as newly structured towers both skeletal and solid (such as chimneys, flarestacks, tall buildings, and the like). These controllers are not merely boxed parts, but carefully designed components containing better monitoring features, all of which should be of prime concern when reporting light outages to the FAA/FCC to avoid a stiff penalty.

Remember the fine print

From the 70/7460-1H Advisory Circular (FAA), Chapter 2, Paragraph 23: "Conspicuity is achieved only when all recommended lights are working. Any outage should be corrected as soon as possible. Any failure or malfunction that lists more than 30 minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to the nearest automated flight service station (AFSS) or flight service station (FSS) so a Notice to Airmen (NOTAM) can be issued."

Toll free numbers are listed in most telephone directories. Continuing, from Chapter 2, Paragraph 24: "As soon as normal operation is restored, notify the same AFSS/FSS that received the notification of failure."

"When the outage occurs on an FCC-regulated structure, the FCC advises that non-compliance with notification procedures could subject its licensees to penalties or monetary forfeitures." If further depth of detail and description of the AC 70/7460-1H Standards are desired, a copy is obtainable by contacting: Department of Transportation, Utilization and Storage Section (Publications), M443.2, 400 7th Street, Washington, D.C. 20590.

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PRODUCER'S FILE

Don't Get Caught by Killer Clichés

by Ty Ford

BALTIMORE Nobody likes production gear more than I do. Give me a box with a few knobs and switches on it and I'm a happy guy. Is this not what production is all about?

What we use the boxes *for* is equally important. I'm talking about *content* and *copy*, the *words* we use to motivate the

Updating Your Public File

► continued from page 26

might determine that enforcement might be necessary?

In any event, the bottom line is that all broadcasters are expected to provide locally-oriented, nonentertainment programming directed to matters of concern to their communities of license and service areas. Failure to provide such programming could jeopardize renewal of your license. While that threat has not been all that great in recent years, a new Democratic administration may change that.

Be fair and prove it

One regulatory area which has been consistently enforced under both Republican and Democratic administrations is the area of equal employment opportunity (EEO). You can almost certainly count on continued rigorous enforcement. What is perhaps most often forgotten by broadcasters is that, to comply with the EEO rules, it's not enough simply not to discriminate.

Rather, the Commission also expects you to maintain fairly extensive documentation concerning your hiring and promotion practices so that you can demonstrate that you don't discriminate. If you don't have adequate files and records, you can get hit with a significant fine, regardless of whether there is any proof (or even any allegations) that you actually discriminated.

All licensees would be well-advised to review their routine hiring and promotion practices to make sure that those practices leave an adequate paper trail showing such information as: which positions were available for hire; which applicants were considered for those positions; how those applicants learned of the availability of the positions; what affirmative, on-going efforts were taken to increase the number of minority and/or female job applicants.

As a general rule of thumb, Democratic administrations have tended to be somewhat more regulatory-minded than their Republican counterparts. If that tendency holds true for the upcoming administration, broadcasters would be well-advised to stay on top of the all of the areas described above as quickly as possible.

Of course, if you have any questions about any of these areas, you should contact your communications counsel.

□ □ □

Harry Cole is a partner in the Washington-based law firm of Bechtel & Cole, Chartered. He can be reached at 202-833-4190.

audience to go somewhere and buy something, or to sell the station to the listener. By letting our enchantment with the boxes become too important, we do so at the risk of not paying enough attention to what we're saying and how we say it.

Can bad copy on your air affect your ratings? I think so. Throwing together a piece of copy to meet the "immediacy demands" of a time buy hurts a station two ways: It turns off your listeners and it fails to perform for your client.

Killer clichés

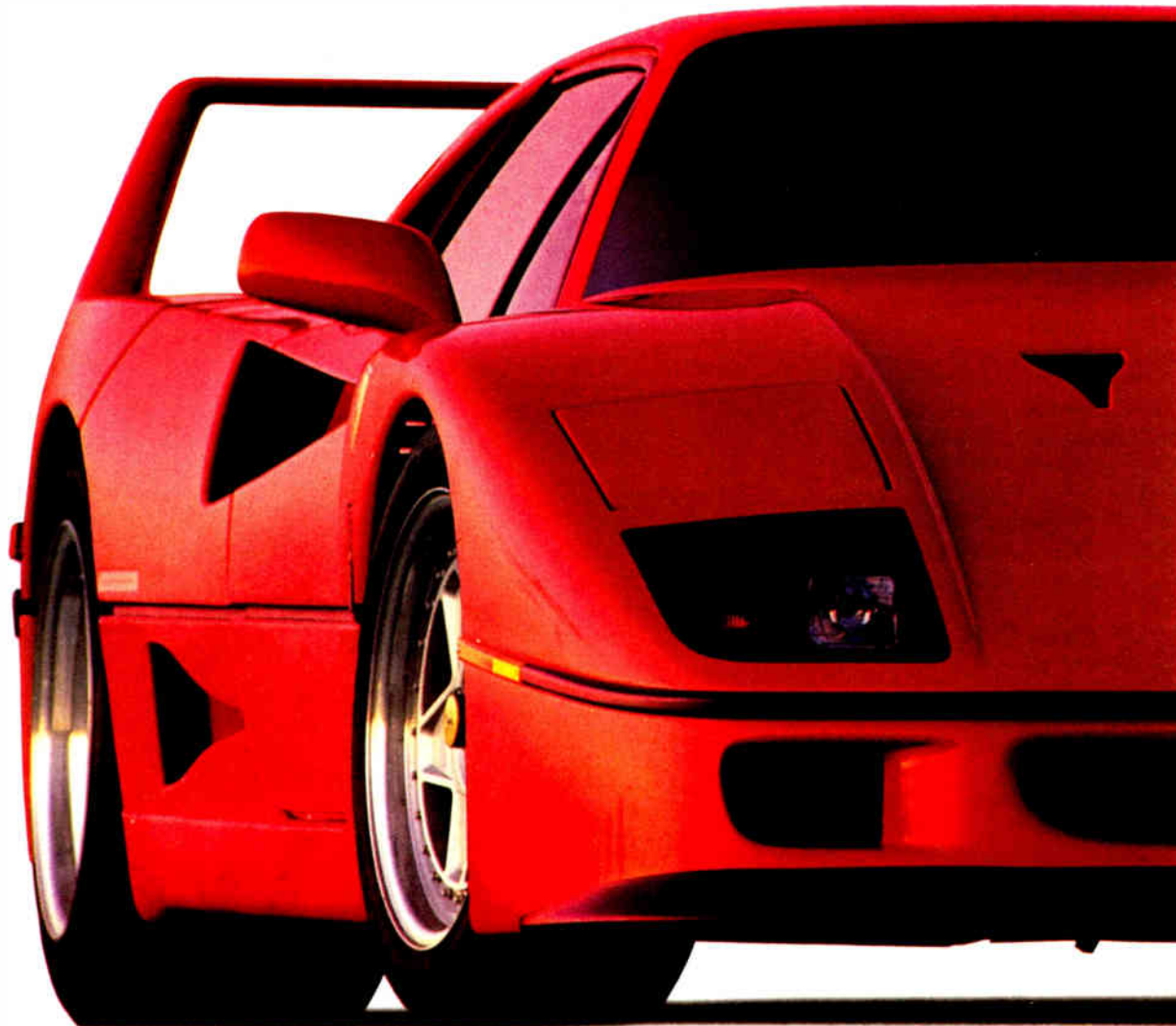
About four years ago I was sent a list of "killer clichés" that was part of a pre-

sentation given by sales consultant Chris Lytle. The following is a partial recount of that list. If you are using these phrases in your copy, *stop* immediately.

- Conveniently located...
- Now that...is in the air
- All the names you know and love
- Don't forget
- The next time you're in the mood for...
- Stop in soon
- Doesn't it make sense...
- Remember,...
- It's sale time at...
- Stretch your budget with values like...
- Super savings...

- Saving throughout the store
- And while you're there...
- Check out...
- A select group of...
- The friendly folks down at...
- Everyday low, low prices
- For all your...needs
- Our friendly, qualified personnel
- Lowest possible prices
- Prices slashed to the bone
- We refuse to be undersold
- We will meet or beat an offer
- People who care about you
- A huge selection of...
- But wait, there's still more.
- You'll save big on...
- And of course...
- Don't miss out...
- All the names you know and trust
- Free parking in the rear.

continued on page 31 ►



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1992 Reminiscences and A Christmas Wish List

Dear Alex,

Man, was it just me, or did 1992 go by while we weren't looking? Talk about a swiftie, huh? And talk about quite a year of life from the ol' *Trench*.

Ever since I began looking at my end of the radio station back in July 1989, my aim has been to observe and smile about some of the loopier aspects of what makes it tick; perhaps offering a technical solution now and again. Mostly though, it's been to offer up a

tidbit or two that we all share or have experienced as a common occurrence. My mail proves many times over that our commonality is deeper than we realize.

This was the year WLAD staffers and engineers put a new air studio and top-flight production room on-line, well-documented in *RW* this past spring. The guys across the street countered by promptly being sold to another company and going from Gold to Talk/CNN. While no doubt a considerable money-

FROM THE TRENCHES

by Alan Peterson



saver to the company, CNN's audio is still geared towards a TV viewer ("the suspect was discovered behind *these* houses, inside *this* orange dumpster"), and tends to lose me a little.

More awards poured in through the front door. WLAD picked up a VFW Voice of Democracy plaque, one from

the MS people, a UPI National Broadcast award for Spot News...and one very ratty-looking piece of artboard autographed with thank-yous and drawings from a Cub Scout tour that came through which remains my favorite for the year. Perhaps next year will bring a few production and ad kudos.

You know Alex, sometimes I wonder what's keeping us from gunning for a Small Market of the Year honor.

1992 was also the year my participation as an IBS convention panelist included a new workshop: MIDI Music Production. In between all the workshops on EBS, New Music, Aircheck Secrets and Meet-Howard-Stern's-Producer, my home synth and sequence rack took the trip to the Big Apple to demonstrate how one production person



WLAD does it again: the western Connecticut full service AC picks up an award from the Multiple Sclerosis Society—one of several for the year. The author (l) and Kirk Michaels show off the plaque and their pearly whites.

can create full orchestrations and commercial beds. For about 800 bucks, nearly any station can be doing music production. Maybe this next batch of graduates will...somewhere.

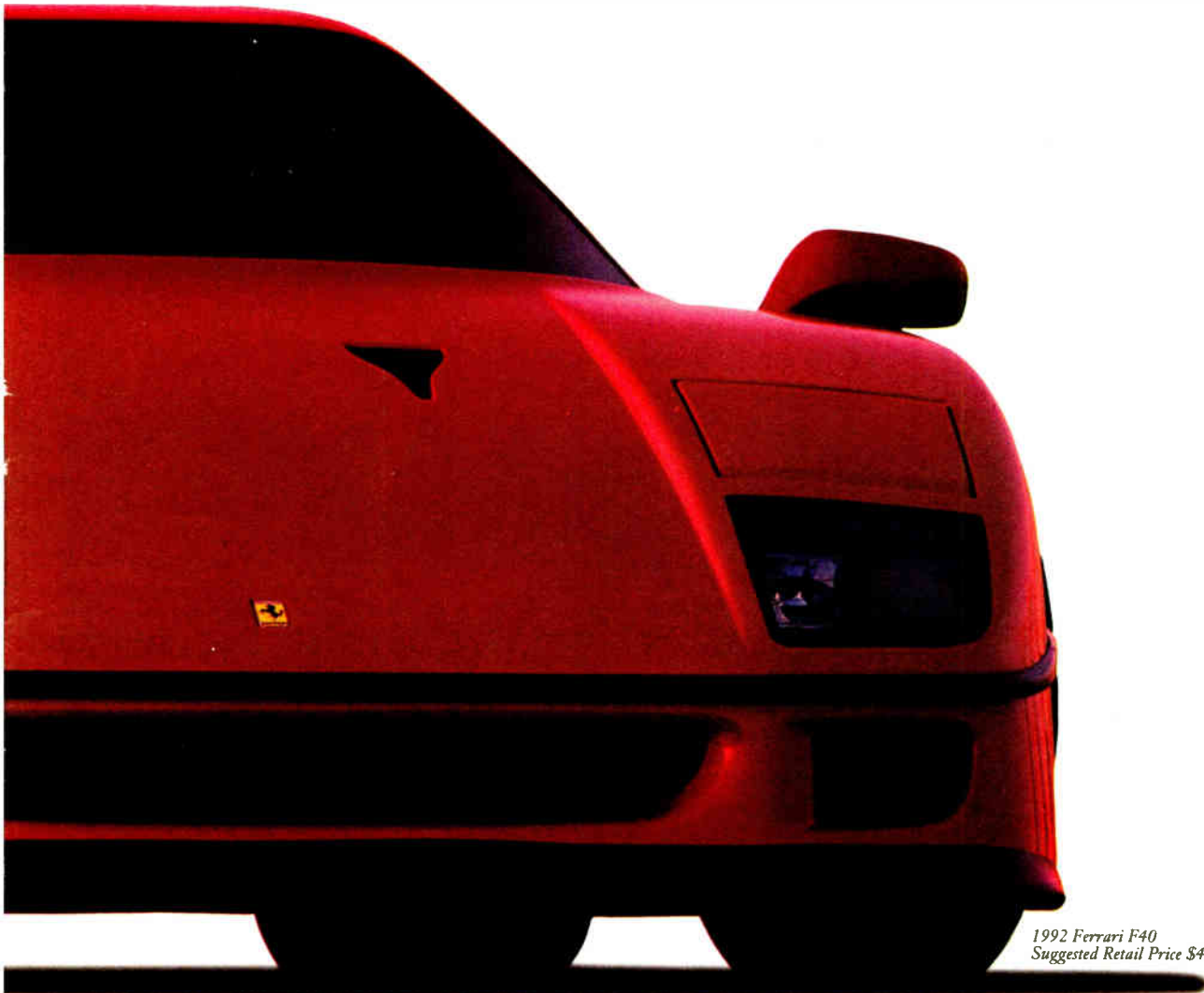
1992 was also the year I gave up hope of ever being able to work again with a Synclavier system; New England Digital in Vermont called it quits. And I heard about that in *Recording Engineer/Producer (RE/P) Magazine* before it went belly up. All around the same time Barry Lunderville decided to yank his syndicated "Radio America Magazine" weekend show off the SEDAT decoder, leaving stations in New England with another hour to fill on Sundays.

All sad losses to be sure, but not as much as my saying my goodbyes to WHMP Northampton, Mass.'s General Manager Tom Hennessy in November, who died after a long illness. In the mid-1980s we made some waves at that (then) Sillerman Morrow property, and Tom kept things moving to newer and greater plateaus as he went. Nice work, Tom.

So what am I looking forward to in 1993? Oh wow, let's see:

•Palmtop computers are nearly here—how about direct-to-disc audio recording capabilities for field recording and editing on the spot?

continued on page 31 ►



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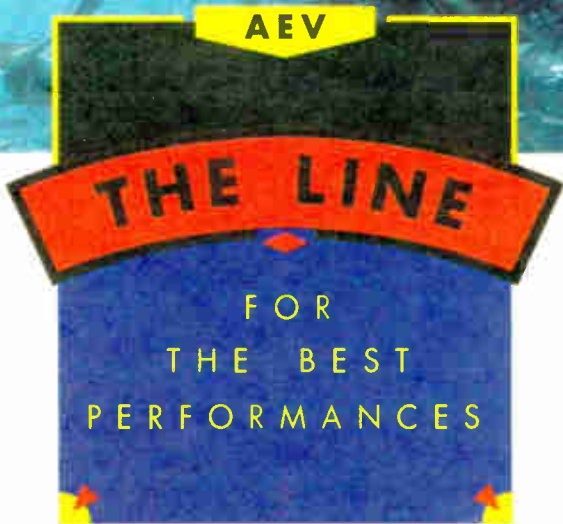
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Don't Get Caught by Killer Clichés

► continued from page 28

The scary thing is, you can actually run a bunch of these phrases together, plopping in a sponsor's name and end up with something that sounds just like a commercial, which is exactly my point. Even though it sounds like copy, it's not. It's a form of cultural residue, ersatz copy, a "copy-like" collection of words.

There's not much you can do about copy that comes in already recorded, but there's a lot you can do when you get to do the writing. Start with a unique selling proposition—something that differentiates the product or service from the rest of the pack.

Position the sponsor's name together with the slug line to reinforce in the listener's mind the single most important fact you want them to retain; for example, "Manor Shop Menswear, your one-store-fits-all store."

Serving the client

Good copy takes time and thought. When the account executive comes back to the station with a few hastily written notes on the back of a fast-food burger bag, ask to talk with the client. I know this will make some AEs nervous, especially if the person making the call hasn't mastered the art of phone etiquette. This job requires that you do more listening than talking.

Your aim is to be as helpful to the client as possible. Banging through the call with a caffeine overload or low blood sugar can be disastrous. Find a time when you and the client can talk without distractions. Let the client tell you about the product or service.

Find out what advertising has worked in the past, and what hasn't worked. If you have ideas, offer them as suggestions. Don't be offended if the client doesn't like them—after all, they're only ideas.

Your real reason for offering ideas is to

A Christmas Wish List

► continued from page 29

•Maybe a clear definition of where CHR is headed, so I know whether it plans to slide into either UC or Very Hot AC. Don't forget, Alex: All this will be *our* "Music of Your Life," when we hit that 70th birthday!

•WFAN's Imus In the Morning blows me up on the air. Alan Colmes has already called me a toothpickhead, so I'm due.

•Digital signal processor (DSP) manufacturers build a production toy that accepts regular plain old SIMMS assemblies for enhanced memory locations and processing power. I'd be awful happy spending 99 bucks for a cleaner reverb than a new box I don't need.

•Mo' MIDI! Mo' MIDI! Mo' MIDI!

•Perhaps another year of life's little ups and downs at stations all across the U.S., that yours truly can have fun talking about from the trenches.

Have a Happy '93,
—Al

□ □ □

Al writes from WLAD198Q Danbury, CT 06810. He plans to celebrate New Year's by playing Auld Lang Syne on an electric violin through a 200 W Crown amp. And no, he hasn't gotten any better on it since last summer.

stimulate the client's mind. Take notes. I use a word processor with a "hands-free" telephone. That way I can easily enter thoughts, phrases and possible copy points during the conversation.

Try to get a sense of what attitude the client wants the spot to have. This will determine the language, the read and any music you might choose. Find the unique selling proposition. The client won't necessarily know the term, so be prepared to explain how having one will improve the power of the copy.

Note all of the copy points, including things like location information and hours of operation. Ask if the client wants room for a

live or pre-recorded tag. Only after you get all of this can you start to write the copy.

Stick to the idea

One of the biggest mistakes you can make is to follow these steps, hang up the phone, get a great idea that has nothing to do with what you talked about and go to town. Two hours later, when you play your brilliant idea for the client, there's a long pause and a big disappointment. The client now thinks you didn't listen to what he or she told you. And the client is right.

Don't use too many copy points in one piece of copy. If the client has a huge list of things that need to be mentioned, write

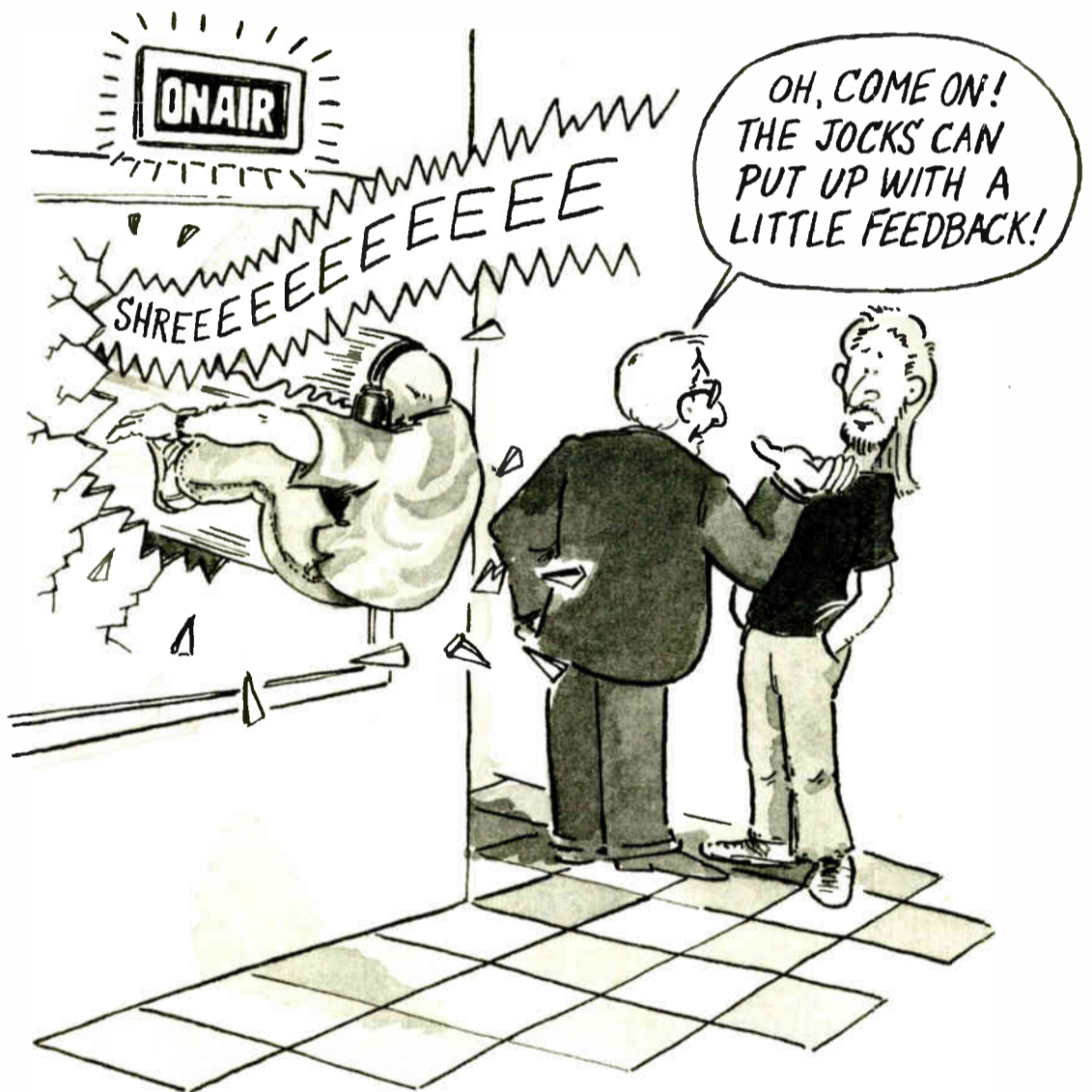
more than one piece of copy and spread the load. Respond to clients who have come to believe that "a busy spot is a good spot" by suggesting that a good read (maybe using two voices) and a good music bed are better ways to make the spot sound busy.

Multiple telephone numbers are a bad idea. Even if the listener is giving his or her undivided attention (not likely), two numbers are very confusing. Pick one and go with it.

Each year, listeners' "BS detectors" get more sensitive. They hear BS, they tune out. Fine-tuning your copy is one of many ways to keep that from happening.

□ □ □

Ty Ford speaks from personal experience. He recently had to excise the line, "...you always get the same special attention," from a piece of his own copy. His conclusion: Stupidity is very insidious.

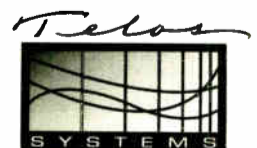
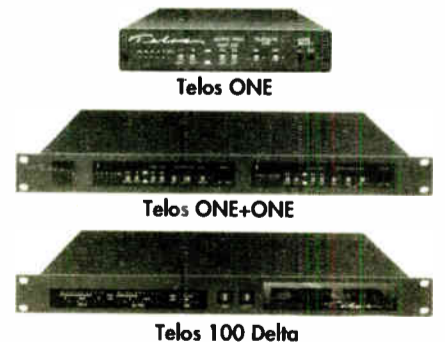


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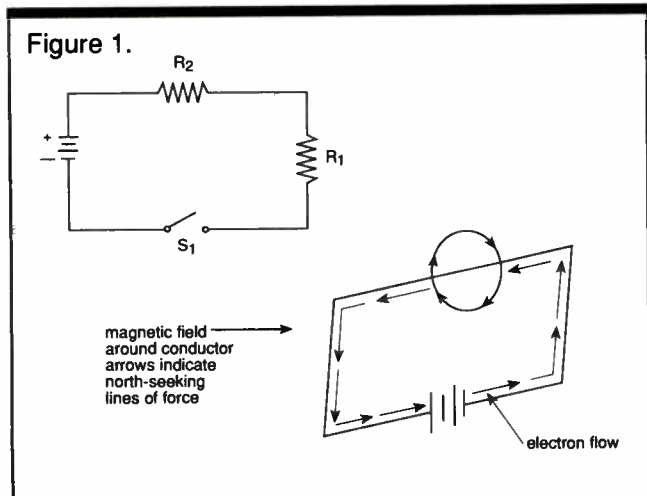
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Understanding Inductance and Lenz's Law

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

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



by Ed Montgomery

Part II of X

ANNANDALE, Va. Inductance is the conductor's ability to produce a voltage from a magnetic field surrounding it. The energy is stored in the magnetic field surrounding the coil. It occurs in coils and transformers. All coils will produce

a self-induced voltage. This is known as self-inductance and will oppose the current that produced it, otherwise known as Lenz's Law.

When the electric current flow of a conductor varies, its magnetic field varies, creating the ability to transfer energy from one conductor to another (Fig. 1). If S_1 is opened, the current flow will cease, and the magnetic field will collapse across the conductor and components inducing a voltage.

Direct current produces induced voltage only when the current is changing, or when S_1 is switched on or off. If the current is maintained at a constant level, the magnetic field will not change resulting in no induced voltage.

Inductance

As electrons flow from negative to positive, a rotating magnetic field is produced around the conductor. Alternating

current circuits have this magnetic field constantly changing in intensity and direction. The constant change produces voltages and currents that oppose the electron flow that produced them.

The electrical characteristics a coil has with DC flowing through it are vastly different from the ones produced when AC flows through it.

The symbol for inductance is "L." The

unit of inductance is the "henry" named after Joseph Henry (1797-1878) an American physicist who studied the relationships of electricity and magnetism. The henry can be mathematically defined as illustrated in Fig. 2.

Figure 2.

$$L = \frac{V_L}{di/dt}$$

V_L = induced voltage

di/dt = current change in amperes per second

L = inductance value in henries

The formula indicates that inductance and induced voltage are directly related to how rapidly the electric current changes in the circuit.

Normally upper case letters indicate a circuit containing DC, and lower case letters indicate the circuit contains AC or pulsating DC. When a change of one ampere occurs in the span of one second and one volt is induced, one henry of inductance is present.

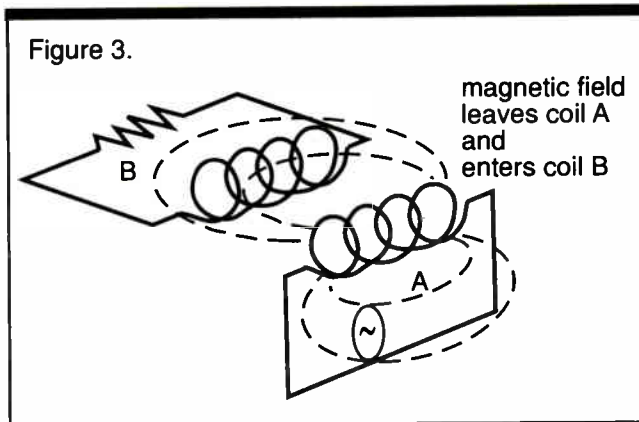
When considering inductance, it is always important to remember Lenz's Law: Induced voltage must oppose the change in current that created it. Fig. 3 illustrates a magnetic field expanding away

from coil A and crossing into coil B's windings.

Magnetic flux

The magnetic field appears to be entering coil B but it is leaving coil A. The end result is a current flow in coil B that is in the opposite direction of the current flow in coil A. An induced voltage is produced in "B" that opposed the potential in "A."

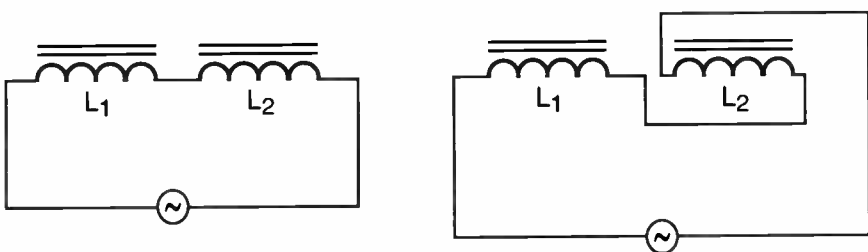
This can be observed when watching electric motors. Often, you will see sparks on the motor commutator while it is operating. The electric current is temporarily broken when the brushes break contact while



rotating. The magnetic field in the coil windings are releasing an induced voltage at this loss of current, attempting to

continued on page 35 ►

Figure 4.



FACILITIES SHOWCASE

Modular Studio Design Lets Premiere Go Mobile

by Dee McVicker

HOLLYWOOD, Calif. About the only thing that reaches greater heights than the stars in Hollywood is the Los Angeles real estate prices. If you want a place to hang your sign for business in this town, you need to get creative.

Creative thinking is exactly what Premiere Radio Networks, Inc. did when it outgrew its facility in Hollywood. Instead of buying into sky-high property prices, the network signed a sublease for roomier space in Sherman Oaks and put its money into modular, movable studios.

In two-and-a-half years, Premiere Radio Networks will again be moving its studio facility in its entirety, carting out five modular studios and two talent booths and piecing them together again in a building elsewhere in the area. It will take no more than a weekend from start to finish, and should come together again with incredible acoustical integrity.

On the ascent

The move by this rising star was made with foresight. Promoted as the fourth largest radio network in the country, Premiere Radio is known for its parody bits, interactive performances and wide variety of specials—including syndicated

shows like *Live From Hollywood*, *Reflections* and a dozen other weekly programs.

Barry Victor, Premiere's director of engineering, said the need for space was paramount from the beginning: "We knew we needed the space. So we looked at either buying or building a building."

Although the timing was right to expand the five-year-old company, which had recently gone public and needed more studio space to reach its full potential, the timing was all wrong for making an investment in California property.

The network stumbled onto a sublease in what Victor describes as "one of the nicest buildings in the Valley." The price was right and the 16,000 square foot facility—at twice the space as the network's old Hollywood studios—seemed to be a perfect fit, sublease and all, for the rapidly growing company.

Going mobile

"We looked at the cost of having a structural build-out and having to leave it here, versus going with modular studios," he said. Overall, Victor figured modular, movable studios would cost Premiere more money up front, but would save the network in the subsequent move.

continued on page 35 ►

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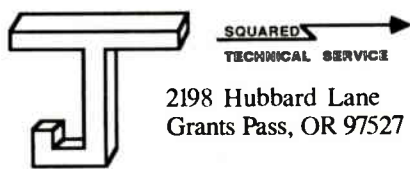
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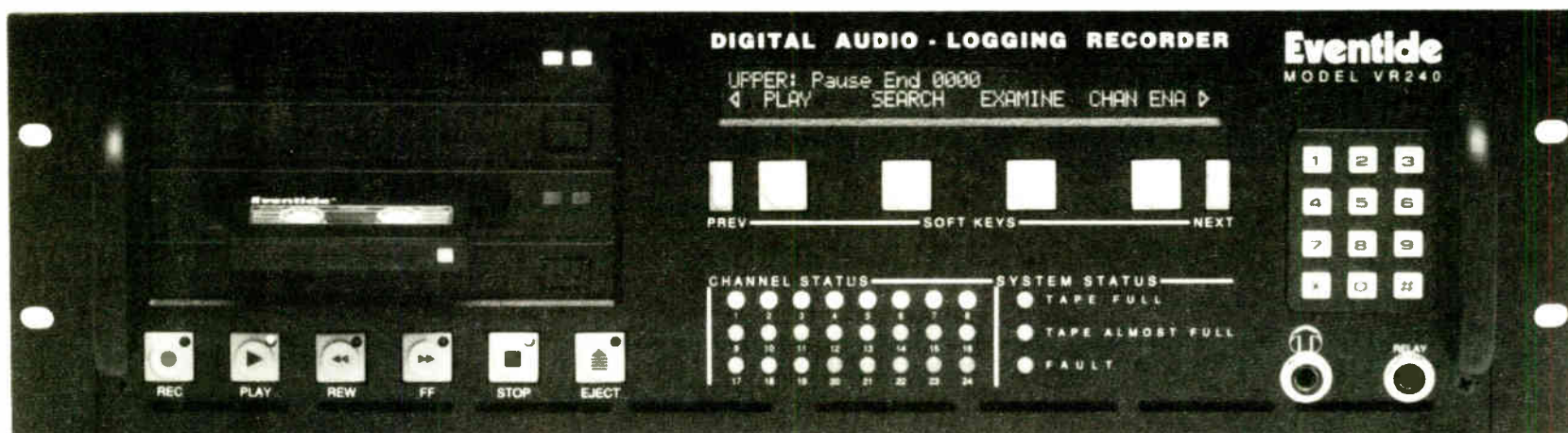
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- DC meter amplifier.

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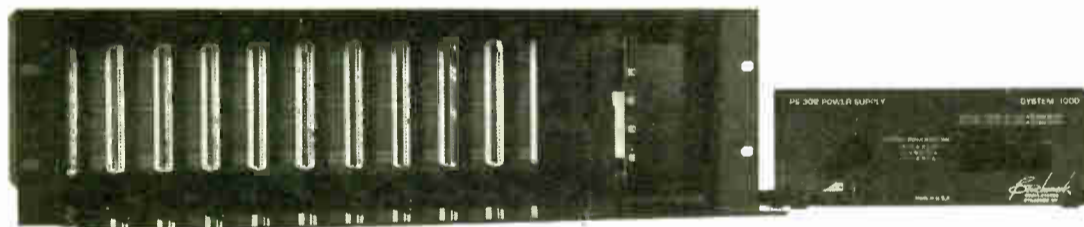
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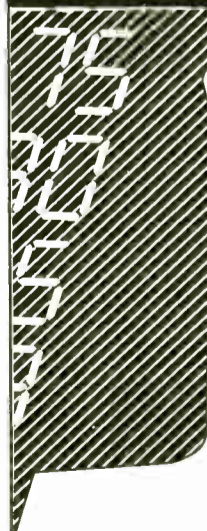
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READER SERVICE NO. 198

Premiere Goes Mobile

► continued from page 32

Opting for custom-designed wall construction by Industrial Acoustics, Inc., which is known for its "silent" hangers for mega-million dollar "stealth" fighters, the network was assured it would not have to forfeit pristine acoustics in exchange for mobility.

For each of the five production studios and two talent booths, Victor ordered heavy-duty construction comprising a floor, walls, double-glazed windows and ceiling. The result, he said, "is a room within a room," each 16-gauge steel, double-walled construction. "They were all constructed to a 50 dB specification," commented Victor.

All studios were outfitted with custom-designed furniture by Arrakis Systems. Two 32-pair audio cables for the studios and a single 32-pair audio cable for the talent booths were routed through the rooms, each terminating at an ADC I.C.O.N. punch block.

At a central rack room, an ADC Ultra Patch cross-connects the studios, acting as the central nerve center for the system. "We can literally unplug the rack, unbolt it, and have our entire audio system moved," said Victor.

With new studios to fill, Victor next needed to check out new gear. Consoles were first and foremost on the list.

Starting out five years ago on a shoe-string budget, Premiere Radio Networks had picked out Allen & Heath production consoles that served its purpose remarkably well for the money.

Selecting the new gear

But today, with more capacity needed, new eight-tracks were called for and the TASCAM M3500 began to look more and more like it might fit into the performance and cost requirements of the network. "It has quite a nice EQ filter, and it's a relatively clean board," noted Victor.

Victor purchased the TASCAMs for all five production studios. In one of the five he interfaced the board to a New England

Digital workstation—a highly sophisticated digital editing system purchased by the network a year ago when the system was still in production.

Currently, the New England workstation supplies 16-track production, including MIDI-based keyboard and synthesizer, for the network's creative pool of musicians and comedians.

For the two talent booths, which were furnished with talkback feed to each of the five production studios, Victor hung onto the Allen & Heath mixers. Each studio is equipped with Telos telephone hybrids and couplers for interactive bits, which have become popular programming for the network's 2,000 affiliate stations.

Given the network's emphasis on production of parody bits, each production studio has a liberal inventory of special effects gear—such as Yamaha SPX reverbs and

Aphex gates—and more than enough digital source gear to make analog production almost obsolete in all five studios.

"Our goal is to eventually replace all the analog equipment from the console out," said Victor, who recently purchased new Denon production compact disc players and Panasonic SV-3700 DAT machines for each production studio.

Always looking for new and innovative ways of doing things, Victor currently is considering replacing the network's existing phone line hook-up to IDB with Ku uplink or Switched 56—technical real estate that no doubt will hold its value over the coming years.

□ □ □

Dee McVicker is a free-lance writer specializing in broadcasting who regularly contributes to RW. She can be reached at 602-545-7363.

Inductance and Lenz's Law

► continued from page 32

restore this loss.

Switch contacts often produce an arc when they are shut off. This is another product of the induced voltage breaking down when the electric current is shut off.

Circuits that contain many windings of wire, such as those in electric motors, develop large amounts of inductance. Coils tend to oppose any change in current. When shut off, their magnetic field collapses inducing a voltage restoring the current flow.

Because of Lenz's Law, the coil induced voltage creates a current that flows in the opposite direction.

The laws that hold true for resistors in series, parallel, and series-parallel circuits also hold true for inductors in series parallel and series parallel (Fig. 4).

However, unlike resistors, inductors can be wired in aiding or in an opposing manner. When coils are connected in an aiding manner, their magnetic fields will reinforce each other and the total inductance will increase. When wired in an opposing manner, the magnetic fields will oppose each other and the total inductance will be the difference of the sum.

Further study of inductance can be found in the ARRL Handbook, or in Basic Electronics by Bernard Grob and published by McGraw-Hill.

□ □ □

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

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BUYERS GUIDE

December 23, 1992

Digital and Analog Cart Machines & CDs

USER REPORT

KTLG Goes from Analog to DigiCarts

by Philip "Moon" Lowry
Production Director
KTLG(FM)

CORPUS CHRISTI, Texas We use two 360 Systems DigiCarts in the production and on-air playback of our entire spot-load here at KTLG. Our analog cart machines served us well through the years, but we knew the future was in digital.

We considered digital cart machines because the technology provided so much more than analog carts and at virtually the same cost. After six months of use, we're pleased with our decision.

Mini-workstation

We use one of our DigiCarts as a mini-workstation in the production studio. The easy operation makes it very user-friendly, and we've greatly increased audio quality since we put DigiCart on-line.

It works just like a stereo cart, with the added flexibility of making seamless edits on voice tracks and music beds. All

...We've greatly increased audio quality since we put DigiCart on-line.

voice tracks are produced on DigiCart, and post-production is done on our analog four-track.

Final mixdowns are done to DigiCart's removable Bernoulli disks. Spots and promos are taken from the production

studio on removable disks, and loaded to the DigiCart in our on-air room.

All cart machines for commercials and promos are gone from our on-air studio.

sequence that plays back just like tape carts would on a triple stack using secondary tones. However, DigiCart can stack an unlimited number of events,



For KTLG, the future was the DigiCart by 360 Systems.

In their place, we use a single DigiCart with a 200 megabyte (200MB) hard disk and an expandable slave chassis with another 200MB drive.

Using Dolby AC-2 data compression, the DigiCart stores about 20 minutes of audio on each removable disk, and over three and a half hours on our hard drives. Although larger hard drives are available, we've found that ours provide an acceptable amount of storage, even in the busy holiday season.

Following the log

For on-air playback, announcers do what they've always done: follow the log. DigiCart can stack sets in a smooth

allowing each jock creative freedom to use drops, sweepers, IDs and special effects as they wish.

All announcers at the radio station have their own removable disks containing personalized liners, IDs and other cuts that are part of their show. This assures our program director that dayparted jingles and drops are scheduled appropriately.

When the on-air jocks have a spot set, they simply find the spots stored on the DigiCart using a feature called "Quick-stack." Sequencing is as easy as pressing "pause," dialing up a spot, pressing play, then dialing up the next spot and so on. When done in sequence, spots and promos play back flawlessly with seamless, clean digital audio.

KTLG is a "live" oldies FM in a market of format giants and small ethnic stations. These stations eat up enough of the total advertising revenue "pie" to require us to put out a cutting-edge on-air sound to compete. DigiCart has helped us succeed in this effort beyond our wildest expectations!

If you need state-of-the-art technology that can be ramped up in about two weeks, shocking your competition and impressing your clients, DigiCart is your answer.

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USER REPORT

Kissin' Country's RS-2000 Love Affair

by Mac McGaha
Contract Engineer

BOISE, Idaho The cart machine of choice at KIZN(FM), "Kissin' Country" in Boise, is Radio Systems' RS-2000, a product from the same company that makes the station's DAs and a line of mixing consoles, DAT machines and other studio equipment.

We use several of the new RS-2000 machines for playback in the air studio.

Every machine corrects for stereo phase error on every cart it plays. Single-ended phase correction is a major audio feature and a surprising one in a cart deck with a mid-range price.

Other features include a splice detector, a timer (in all models), three cue tones, fast forward and encoded flutter correction. But it's not overly fancy, just neat and reliable.

These machines replaced an aging triple-decker. You know the problem:

One slot fails, three slots are gone. So we went to a one-third rack-width machine this time.

Trouble-free machines

Eight months later, I can still say the RS-2000s are among the most trouble-free pieces KIZN purchased when it moved from its downtown location to a new facility last spring.

The RS-2000 is the design work of Mike Sirkis, who has developed some of the

most successful cart machines of the last decade. He has also designed mixing consoles and DAT machines for Radio Systems.

The jocks like the new machines, and the features sure are nice. But for me, the real test of quality is ease of service. Anyone who's ever fully disassembled a cart machine just to get at a regulator knows what I mean.

The inside story

Important internal points are accessible in the RS-2000. The major electronics are modular, and the side panels can be removed without the entire chassis collapsing.

I can set the azimuth of the heads from the front panel, with a recessed Allen wrench adjustment. Tape guides are also simple to set: just one screw setting for each guide. A roller-cleaning mode lets me get at the puck easily.

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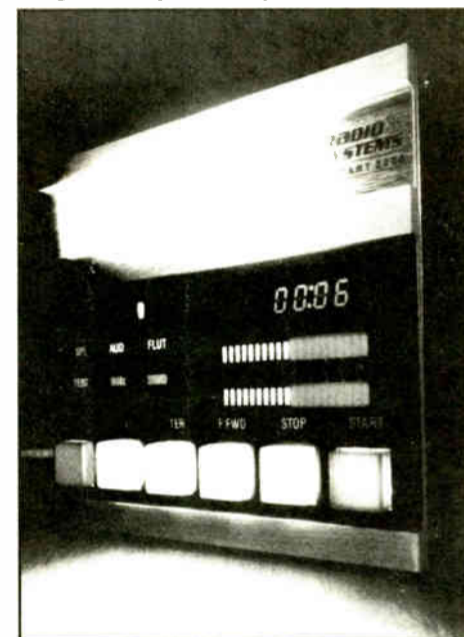
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World Radio History



KIZN uses several RS-2000 Series cart machines for playback in its air studio.

A Regdon solenoid is run by a constant current low voltage circuit. This keeps the operating temperature down by dropping the current to a low level after the roller has engaged.

Internal jumpers make programming simple. For instance, I can choose to run the motor constantly, or only with a cart inserted. Jumpers also set tape speed, leading/lagging functions and cart-not-cued lockout.

Service help

Radio Systems has given me excellent service. They have a toll-free customer line, and they readily admit when minor problems crop up. They had a problem with a batch of servo cards; as a result one of my motors didn't start properly. A replacement card was rushed to me.

And I appreciate the fact that when I call, they either pick up the phone or call back promptly. This is a little thing, but I can't believe how many companies take a day or longer to call back with service help.

More than anything, the station ownership was price conscious. We did well; the RS-2000 is a fine value. I can recommend it without hesitation.

□ □ □

For information about Radio Systems' RS-2000, contact Paul McLane in New Jersey: 800-523-2133; fax: 609-467-3044; or circle Reader Service 84.

TECHNOLOGY UPDATE

Denon DN-951FA Keeps DJs on Track

by Michael Stelts
Product Manager
Denon America

PARSIPPANY, N.J. With Denon CD cart players installed in thousands of studios, engineers have had an opportunity to evaluate the players and suggest future improvements to Denon. Those ideas are incorporated in our latest player, the DN-951FA.

Perhaps the most obvious new feature is the Auto Track Select System (ATSS). Using bar code stickers applied to the cart, a particular track can be cued direct-

ly. For example, by putting "Track Exclusive #3" on a cart, the player automatically cues to track 3, and no other track can be chosen. Track Priority and Lock-Out bar codes also are available.

Track Priority #3 will also cue to track 3, but it allows you to change tracks. Lock-Out #3 will cue up normally (track 1), but will not allow you to choose the third track.

More room and features

Every inch of space counts in most studios, so the new machine has been resized to fit three across in a rack. Also,

the circuitry has been optimized to run cooler than before. This ensures long-term reliability.

To minimize cleaning time, new inte-

Every inch of space counts in most studios, so the new machine has been resized to fit three across in a rack.

grated construction eliminates circuitry between the top cover and laser assembly. Simply remove the top cover (four screws) and the entire CD transport is accessible.

Carts often are left in the machine long after they have played. The DN-951FA automatically shuts down its laser and transport 30 seconds after the CD has finished playing. This minimizes wear on the spindle bearings and laser.

Easier to use

Remote control of the new CD cart player is easier to implement. The DN-951FA uses the common ground switching found on most broadcast consoles. Also, an RS-422 serial port is now available for computer control.

Finally, every playing mode adjustment

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USER REPORT

Fidelipac DCR-1000 Offers Versatility to WEAZ-FM

by Russ W. Mundschenk
Chief Engineer
WEAZ-FM

PHILADELPHIA, Pa. When EZ-101's carted music library started showing its age and programming announced a change to a more contemporary format, it was time to look for a digital alternative.

CDs weren't versatile enough. They couldn't be edited or individually equalized, and syndicators didn't have all the songs in their libraries.

We didn't feel that digital mass storage for music was versatile, redundant or cost-effective enough to implement.

The solution

Enter the Fidelipac DCR-1000. This digital cart machine looks just like its analog grandfather, but uses 2 megabyte (2MB) and 13MB 3.5-inch floppy disks as a storage medium.

The Playback and Record units are in the same size box as the old analog cart machines, but they aren't as cumbersome. After recording, a standard keypad enables you to enter subcode information such as Artist, Title, Intro, Ending, etc. When loaded, this data (plus function and timer information) is displayed on a 2x24 backlit LCD screen on each machine.

To dub a song, insert a 13MB disk and select mode (mono/stereo) and sampling rate. These super-floppies will record three minutes and 44 seconds (3:44) of stereo material at 44.1 kHz sampling rate and 5:10 at 32 kHz. Then choose either digital (SPDIF and AES-EBU) or analog input. (Because there is no rate conversion, digital copies from CDs must be made at 44.1 kHz.)

Recording

Enable the "Record Start-on-Audio" push button and play your source. Recording starts at a user-defined threshold and is always "tight." Enter titling information into the keyboard and press stop when finished. Secondary and tertiary "tones" may be entered and subsequently edited at any time.

Up to 16 multiple cuts can be recorded and randomly accessed. The 2MB disks function similarly but must be initially user-formatted. The system also supports 48 kHz, 25.75 kHz and 22 kHz sampling rates.

Playing back a disk is a cinch: Insert and press Play. The playback decks work just

like an analog machine, except there is no recue time. The jocks here had no instructions and picked up the operation immediately.

The 3.5-inch floppy is a real space saver. A stack of five disks is as thick as one traditional cart, and racks of music or commercials take up about one-third as much space. The little digital carts are physically rugged too. Because they are so thin, com-

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USER REPORT

PMD-700 Logs in Miles of Field Work

by Tom Mac Donald
News Reporter/Remote Engineer
WWDB-FM

PHILADELPHIA, Pa. A long time ago, when I started as a field reporter at a college radio station, my first field recorder was a Marantz PMD-200. If you have ever used one, your shoulder and back will remind you...mine still hurts when I think about it.

But the machine would always work, even during blinding snowstorms in below-freezing temperatures.

Why all the nostalgia? When I decided

to look into the world of digital audio tape (DAT), I decided the Marantz PMD-700 was miles ahead of the competition in quality and price.

Fully loaded

The PMD-700 has been discounted to about \$1,500 and is the smallest of the so-called "pro" DAT decks on the market. It weighs less than three pounds, even when fully loaded with 10 AA batteries and its rechargeable battery pack.

Even without the manual, the PMD-700 was easy to figure out, and I had it recording and playing back within minutes. This

machine has all the features of a cassette recorder and more, and excludes one feature every broadcaster can do without—SCMS copy protection. Exclusion of this copy protection function allows perfect digital-to-digital copies every time. We used an optical cable from our CD player to the PMD-700 for copying, with no loss of digital fidelity.

The first time I took the PMD-700 into the field, I used it on a news story. Sound reproduction was fantastic; total harmonic distortion in the unit is listed as 0.018 percent and wow and flutter is under measurable limits.

At first, cueing was a problem with news actualities, mostly because of the recorder's rotary head arrangement. But after some practice, a little old-fashioned anticipation solved that problem.

The PMD-700 really excelled in critical field recordings. The second day I had the deck we needed to record a commercial at the office of one of our talk show hosts. Using an Electro-Voice RE15 mic, the script sounded better in the field than in the studio, according to our production director. And the client really loved the spot.

Field work

The PMD-700 was just as easy to work with in the studio as in the field. After recording in the field with the easy-to-use XLR mic connection, I took the machine right into the studio and connected it to the console through RCA-type line out jacks neatly concealed in the rear of the unit by the case. The machine also has line in analog and digital inputs via RCA and digital XLR and RCA connectors, respectively.

The PMD-700 also has a wired remote control with a headphone jack for source monitoring that's useful when taking

notes or transcribing soundbites, or even music. Major controls are duplicated on the remote, allowing for easy access. In addition, a thumbwheel control for the headset volume allows for a comfortable listening volume without fumbling.

Battery life in the recorder is quite good, considering DAT machines are known far and wide for their ability to drain batteries faster than any other known piece of electronic gear. I would recommend keeping the rechargeable battery fully charged and using the 10 AA batteries as a backup, because you could buy Eveready stock if you used alkaline batteries exclusively.

The manual on the PMD-700 is concise and to the point, and is written in several languages, making translation for foreign correspondents a snap.

Saves money

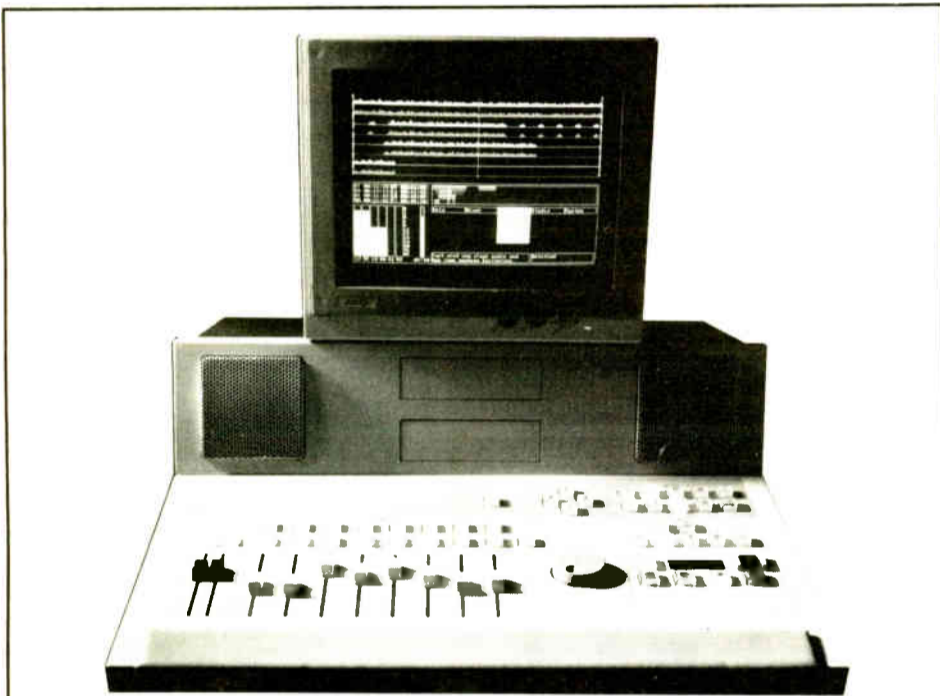
Using a DAT deck could actually save some operations money, because archiving could be done with no generational loss and the space that analog tapes occupy could be used for other purposes. DAT tapes also cost less than open reel tape. And with the ability to designate starting cues on various tracks, it's as easy to use as a CD player.

This is not the machine to use, however, if you are working in the field and have to send soundbites back over the telephone, because of the rotary head arrangement of a DAT machine. (But who would use a digital machine for this purpose?)

The Marantz PMD-700 is a remarkably affordable machine if you are looking for DAT reliability in a machine that is small and lightweight. You wouldn't believe the power it contains. And if studio-quality field recording is your aim, this is your machine.

□ □ □

For information, contact Dave Schwartz at Marantz in Illinois: 708-820-4800; fax: 708-820-8103; or circle Reader Service 35.



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TECHNOLOGY UPDATE

Customize Your CDs with Studer's D740

by **Sandra Hale**
Advertising/P.R. Manager
Studer

NASHVILLE, Tenn. Worldwide, more than 60 percent of the radio programs utilize the compact disc medium for broadcasting. The reasons for this are simple: CDs offer reliability, high quality audio, a compact size, instant

supply are housed in a solid die-cast aluminum chassis about the size of a home stereo receiver.

No external hardware or controls are needed for operation. The logically arranged keyboard is easily mastered by anyone familiar with a cassette recorder.

An optional parallel remote control supports operation of both the D740 and Studer's D780 R-DAT recorder and can

Excellent broadcast quality digital audio isn't the only advantage this new technology allows. With the price of

commercial to be played at home, in their car or at the office. In addition, customers can choose the CD for dubs of their spots

to be aired on other radio stations or used on TV spots. For national advertisers, shipping costs of the convenient, lightweight CDs will be much lower than for tapes.

Archival material can be recorded and stored in a fraction of the space that was needed for analog tapes. And studies have shown that CDs are more reliable and have a much longer shelf life. Jingles, sound effects, music libraries, station IDs and promos can be instantly



Studer's D740 CD read/write recorder

The D740 CD recorder from Studer offers fully compatible, high quality digital recordings within a totally professional design.

access to tracks or programs and much more.

Given the widespread acceptance of this format, it seems only natural that modern broadcast facilities will be soon recording their own custom CDs for station promotions and IDs, high quality dubs and archiving purposes.

Professional design

The D740 CD Recorder from Studer offers fully compatible, high quality digital recordings within a totally professional design. Completely functional as a stand-alone system, the D740's read/write recorder, converter, encoder, decoder, subcode generator and power

be installed directly into a mixing console.

Audio specifications include dynamic range of nearly 98 dB and a flat 20 Hz to 20 kHz frequency response. The back panel offers a generous supply of professional and consumer interfaces including: balanced XLR line inputs and outputs; unbalanced RCA connector outputs; digital inputs via optical, RCA and XLR (S/PDIF and AES/EBU formats) connectors; digital outputs via optical, RCA and XLR connectors; and a 25-pin parallel remote socket with fader start.

blank disks continuing to decline, recordable CDs offer a new profit center for broadcasters. Blank discs can be imprinted with the station logo and used for promotional items, giveaways and contests.

accessed for on-air broadcasting.

For those innovative stations ready to move boldly into the future of digital broadcasting and production, there's no better choice than Studer's D740 professional model CD Recorder.

□ □ □

For information, contact Sandra Hale at Studer in Tennessee: 615-254-5651; fax 615-256-7619; or circle Reader Service 113.

Custom copy

Advertising clients can leave the station's in-house production department with a custom CD copy of their latest

Denon Keeps DJs on Track

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is accessible from the front panel. While holding down the Index and Time buttons, press the Stdby/Cue button to toggle through seven sets of DIP switches. These switches can change 29 different



Denon's DN-951 FA allows tracks to be cued directly.

parameters, including Variable Speed, Cue Detect level and End Monitor Time.

For production applications where more user control is desired, the DN-970FA is available. Or, if your studio isn't ready to adopt the CD cart format, a drawer-loading version of the new player, the DN-961FA, offers all the features of the DN-951FA (except ATSS).


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For information, contact Michael Stelts at Denon in New Jersey: 201-882-7460; fax: 201-808-1608; or circle Reader Service 156.

Table of contents

Once the process of recording selected material onto the Write Once CD is complete, Studer's D740 will generate a table of contents with track numbers and exact running times. Both the D740 and its recorded CDs are compatible with the specifications defined in the Red Book and Orange Book, assuring users of playback on professional and consumer CD players.

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TECHNOLOGY UPDATE

Audiometrics CD 10: Rugged, Reliable

by Ron Oler
Broadcast Engineer
Radio Studio Service Staff
Harris Allied

RICHMOND, Ind. The Audiometrics CD 10 from Harris Allied is an affordable, full-featured CD cartridge machine. Like previous CD cart players, the CD 10 protects compact discs from damage by using industry-standard cartridge shells.

No more accidents

Sized to fit three in a rack, the CD 10 is designed for accident-free use. CD titles are clearly visible from the front of the unit, and innovative autolock makes it virtually impossible for a jock to accidentally eject a cartridge during playback.

Advanced linear tracking enables rapid cueing. An adjustable cue-to-music threshold (-54 to -72 dB) decreases "start" lag time.

With ability to recognize and respond to INDEX 3 subcodes used by several syndicators on CDs, the CD 10 can emulate automation in a manner similar

to the secondary tone on a tape cartridge.

CD 10 controls are designed to resemble those on NAB-style cart machines. A jog shuttle wheel on the front panel performs frame search and location functions quickly, and also permits a user to search forward into the next track or reverse into the last track. Four separate illuminated



The Audiometrics CD 10 was designed for accident-free use by almost any operator.

buttons are also located on the front panel for "Play," "Standby," "Stop" and "Pause."

Panel displays

Front panel displays provide a great deal of functional information. A large flashing indicator displays end-of-mes-

sage (EOM) data, and the CD 10 features an adjustable variable timed (five- to 35-second) EOM relay closure. The front display also can selectively show remaining or elapsed time.

The CD 10 features Sony's latest three-beam optics, easily accessible for cleaning. Use of a one-bit, analog-to-digital converter with 8x over-sampling and an FDNR analog filter provide superior phase characteristics. The unit's toroidal power transformer reduces hum and RFI.

Designed for long life, the CD 10 fea-

tures a heavy aluminum deck panel for shock isolation from the chassis. Low heat generation and positive ventilation allow cool running, and vertically-slotted plug-in cards permit easy access and service.

With the CD 10's IEC II output, direct digital dubbing is as easy as running a cable with appropriate connectors from the CD 10 to a DAT machine.

The basic CD 10, available exclusively from Harris Allied, is priced at \$1,195. The unit is backed by a one-year parts and labor warranty.

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For information on the Audiometrics CD 10, contact Tom Harle in Indiana: 317-962-8596; fax: 317-966-0623; or circle Reader Service 186.

TECHNOLOGY UPDATE

dB-Cart Employs 21MB 'Floptical' Disk Drive

by Jeffrey E. DeBry
VP of Sales
Digital Broadcast Associates

TIGARD, Ore. dB-Cart is the first offering in a new line of digital source equipment from Digital Broadcast Associates. By now you've heard a lot about digital cart machines and how they're going to replace your tried and true analog carts.

At Digital Broadcast Associates, we feel that digital processing provides so many advantages over analog machines, the only question is how to switch.

New and old

dB-Cart takes a unique approach to this problem by combining the familiar user interface of the analog machines with the inherent sound quality improvement and the reliability of digital processing.

In order to achieve maximum storage while maintaining ease of use, dB-Cart's design is based on a 21 megabyte

(21MB) "floptical" disk drive. The drive uses both 3.5-inch 21MB floptical diskettes produced by IBM, Iomega and Maxell, and standard 3.5-inch 1.44MB diskettes used with your IBM or Macintosh computer.

The floptical's advantage over other high-storage floppy media is twofold: It's readily available from a variety of sources and it can be bulk erased and reformatted in the field. The floptical is a

The dB-Cart's design allows for upgrades.

combination of CD-ROM optical servo and traditional magnetic recording, two proven technologies.

dB-Cart provides a 32 kHz sampling rate (others are available), with a frequency response of 20 Hz - 15 kHz, ±0.5 dB. The dB-Cart is capable of storing over 10 minutes of stereo on a single 21MB diskette at full bandwidth; up to 70 seconds of stereo can be stored on a 1.44MB floppy. Multiple spots or programs can be stored on each diskette and played back in any order. The signal to noise ratio is better than 90 dB and the total harmonic distortion is better than 0.05 percent.

Program information

Program information is displayed via a front panel LCD display. The information can be edited with a simple keyboard. Remote operation and secondary or tertiary cues are available and simple to implement. Program material also can be edited for tighter start and stop.

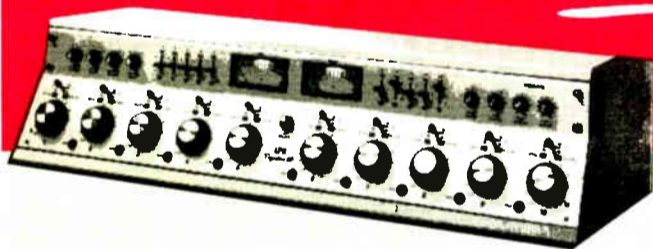
The dB-Cart's design allows for upgrades. Modular construction allows dB-Cart to be fitted with different components as technology changes.

Overall, the dB-Cart offers a simple transition to digital and a host of must-have features. dB-Cart is a sound approach for broadcasters looking forward to the benefits of digital.

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For information, contact Jeffrey E. DeBry at Digital Broadcast Associates in Oregon: 818-567-2873; fax: 818-567-2917; or circle Reader Service 131.

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TECHNOLOGY UPDATE

ITC Bucks the Digital Trend with Series 2

by Bruce Helling
Marketing Communications Mgr.
ITC

BLOOMINGTON, III. When ITC introduced the Series 2 last spring, more than a few of our broadcast industry friends, and a few competitors, wondered why we chose to develop and market yet another NAB-type cartridge machine. Especially with "digital" being the buzz-word.

Well, it has been said by some for close to 10 years now that cart machines are on the way out, yet they continue to be the day in, day out bread-and-butter money makers for a majority of radio stations in the U.S. and abroad.

Recreating history

In 1982, we retired one of our most popular cart machine lines ever, ITC's Premium Line, in favor of the Delta Series. We had taken our time in developing the Delta Series, listening to what broadcasters from all types of markets were saying about their studio needs, and the Delta turned out to be even more popular than its predecessor.

The same concept of listening to the market, combined with innovative and efficient technical design execution, holds true for the Series 2 some 10 years later.

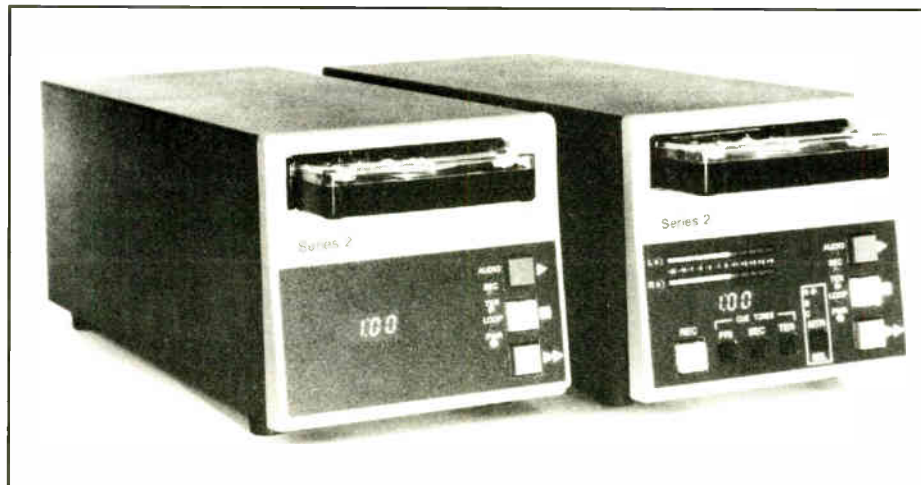
The Series 2 combines record and playback electronics in a one-third rack unit package. Space is money. The basics pioneered by

ITC over the years provided the platform to build on: motherboard/daughterboard construction, microprocessor logic, triple cue tones, high-speed recue, audio mute at EOM, primary tone add/defeat, replay lock-out and multi-turn potentiometers.

The mechanics started with a heavy-duty

an easy-to-read digital tape timer, high-resolution LED bar-graph metering, multi-function Record/Bias/Cue metering select, a looping function, optical sensor for mono/stereo cartridge and Dolby HX Pro™ headroom extension.

For servicing, we added a cleaning mode



The Series 2 cart machine combines record and playback electronics in a 1/3 rack unit package.

cast aluminum deck, precision adjust head block, constant tension cartridge hold-down mechanism, dynamic motor braking and more.

Improvements

From there, we looked to our customers for improvements. Our design team added

for normal maintenance, and a slide-out chassis for full access. For the daily production room/studio pounding, a unique cam-latching pressure roller mechanism and super-efficient solenoid provide smooth, silent pull-up and consistent contact. We also added an On/Off switch, micro-adjust Kevlar® tape guides, a

removable fuse case, the heavy-duty motor from our 99B Series master recorder/reproducers and a completely new and improved controller. No fluff, just usable features the customers asked for, period.

One feature we didn't need to add because it comes standard is our technical service and customer service staff (available toll-free in North America), plus a four-year limited warranty.

The new machine

So, why the new machine? Because the NAB tape cartridge machine remains a reliable, economical and operationally friendly method for recording music and spots available. Sure, we've also been busy perfecting our DigiCenter® Digital Audio Platform, but true advancement is a slow process of combining new technology with operational variables and customer needs, while ensuring quality and reliability. We've just now created a successful marriage, but that's another story.

A large population of broadcasters worldwide continues to need reliable, high-quality, cost- vs. feature-efficient cartridge machines. They have an investment that shouldn't be taken lightly, or simply dismissed.

If you're in the cart machine market, the new Series 2, plus our economical Series 1 and top-of-the-line 99B Series, guarantee that you still don't have to settle for anything less than an ITC.

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For information on the Series 2, contact Bruce Helling in Illinois: 800-447-0414; fax: 309-828-1386; or circle Reader Service 44.

Message Repeaters Enter The Digital Age



Despite all the advances in Digital Signal Processing technology, when it comes to recording and reproducing repetitive program material, a lot of facilities are still stuck with choosing between updated versions of well, "squawk" boxes. Listeners are treated to that drive-in restaurant sound, usually responding with, "what did he say"?

Now, the solid state DPR-612 Digital Message Repeater from ITC finally delivers on the promise of digital audio quality, in a flexible, convenient to operate package. Designed to provide the same reliability and performance as our other renowned audio products.

The DPR-612 offers:

- 6 or 12 minutes storage, selectable
- 15 separate high quality monophonic messages
- Secure recording controls
- Full, multi-function remote control
- Simultaneous playback of two programs

Perfect for repetitive announcements, ID's, music segments, concert lines, and emergency management situations.

And, no squawk.

For more information on the DPR-612, contact ITC at:

(800) 447-0414

Outside North America, (309) 828-1381;

FAX: (309) 828-1386

International Tapetronics Corporation

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TECHNOLOGY UPDATE

Tapecaster Makes Quality Affordable

by Robert E. Jones
President
Tapecaster

SOUTH HAVEN, Miss. When Tapecaster designed the 900 Series cartridge machines, our goals were to offer a machine that was reliable, had good specifications and provided the necessary features for today's broadcaster with a price in the mid-market range.

The 900 Series has all standard operating functions, plus some functions found in cartridge machines in the higher price range.

The chassis is of a rigid steel construc-

tion, one-third rack space wide. The motor is mounted on a subplate and prealigned, and the whole assembly is mounted to the bottom of the deck. A motherboard is mounted on the bottom rear portion of the chassis, and the front panel and subpanel attaches to the chassis and deck. A cover fits over the entire assembly.

Stainless steel construction

The head mounting bracket is constructed from stainless steel. Azimuth and height adjustments are provided. The azimuth adjustment screws are spring-loaded to provide micro adjustment.

The capstan motor is a direct-drive AC hysteresis synchronous motor. The capstan shaft is non-magnetic stainless steel, precision ground and chrome plated with precision ball bearings. This provides low flutter, long life and low ambient noise.

The solenoid is air dampened and operates at low current in the holding mode. The pull-up mechanism is a heavy-duty stainless steel cable. These features will provide low heat generation and long-term reliability.

The 900 Series is available in four different machines: mono playback, stereo playback, mono record/playback and stereo record/playback.

Cue tones

All machines have three cue tones standard with the defeat function. The play-

back amp is muted in the stop and fast-forward mode. The fast-forward mode is activated manually or by the secondary/tertiary tones. The operator can choose to have the stop light flash and/or replay lockout at the end of play by changing DIP switches on the logic board.

An optical sensor is located underneath the cart on all stereo machines to automatically select for mono or stereo operation.

The motor shuts off when the cart is removed, but when the cart is properly reloaded, playback (or record) is delayed until the motor has reached the proper speed. The motor will run continually by changing a DIP switch on the logic board.

All inputs are 20K ohm balanced bridging, and outputs are 600 ohm active balanced with +24 dBm max.

The LED level meter on the recorder is selectable for monitoring record only, playback only and automatic. All of the cue tones can be recorded in playback as well as the record mode.

Plug-in boards

The playback machines have three plug-in boards (playback, tone sensor and logic); the recorder has these same boards plus another, the record board. These boards plug into a motherboard with only connectors and a cable going to the switch board, located behind the front panel. The switch board contains front panel switch-

es, LEDs, level meter and multiturm record level pots. The frequently adjusted pots are located at the top of the plug-in boards.

The available accessories include a seven-inch-high rack tray for three playback/record machines, an extender card used on all plug-in boards and test tapes.

□□□

For information, contact Robert E. Jones at Tapecaster in Mississippi: 601-349-2881; fax: 601-349-2882; or circle Reader Service 104.

DCR-1000: Easy to Use

► continued from page 39
pression of the case just forces all the layers together without breaking.

The production manager loves the randomly accessed multi-cut feature of the system and stores various "bits" for later assembly in our digital editor. Unwanted cuts can be skipped by "flagging" them, and trimming the head and tail is easily accomplished with the keyboard.

Installing the machines took about a half-hour. All I had to do was change from the "Jones Plug" on the old machines to a D-25 on the new ones.

The four DCR-1000s at EZ-101 have been on the air for more than a month, and they've all been running well.

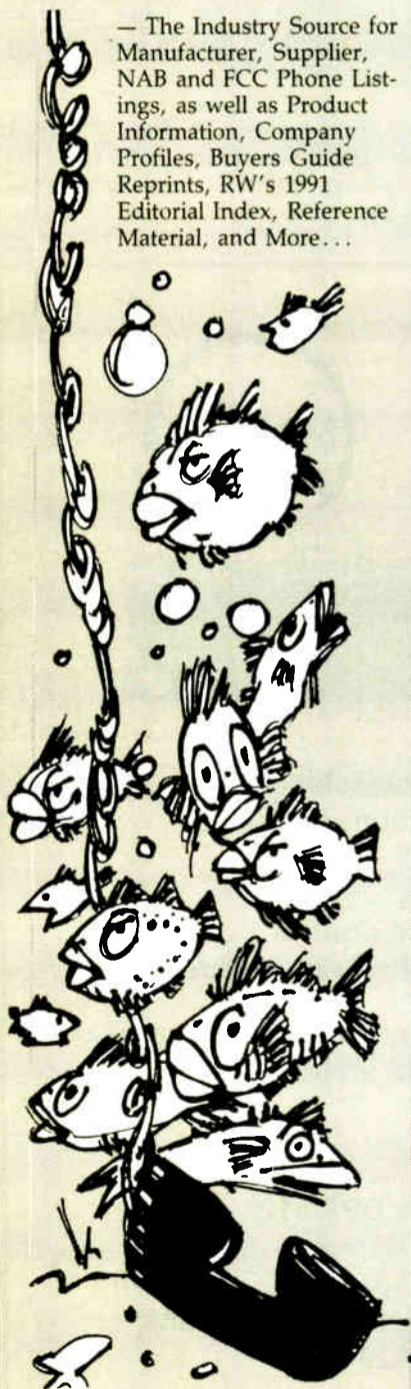
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For information on the Fidelipac's DCR-1000, contact Scott Martin in New Jersey at 609-235-3900; fax: 609-235-7779; or circle Reader Service 19.

Fishing For A Phone Number?

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TECHNOLOGY UPDATE

Cue Up Faster with the Tascam CD-601

by Bill Mohrhoff
Marketing Manager
TASCAM

MONTEBELLO, Calif. The world of broadcast radio can sometimes seem like a lonely and pretty mechanical place. Faders and dials. Turntables and carts. Three-ring binders with prepared copy. Equipment that must be finessed to cooperate while on-air.

Occasionally, a technology or device comes along that makes this world a lot more pleasant. Personal computers that help manage schedules, copy and call-ins. CDs that introduce a whole new qualitative audio environment. And now the Tascam CD-601.

The CD-601 Player Unit and RC-601 Remote Control Unit form the nucleus of a

powerful professional CD reproduction system aimed at broadcast and audio production applications.

No compromises

The CD-601 has been created and designed with no compromises in mechanical or electronic design and construction. Without its optional BU-2 RAM Buffer, the CD-601 will start up in less than 0.03 seconds. This is fast enough for many applications, but when touch-and-go startup is required, the optional BU-2 is indispensable.

The BU-2 stores the first 1.5 seconds of program material from the selected start point, and overlaps playback of the stored material with the signal from the disc to achieve instantaneous startup. The BU-2 also enables seamless looping with the RC-601 control unit.

Cueing control

Each CD-601 connected to the RC-601 can be individually selected and switched to the Monitor mode for cueing or programming, or the On-line mode for playback. The CD-601 outputs are automatically muted in the Monitor mode, or they can be forced "on-line" at all times by an internal jumper.

Cueing can be accomplished with frame accuracy by using the smooth-operating search dial, or by directly entering the desired start position via the numeric keypad. The dial even has a Search Fast mode

for extra-fast coarse cue-point location. You can also cue directly to track or index numbers as required. The RC-601 Auto Cue function can save time and trouble by taking care of the cueing for you. When Auto Cue is on, the RC-601 will automatically cue to the beginning of the audio signal when a track is selected.

Then, when you hit Play, the audio will begin in no more than 0.3 seconds if the CD-601 is not equipped with the optional



Tascam's CD-601 Player Unit was made with efficiency in mind.

BU-2 RAM Buffer, or instantaneously if the BU-2 is installed. DIP switches on the rear panel of the CD-601 make it possible to set the Auto Cue for optimum sensitivity.

So whether you own, manage or program a station, or engineer the feed, or spin the sounds, seamless high quality digital audio is now available to add to the quality of life for you, your staff and your listeners.

□□□

For information, contact Bill Mohrhoff in California: 213-726-0303; fax: 213-727-7656; or circle Reader Service 172.

AEV

a leading Italian and European manufacturer of audio broadcasting equipment, particularly aimed at FM radio studios, is looking for dealers willing to market its products all over the US territory.

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Circle (160) On Reader Service Card

USER REPORT

WZBB Gets the Edge with Disc Trak

by Donny Brook
Owner
WZBB(FM)

ROCKY MOUNT, Va. In order to be competitive, an FM stereo station's commercials have to sound as good as its music programming.

WZBB, operating at 6 kW, recently moved into the Martinsville market. We're competing with nearby larger stations that have lots of money to

spend on equipment, so we need a quality edge. Broadcast Electronics' Disc Trak Digital Cart Machine has given it to us in terms of consistent sound quality.

It sounds better

We're not really very competitively-oriented, but I had an idea that digital recording and playback ought to be better than analog on reel-to-reel tape.

Now, it may be my imagination, but recording digitally with the Disc Trak actually sounds like the source has been enhanced. All of our music is on CDs, and now that we've switched all of our

jingles, commercials and station IDs over to the diskettes, they sound just as good as music.

All of our personalities really love the Disc Trak, because it's easy to use. This machine is also simple to learn, even for people at WZBB, who don't know much about computers. I think we could teach people who don't know anything about the Disc Trak how to operate it in about three minutes.

Instant cueing

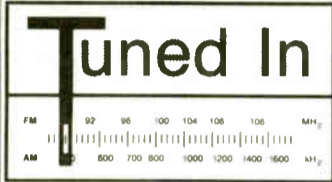
Dubbing is easy. Just set the levels, hit the Escape button and go. And the instant cueing feature is really nice. For

example, if you're on the air and you happen to start a spot a little early in cue mode or before the pot is on, just keep talking, hit that button and there it is, recued and ready to play.

Another thing I like about the digital machine is that it doesn't require cleaning. With the tape cart machines, the heads get dirty pretty quickly. We had to clean them every other day to keep up the sound quality. So far, the Disc Trak has been maintenance-free. I'm looking forward to adding a second three-deck machine in the near future. It has given us a definite competitive edge.

□ □ □

For information, contact David A. White at Broadcast Electronics in Illinois: 217-224-9600; fax: 217-224-9607; or circle Reader Service 180.



New office

RF Specialties recently opened a branch office in Dallas, Texas to assist its main Southwest office in Amarillo, Texas.

Walter B. Rice will head the new RF Specialties office. Rice is a veteran broadcaster with over 20 years experience at Gates/Harris and Continental Electronics.

The opening marks the eighth office in the nationwide organization, and the second in the group to be opened this year.

People

Michael J. McBride Jr. has been promoted to Director, Business Development at Harris RF Communications. He will be responsible for sales and marketing of Harris HF, VHF and UHF radio products, imaging products and communications systems to the U.S. government market.

McBride joined Harris Corporation in 1988 as Director of Army Business Development.

David L. Headley has been named National Sales Manager at Microwave Filter Company. He will plan and coordinate sales programs, develop relationships with key accounts, coordinate outside sales representatives and in-house sales staff.

Headley comes from Comband Technologies in Chesapeake, Va., where he was national sales manager.

Jay Batista has joined Wegener Communications as U.S. sales manager. He was the former vice president of business development for the LBA Group of Companies in Greenville, N.C.

Keith Arnett has joined the marketing staff of Marketing Concepts of Winchester, Va. Arnett had been VP of marketing for Broadcast Services Co. of Four Oaks, N.C. Arnett will be responsible for developing new accounts and providing services for existing clients.

Leasing program

Television Technology Corporation (TTC) will provide financing for the purchase of TTC transmitter systems and related equipment during an introductory leasing program offer.

Through Jan. 31, 1993, TTC has arranged for three- to five-year operating leases at a 6.9 percent stream rate, with approved credit. Leases can range from \$15,000 to \$100,000. Systems costing more than \$100,000 also may be eligible for reduced rates during this introductory period.

Who said a workhorse can't be a thoroughbred?



The Sony PCM-7010 DAT Recorder

It wasn't Sony. Because the PCM-7010 was built from the ground up as a professional DAT recorder that can handle everything from music recording and on-air radio and television broadcasting to audio-for-video production and corporate multimedia systems.

The PCM-7010 features high-speed search, variable-speed playback, punch-in/out with cross-

fade and confidence monitoring. And, with its advanced options, you can record, playback and display SMPTE time code and store digital audio in memory for instant-start playback. If you want a workhorse DAT recorder that can do it all, today and tomorrow, you want the Sony PCM-7010. For more information, call the Sony Professional Audio Group at 1-800-635-SONY, ext. 7010.



BUYERS BRIEFS

WINCHESTER, Va. audiopak manufactures cartridges and tape for NAB-style cart machines. The AA-3 cartridge, an addition to the A-2 series, combines a "neutral" casing design that enhances stereo performance with high-performance ferric oxide 613 tape. The AA-4 combines the same shell with an even more advanced tape formulation that delivers high frequency saturation headroom.

All three of these cartridges have been in production for years. This experience has enabled audiopak to fine-tune procedures and maintain high



levels of quality control.

For information, contact Gordon Stafford at audiopak: 703-667-8125; fax: 703-667-6379; or circle **Reader Service 72**.



MONTVALE, N.J. The Sony CDP-2700 compact disc player offers many features required by the broadcasting industry, including:

- *Auto Cue Playback*, which provides a rapid start from the point at which modulation is detected on a CD;
- *Vari-speed Playback*, which can reduce or extend a program by ± 12.7 percent from the original, in 0.1 percent steps;
- *Fader Start*, for on-air applications

where control from a mixing console via contact closure is required;

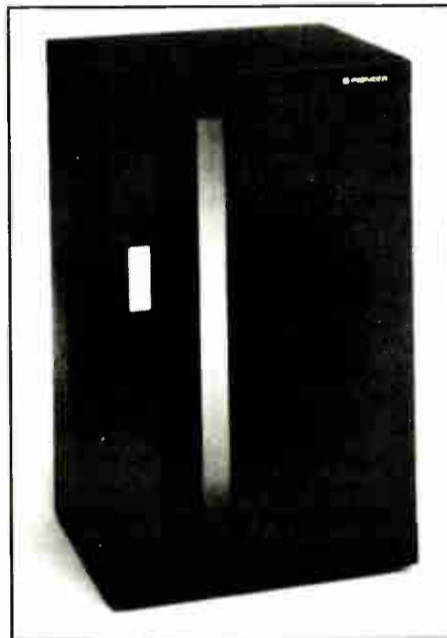
• *End of Cut Indication*, where the play button flashes 15 seconds before the end of a single cut;

• *Professional I/Os*, both electronically-balanced analog line outputs and AES/EBU & IEC-958 Type II digital outputs; and

• *Reproduction Mechanism*, combining an RF amplifier and anti-vibration actuator into an efficient optical servo system.

Also included in the CDP-2700 is the Custom File feature, which allows for the storage of operational parameters for up to 185 discs. Some of the parameters include 10 customized index points, playback order, a 10-character name, fade-in and fade-out times, playback mode and programmed playback order.

For information, contact Art Gonzales in New Jersey: 201-358-4198; fax: 201-358-4907; or circle **Reader Service 110**.



UPPER SADDLE RIVER, N.J. Pioneer's CAC-V3200 Compact Disc Autochanger allows access to 300 CDs with uninterrupted playback because of its dual CD player configuration.

Designed for radio stations, production houses and sound/special effects libraries, the CAC-V3200's built-in interface allows control by almost any type of personal computer. The autochanger also can be preprogrammed for error-free playback.

With the possibility of connecting 32 CAC-V3200s together, immediate access to 9,600 CDs is possible.

Other features include Fade In and Fade Out capabilities, pitch control and analog and digital outputs.

For information, contact Lynn Regino at Pioneer in New Jersey: 800-421-6450; fax: 201-327-9379; or circle **Reader Service 145**.

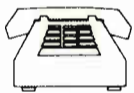
FORT LEE, N.J. DIC Digital has introduced the CD-R Recordable CD, available in 63- and 74-minute recording times and packaged in an unbreakable, reusable and recyclable storage case.

The product comes in response to increasing demand for professional-quality digital media, according to VP of Marketing Kevin Kennedy. The new storage case, designed for professional recording and studio applications, allows room for documentation of information pertaining to material recorded on the disc.

For information, contact Kevin E. Kennedy at DIC Digital in New Jersey: 800-DAT-1-DIC; fax: 201-224-9363; or circle **Reader Service 27**.

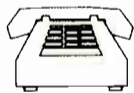
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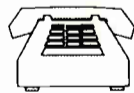
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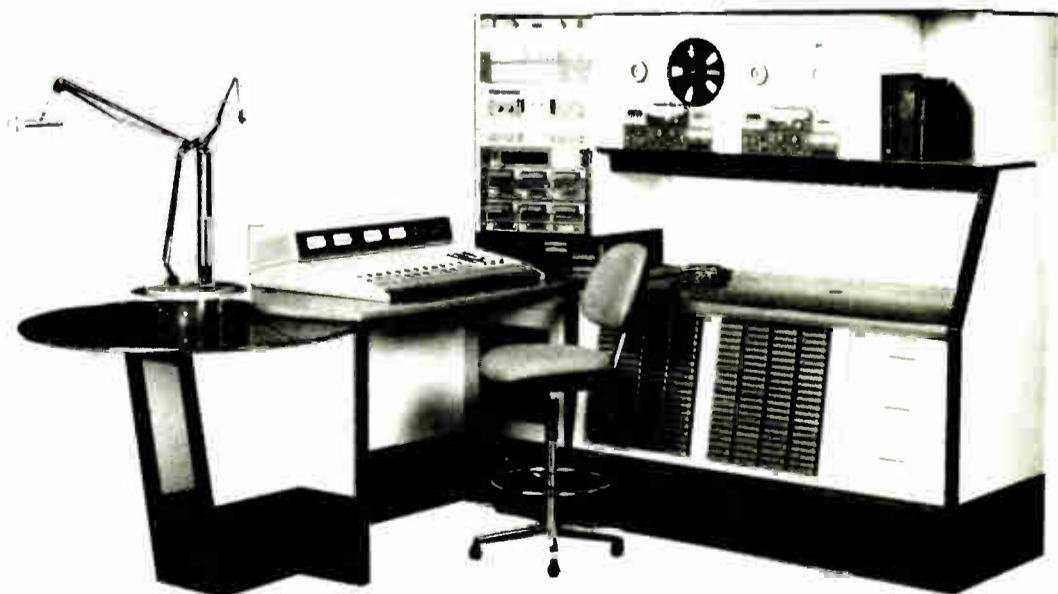
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Circle (42) On Reader Service Card

World Radio History

Which type of CD player is right for your station?



Denon.

With its hugely successful DN-970 and DN-950 CD Cart™ Players, Denon helped make CDs the broadcast media of choice. Given the success of these industry-standard players, there were only two things Denon could do: 1. Make a CD Cart player that is smaller, faster, smarter and better; 2. Make a pro CD player that is *not* a Cart player. Denon did both.



ACD-5B CARTRIDGE WITH ATS BAR CODE.

The new DN-961FA Drawer-Loading CD Player is Denon's answer to the many broadcasters who *formerly* had to choose between the drawer-type player they needed and the Denon performance they wanted.

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

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

The DN-961FA and DN-951FA. Denon just made it twice as easy to decide which CD player is right for you.

DENON
The first name in digital audio.

Products & Services Showcase

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



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READER SERVICE NO. 147

MARKETPLACE

Radio World's Marketplace, a compendium of new and recently introduced radio broadcast products, appears monthly in Buyers Guide.



Audioarts Audio Console

Wheatstone Corp. has introduced the Audioarts® Engineering A-50 Audio Console, designed to go beyond the performance of digital input sources without the high performance price.

The console has many features, including gold (rather than silver) contact switches in areas such as bus assignment and source selection. This helps prevent tarnishing, allowing for higher sound quality over a longer period of time.

All ICs are burned-in and socketed

rather than soldered, which allows for easy replacement. The A-50 also uses high quality Sigam VU meters, which are protected from RF by an enclosed meter-bridge housing.

Audioarts® Engineering has put clocks, timers and associated electronics in the meter bridge housing to keep digital noise-producing items away from the audio electronics.

For information, contact Mark Kaltman in New York at 315-455-7740; fax: 315-454-8104; or circle Reader Service 194.

A-T Engineered Sound Mics

Audio-Technica has introduced its new "Engineered Sound" series of microphones, and first out are the AT933PM/ML and AT933R/ML Micro-Line™ miniature shotgun microphones.

The microphones offer low-noise characteristics, an output that is 15 dB higher than conventional miniature condenser microphones and excellent signal-to-noise ratio for distance miking.

The problem of difficult sound pickup

is solved by the microphone's narrow acceptance angle.

The AT933PM/ML includes a power module containing the necessary circuitry for installation into a standard electrical box in ceilings. The AT 933R/ML is similar but comes with a standard XLR connector. Both models are phantom power only, nine to 52 volts DC.

For information, contact Garry Elliot in Ohio at 216-686-2600; fax: 216-688-3752; or circle Reader Service 138.

The Generation II DP Series Power Protector

The Generation II DP Series was recently added to Current Technology's line of power protection products. The product was designed for cost-effective installation in medium-exposure distribution system applications.

The DP Series models include seamless technology™, a new design concept incorporating four key elements for protection: selenium cells, self-protected metallized polypropylene capacitors, non-linear voltage dependent metal oxide varistors and synergistic geometry™.

The safety interlocked fused disconnect switch uses 200,000 AIC fuses that help reduce installation costs, ease maintenance procedures and allow system testing without facility power interruption.

For information, contact Teresa Henderson in Texas at 214-669-0818; fax: 214-669-0420; or circle Reader Service 41.



Hnat Hindes Telephone Amp

The TAG-2020, a telephone AGC amplifier, was made for any broadcast operation in which fidelity, level control and signal-to-noise performance is essential.

The amplifier comes with a band pass

filter with a frequency response that may be custom tailored by changing a plug-in serial resistor pack (SIP) or bypassed completely for wideband operation.

For unattended operation, the amplifier comes with an optional Auto Answer control board. Rack mounting is also available in a single or side-by-side configuration for multiple installations.

For information, contact Bonnie Hnat in Connecticut at 203-935-9066; fax: 203-935-9919; or circle Reader Service 12.

Acoustic Pressure Equalization Adapters

A new series of Acoustic Pressure Equalization (APE) adapters was introduced by Bruel & Kjaer for the company's 4003 and 4006 omnidirectional microphones. The APE series consists of the APE 40, APE 30 and the APE CYL.

The adapters function as both spatial

and spectral equalizers. They are passive acoustic processors, using diffractive technology to modify sound reception near the microphone diaphragm, changing the microphone's frequency and polar response.

The original APE 50 increases front-to-rear hemisphere reception for frequencies above 1 kHz, while the new APE 40 and APE 30 adapters increase directionally starting at 2 kHz. The APE CYL was designed for saxophone and reed instruments, but can be used for a variety of recording applications.

For information, contact Mark Kinzie in Canada at 519-745-1158; fax: 519-745-2364; or circle Reader Service 99.

Audio Transmission by Fiber

Fiber Options has announced the new Series 310B Audio Transmission System, which is matched to the requirements of audio routing for editing, master control operations and links to and from transmitters.

With a frequency bandwidth of 20 Hz to 20 kHz, the system has less than three percent distortion. A two-color LED at the transmitter is used to indicate audio level and clipping, and a Level/Loss LED at the receiver indicates received optical power.

The system can be ordered in either stand-alone or rack modules.

For information, contact Barbara Harned in New York at 800-342-3748; fax: 516-567-8322; or circle Reader Service 46.

Solution to Dec. 9 Puzzle



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Japan: Eiji Yoshikawa	+81-3-3327-2688 Fax: +81-3-3327-3010

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Radio World

Broadcast Equipment Exchange

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AMPLIFIERS

Marantz 8-B, exc cond, \$995; Mdl 9s, BO. 305-866-6048.

UREI 1122 phono, stereo preamp, T Devine, WVLC, 300 W Vine St, Lexington KY 40507. 606-253-5900.

Dynaco stereo 80, solid state, exc cond, \$85. J Newman, 401-847-0455.

Shintron 220 audio dist amp, 1x6 w/manual, new, \$30. D Bailey, Rock Shoppe Prods, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Marantz 18 high voltage, discrete rcvr, 40 W chnl, mint conc, \$350. J McLane, Oddeo, 115 W Gutierrez, Santa Barbara CA 93101. 805-963-3341.

Dynaco Stereo 70, gd cond, new output tubes, \$125. D Heinen, KRSE, 2120 Riverside Rd, Yakima WA 98901. 509-248-1390.

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

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

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

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

Want To Buy

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

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

ANTENNAS & TOWERS

Want To Sell

Cablewave CFM LP-3 3-bay circ polar FM on 92.1 MHz. 318-728-5852.

ERI G4CPL-3 3-bay CP tuned to 98.3 MHz, end fed, 1 5/8", \$3000+s/h/BO. W Kafka, KNOT, 116 S Alto, Prescott AZ 86303. 602-778-2983.

Shively 6-bay, 3 yrs old on 98.9 MHz, avail 12/92. K Stone, 512-332-9191.

Cablewave 1 5/8", 270' w/ant conn attached ground strap, twr clamps attached, rolled up & boxed, \$6/foot. W Schlaugat, WPRE, Box 90, Prairie du Chien WI 53821. 608-326-2411.

HJ5-50A 480' Helix w/conns, type N; 150' RSL5-1; (4) L47PN pated, new, \$150 ea; 1 5/8" snaps 206706-4, \$3 ea; 1-879 EIA conn, \$150. 817-566-5036.

UTC 120 180' guyed, beacon, side light tuning unit, lighting chokes, diode unit, 0-5 amps, electric eye, you dismantle, \$3500/BO+s/h. J LoPresti, WGSR, 111 Avalon Dr, Warner Robins GA 31093. 912-929-4904.

Capacitors MC-1-1000 vacuum, \$150; Aerovox 1970S.001 @ 20 kV mica, \$120. L Caldwell, KRLW, Hwy 412 E, Walnut Ridge AR 72476. 501-935-0438.

Andrew 1062 3 1/8" elbow, \$200; 1861 reducer w/bullet, \$50; 7/8" to F part #33682, \$25; 78AGM 3 1/8" end kit, \$70. J Cunningham, KEOR, R12 Box 113B, Stonewall OK 74871. 405-265-4496.

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

160' galvanized tower, painted, make unknown, \$6000. M Latham, KAGY, POB 1307, Buras LA 70041. 504-657-7003.

ERI G5CPS 5-bay, tuned to 105.1, top bay damaged, BO+sh. B Brintzer, WINC, 1000 Park Forty, Durham NC 27713. 919-361-1429.

Shively 6810 2-bay, 2 yrs old tuned to 100.7, \$2500. M Bitner, WGWD, POB 919, Quincy FL 32353.

RCA BFC-10B 10-bay w/radomes tuned to 91.7 MHz, \$750. D Kolbert, KLSE, 735 Marquette Bank Blvd, Rochester MN 55904. 507-282-0910.

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

ERI FML2E 2-bay on 92.1 MHz w/ 1/4 wave stub. BO. D Murray, WCCW, 121 E Front St, Traverse City MI 49684.

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

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

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

USED TOWERS BOUGHT AND SOLD. Call 1-800-643-6988.

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

Want To Buy

ERI/Cablewave 6-bay circ polar FM, rated at 10 kW, input on 92.3 MHz; 3/6-bay circ polar FM on 99.5 MHz. 318-728-5852.

51.5 ohm coax switch similar to RCA MI-561562-C/Dielectric 12724110. J Landry, WHDH, 7 Bulfinch Pl, Boston MA 02114.

150'-198' self-supporting tower; trade 198' guy twr w/new cables & insulators for 150'-198' twr. E Prendergast, KAOK, PO Drwr S, Lake Charles LA 70602. 318-474-0645

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

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

AUDIO PRODUCTION

Want To Sell

Symetrix 528 voice proc, para EQ, phantom pwr, de-esser, \$300. S St John, St John Prods, 3620 Connecticut Ave, Kenner LA 70065. 504-464-8881.

UREI 527A (2), gd shape, \$325 pair. M Reichard, 219-482-9288.

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

Tapco 2200 10-band graphic EQ, XLR & 1/4", in & out stereo, \$75; Orban 526A deesser, XLR in, 1/4" line out, \$115; Yamaha PM430 8-chnl, XLR in & out, 2-band EQ, pan pots, effects in & out, carry case, \$250. A Mitchell, 703-768-6186.

UREI 532 single-chnl graphic EQ, \$150. T Devine, WVLC, 300 W Vine St, Lexington KY 40507. 606-253-5900.

Symetrix T1-101 telephone hybrid, exc cond, \$320; SWA UA 1.0, (2) UAD.5, UPS-3, L+R/L-R matrix w/rack mount case, \$250; Orban 621 A/R para EQ, \$100. M Persons, WYRQ, 402 Buffalo Hills Ln, Brainerd MN 56401. 218-829-1326.

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

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

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Eventide BD 980 audio delay unit, \$4800. Shawn, WGNV, 429 Little Britian, Newburgh NY 12550.

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

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

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

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

AKG 414 P48 like new, \$675; Dynaco 410, 400 W amp, \$400; dbx 18X expander, \$135. W Gunn, 619-320-0728.

SKL H/L/O variable filter (pair), \$200. W Gunn, 619-320-0728.

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

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

Want To Buy

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

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

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

AUTOMATION EQUIP

Want To Sell

Cetec Schafer 7000 level 1 memory w/ext memory, 4 racks, (4) ITC 750 R-Rs, (2) audio file lls, terminal & printer, works fine, \$3500. G Kauffman, 319-243-1390.

BE Control 16 (2) brains w/manuals, sat cards, spare source cards & parts w/o tape decks, \$2500 ea/BO. B Mounjoy, WETB, POB 1162, Eliz TN 37644. 615-543-5849.

Harris System 90 from retired syst. L Caldwell, KRLW, Hwy 412 E, Walnut Ridge AR 72476. 501-886-6666.

SMC MSP-12 w/DAS-12 audio switcher, (3) IGM 250 mono Carousels, (3) PB carts, keyboard, mon, manual, cables, wiring & pwr splys, racks, \$8750. 503-563-5100.

Schafer 7000 w/new pwr sply, all/part. 907-586-6037.

Harris 9000 w/Tel 70 terminal/CRT & Eitel AH-11R printer w/10 cases of paper, BO; (2) 48-tray stereo IGM Instacarts, gd cond, \$5000 ea; (2) 42-slot stereo Go-Carts, gd cond, \$1000 ea; (4) ITC 750, gd cond, \$200 ea, free rack w/all 4; MEI Digisound/Satmaster, \$1500. D Greer, WDZZ, 1830 Genesee Twrs, Flint MI 48502. 313-238-7300.

Schafer 903 E (5) ITC 750 stereo R-Rs w/5) ITC Prem line mono PBs, (4) 48-cart audio files, 3-day memory, exc cond, \$5000. J Curtis, KFRO, POB 4299, Longview TX 75606. 903-663-3700.

IGM Go Cart 48-tray, BO. 907-586-5037.

IGM RAM w/2K mem, 6 inputs, random access card for Instacart, books, ext cards, BO; Altec 9013 600-ohm passive EQ, Acousa voice series, 400 Hz-12.5 kHz in 16 bands, very gd cond, \$100. C Gennaro, WJMS, 222 S Lawrence, Ironwood MI 49938. 906-932-2411.

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

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

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

BUSINESS OPPORTUNITIES

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CAMERAS (VIDEO)

Want To Buy

RCA TK-45 control cable & manual; RCA TK 86 12 VDC pwr sply. G Kirby, Gray Fox Video, 13613 US 36, Marysville OH 43040. 614-261-8871.

CART MACHINES

Want To Sell

ITC 99B/RPSE stereo R/P w/ELSA, little use, mint cond w/manual, \$2495/BC. B Mounjoy, WETB, POB 1162, Eliz TN 37644. 615-543-5849.

Tapcaster 700 RP delay unit, gd cond, \$100; (3) Harris Criterion III, gd cond, BO. B Brintzer, WDCN, 1000 Park Forty, Durham NC 27713. 919-361-1429.

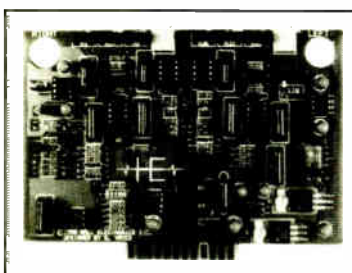
Gates mono R/P, 2 piece deck mount; BE 2000PS stereo PB, w/aux tone sensing; Pioneer 1050 2-trk, stereo, 18 & 7". 214-563-1071.

ITC R/P Mono Premium Series. BE R/P mono 3000 Series . . . \$395/ea, good operating condition. Warranties & Rebuilds available. Mark at 619-598-3311.

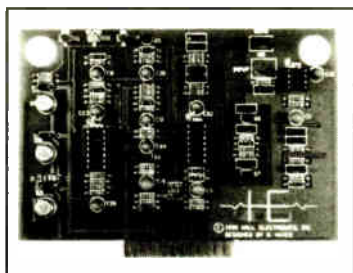
Harris/Gates AHS-3A-4A auto switcher, audio, \$500; (3) Criterion PB units, 1 counter top, 2 rack mounted in custom cases w/spare parts & manuals, \$150 ea. B McKilrick, McKay Enterprises, 331 Mulberry St, Catasauqua PA 18032. 215-264-5295.

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

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

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

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

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

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

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

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

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

ITC RP mono record, rack mount, \$475/BO. Mark 916-573-1452.

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

Want To Buy

Mono R/P, any mdl, working/not, up to \$50. E Lightman, WEDL, 550 Merchant St, Ambridge PA 15003. 412-266-2802.

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

CASSETTE & REEL-TO-REEL RECORDERS

Want To Sell

Pioneer RT-1020L, 3-hd, 3-motor, stereo w/o manual, \$125+s/h. D Morris, WKUN, 702 E Spring St, Monroe GA 30655. 404-267-6558.

Otari MX-5050BIIQ 4-chnl, 4-trk, 1/4", 7 1/2-15 ips in roll-around, exc cond, \$2195/BO. B Mountjoy, WETB, POB 1162, Eliz TN 37644. 615-543-5849.

Otari MX-5050, mint cond, \$2150. D Sainte-Johnn, KFRC, 500 Washington St, San Fran CA 94111. 415-986-6100.

Scully 284-B8-trk, vari spd, \$5000; Technics RS 85M, \$75; Echo Plate H2, \$500. H Sewll, Oakridge Music, 2001 Elton, Ft Worth TX 76117.

Amplex 350 rem ctrl box, \$20. D Bailey, Rock Shoppe Prods, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

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MCI JH-110 (2) 2-trk 1/4" in roll around cabinets, \$2000. C Durso, KPBS, 5164 College Ave, San Diego CA 92182. 619-594-8100.

Scully 280 motors, cards, parts; 8-trk 1" R/P combo hd & erase hd to match for Scully 100; Inovonics Trentol units; Tascam T-2640 duplicators, 8:1 spd, 3 slaves. R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

Telefunken M15A 2-trk, 7 1/2 & 15 ips in console w/outboard meters. R Rhodes, R Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

Marantz PMD 221 (2), 2-spnd, port, \$125 ea; (16) Scotch-Ampex 10 1/2" reels, 1/4", used once, \$5 ea/\$60 all. A Mitchell, 703-768-6186.

Tascam 22-2, gd cond, Shawn, Sunrise Broad, POB 2307, Newburgh NY 12530. 914-561-2131.

Otari MX5050 (2) 1/4" 2-trk, 4-hd, 7 1/2-15 ips, 10 1/2" reels, XLR in & out w/rem & rack mounts, low hrs, \$525 ea; Tascam 22-4 1/4", 4-trk, 3-hd, 7 1/2-15 ips w/rem, low hrs, \$500; Audiotronics 162-S-2 sync, \$100. A Mitchell, 703-768-6186.

Otari 5050B, 4-chnl, 1/4" tape, (2) road cases, clean, 12 yrs old, \$750; Sony TCM-5000 EV, 3-head mono, port, built in condenser mic, voice-operated, start w/dig delay, mixes 2 mics, line in, pre-end alarm, hard case & book, mint cond, \$285. 718-347-2940.

Tascam 48 1/2", 8-trk, min/sec counter, mint cond, \$2950. Wayne Gunn, 619-320-0728.

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

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

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

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

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

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

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

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

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

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

Scully 280 parts; Inovonics Trentol units, constant tension upgrade kit; Tascam duplicators, T-2640, 8:1 spd, 3 slaves, expandable. R Robinson, 203-269-4465.

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

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

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

Technics RS-1700 auto-rev, 6 hds, 10.5", 4-trk, 3 3/4, 7.5, 15 ips, timer, 3-motor, fair hds w/manual, exc cond, \$1000/BO. D Fields, 501-451-8803.

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

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

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

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

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

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

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

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

Want To Buy

Otari MK III 8-hd bridge w/o hds. R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

Marantz/Superscope 320/220, any cond, working/not. L Houck, Rollin Rcdg, 210 Altgelt, San Antonio TX 78201.

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

Amplex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

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

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

CD's

Want To Sell

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

COMPUTERS

Want To Sell

Hitachi 1503S CD ROM plyr, works well w/software, \$250; HP Scan Jet reads printed text, new, \$450. 718-347-2940.

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

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

CONSOLES

Want To Sell

Sparta/Cetec 3410 10-chnl stereo, gd cond, \$1250. M Persons, WYRQ, 402 Buffalo Hills Ln, Brainerd MN 56401. 218-829-1326.

Harris Medalist 8, 8-chnl stereo board, stereo & mono outputs, 24 stereo chnl inputs, \$1800/BO. J Curtis, KFRO, POB 4299, Longview TX 75606. 903-663-3700.

RCA 15AD dual-chnl, nice cond, \$500. R Elm, WWJC, 1120 E McCuen St, Duluth MN 55808. 218-626-2738.

MCI JH618 8-mic line & 8 stereo line cards, non-VCA, up to 18 direct outs, patchbay, VU, BC opt, papers & conns, low hrs, \$8000. T Perkins, 301-420-4692.

Gates M6407 4-chnl prod, mono, gd cond w/manual, \$100. E Lightman, WEDL, 550 Merchant St, Ambridge PA 15003. 412-266-2802.

RCA OP-6/OP-7 tube mixers & expanders, 4x1, gd cond, \$250 ea. 805-963-3941.

McMartin B802 stereo w/spare ladder attenuators & misc parts, works good, \$1000+s/h. P Wahl, WWIB, 5558 Hallie Rd, Chippewagun WI 54729. 715-723-1037.

Harris Deluxe 80 8-chnl mono, gd cond, \$700+s/h; BE Spotmaster 8 mono, great cond, \$750+s/h. B Brinitzer, WDNC, 1000 Park Forty, Durham NC 27713. 919-361-1429.

Russco Studio Master 505, mono; McMartin EBS recond set. 214-563-1071.

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

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

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

Gates Gatesway 80 audio, mono, 8-chnl, 12 input, \$1800; Ampro 501 audio, mono, 6-chnl, 24 input, \$2000. H Jernegan, WGA1, 179 Lovers Ln, Elizabeth City NC 27909. 919-335-0856.

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

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

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

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

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

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

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Want To Buy

RCA/GE/Gates pref, 40s/50s mdl, gd cosmetic cond, min external visible mods. R Wells, KSRO, 627 College Ave, Santa Rosa CA 95404. 707-545-3313.

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

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

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

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

DISCO & SOUND EQUIPMENT

Want To Sell

Ashly SC-66 para EQ, great cond w/manual, \$300. D Bailey, Rock Shoppe Prods, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

JVC 4-DD-5 CD-4 quadraphonic disc demod, new, \$75/BO. D Pulwers, 703-751-9346.

EV Sentry 100 (2) studio mon spkrs, \$115 ea. A Mitchell, 703-768-6186.

Duntech Sovereigns mdl 2001, light oak, fine cond, \$6000+s/h. 305-866-8048.

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

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

For details on space availability contact Simone at 1-703-998-7600

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

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

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

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

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

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Want To Sell

Mod Sci Stereomaxx FM audio separation enhancer, 1 yr old, \$1000. A Keddie, WTPI, 3135 N Meridian, Indianapolis IN 46208. 317-925-1079.

CBS Audimax 4450A; FM Volumax 4110; Audimax tube ALC, all gd cond, BO, P Wahl, WWIB, 5558 Hallie Rd, Chippewagunus WI 54729. 715-723-1037.

Optimod 8100A1, exc cond, \$3400; UREI LA-4 compressor, exc cond, \$350. B Watson, KSAK, 3352 Honeybrook Way, Ontario CA 91762. 909-947-8440.

Electrodyn CA700 (2), \$400 ea. R Rhodes, R Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

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

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

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

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

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

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

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

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

Want To Buy

Shure M-62 level-loc. J Arthur, DVS Comms, Rd 1, Belfast NY 14711. 716-365-8870.

Collins 26U-1/Gates 39-B. T Smith, RF Concepts, 13034 Elmington Dr, Cypress TX 77429. 713-260-5842.

CBS Audiomax & Volumax, AM mono. D Gagnon, WTBC, 20 Jackson Hgths, Essex Jct VT 05452. 802-878-8293.

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

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

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RCA 77-DX, nice cond w/monogrammed RCA canvas bag, \$550. 718-347-2940.

AKG 451 EB condenser w/rolloff & cardioid capsule, \$125; Crown GLM very small, nds ext pwr, used twice, \$135. A Mitchell, 703-768-6186.

EV RE-20 w/Luxo boom, mint cond, \$335. 404-267-6558.

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10 yr male radio vet exper in most formats seeks air/PD/air pos, perf midwest, will relocate, familiar w/dig DJ. 219-271-8457.

Operations/Engineering Director, 25 year results oriented pro seeks solid company that appreciates excellence. Write to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box #12-09-01RW.

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1 yr 2 wks exper on air & 1 mo prog dir exper, anywhere in US. Gary, 814-266-1173.

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10-yr pro seeks C&W station anywhere for lasting relationship, w/copy-writing. T Brehmer, 319-326-0255.

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

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

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HELP WANTED: Any company or station can run "Help Wanted" ads for \$1.50/word or buy a display box for \$55/column inch. Payment must accompany insert, use your MasterCard or VISA; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$10. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for details.

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

Telex FMR 50 wireless, \$250. Randy, WHFS, 8201 Corp Dr #550, Landover MD 20785. 301-306-0991.

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

Telefunken tube mic pre amps V-76, U-73 limiters; RCA BA-21As, BA-1As; Altec tube mic-pres. Tracy Eaves, 615-821-6099 (evenings before 10PM EST). **EV 676** supercardioid mics 3/\$200; **EV RE10** mic, \$125. W Gunn, 619-320-0728.

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

Want To Buy

Sennheiser 405/6 access. R Rhodes, R Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

Turner U9S dynamic. S Sparkman, WSGS, Box 7898, Hazard KY 41701. 606-436-5580.

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

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

MISCELLANEOUS

Want To Sell

Cannon Faxphone 15 combo fax & phone, thermal replaced w/plain paper, all modes, memory, \$275. J Schloss, KICD, 2600 N Hiway Blvd, Spencer IA 51301. 712-262-1240.

WE 189D xformers, \$35 pair; **UTC LS-141** hybrid xformer, new, \$50; **UTC LS-33** 20 W line to line xformers, \$100 pair; **Cinema Engrg 64266** xformers, \$30 pair. R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

Dayton W3056 5000 W gener w/220 & 110 AC output voltage. 214-563-1071.

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Audio Line (3) 1/4", 48-pt patchbays, new, \$50 ea. D Heinen, KRSE, 2120 Riverside Rd, Yakima WA 98901. 509-248-1390.

Vacuum capacitors, variety; 200 W wirewound resistors. R Elm, WWJC, 1120 E McCuen St, Duluth MN 55808. 218-626-2738.

Heathkit VTVM, \$10; **McCurdy** switch mod, \$5; (44) ADC patchbay jacks, unbal w/normal, \$1.25 ea. D Bailey, Rock Shoppe Prods, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Optima desktop rack cabinets, 7" & 10 1/2", \$65 ea. D Heinen, KRSE, 2120 Riverside Rd, Yakima WA 98901. 509-248-1390.

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

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

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

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

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

Want To Buy

Someone to start 4-chnl quadrasonic rcdg & sound repro club. D Pulwers, 703-751-9346.

UTC LS-10X, 12X, LS-18 xformers; West Electroacoustic schematic for mic #120A; **Hycor 4201** passive EQ. R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

Mod xformer for RCA 10U2/BC-10P. G Arroyo, WONQ, 1033 Semoran Blvd, Casselberry FL 32707. 407-830-0800.

CCA 2500R dummy load. 214-563-1071.

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

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

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

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

Jazz record collections, 10" LP/12" LP be-bop, swing, dixie, highest prices paid. B Rose, Program Recdgs, 228 East 10th, Nyny 10003. 212-674-3060.

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

Old radios, including microphone style & other promotional radios, older plastic & early transistor radios. Will buy or

trade for broadcast equipment. Jon Hall, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

MONITORS

Want To Sell

TFT 724A stereo; **FM 763**, new parts, \$2500 both+s/h. 614-775-2600.

RCA WM-43A AM mod, tube-type, gd cond, 500 kHz to 8 MHz, all conns, tubes & manual, \$200/BO+s/h; **McMartin TBM 3000** SCA, exc cond, \$300/BO+s/h. R Kelly, KLOO, 1221 SW 15th, Carvallis OR 97333. 503-933-2217.

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

Want To Buy

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

MOVIE PROD EQUIP

Want To Sell

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

RECEIVERS & TRANSCEIVERS

Want To Sell

Sony XR-A 37R 12 V, auto, 22 W/chnl, new, \$275. 718-347-2940.

Scott Radio Labs, Navy Shortwave rcvr, rack mount, old, works, BO. D Heinen, KRSE, 2120 Riverside Rd, Yakima WA 98901. 509-248-1390.

AM STEREO RECEIVERS
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RRADCO GROUP
 708-513-1386

GE MPI 2 W, 2-chnl, UHF handheld mobile radio w/belt clip, exc cond, \$200. J Newman, 401-847-0455.

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

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

Want To Buy

Regency ACT-R-106 scanner, gd cond w/ or w/o crystals. G Edwards, 704-488-9301.

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

REMOTE & MICROWAVE EQUIP

Want To Sell

Marti RPT-40 161.64, 161.67, fact tuned, \$450; **Scala Paraflector PR-450**, 942.5 MHz, 2 dipoles only, not complete dish, BO. 210-774-1320.

Comrex LXR single-line rcvr, exc cond, little use, BO. B Clain, 413-783-4626.

Marti telemetry equip. 214-563-1071.

Moseley TRC-15 STL rem ctrl & cntrl term & telemetry rcvr, \$750. G Wise, WEKU, 102 Perkins Bldg, Richmond KY 40475. 606-622-1672.

Moseley TRC-15 (2), 1 Hallikainen interface, radio send/telex rcv, \$1000, 1 radio send/SCA return, \$500, both w/manuals. M Martindale, KVON, 1124 Foster Rd, Napa CA 94558. 707-252-1440.

Moseley TRC-15AW 16-chnl, gd cond, SCA option, \$750. B Brintzer, WDNC, 1000 Park Forty, Durham NC 27713. 919-361-1429.

Moseley PCL-505/C comp stereo STL system w/stripline on-freq PA w/factor upgrades, **Andrew P6-9C** 6' grid dishes, GC category A w/ 7/8" feed, exc cond, \$6000; (2) **Moseley/ADDs** viewpoint CRT displays & keybds, \$300 ea. E Stolz, KWOD, 1425 River Park Dr, Sacramento CA 95815.

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Burk Tech TC-8 8-chnl rem ctrl w/IP-8 interface panel, clean, \$1050/BO. S Morse, KWOS, 3109 S 10 Mile Dr, Jefferson City MO 65109. 314-893-7857.

Moseley MRC-1600 16-chnl microproc, perf cond. D Siddall, 219-362-5290.

Gentner ANA dig hybrid, new, \$500. B Brintzer, WINC, 1000 Park Forty, Durham NC 27713. 919-361-1429.

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

Moseley MRC 1600, Applied Dig dat syst term w/mon & modems, \$1995. D McIver, KBHL, Box 247, Osakis MN 56360. 612-859-3000.

RENTALS RENTALS RENTALS
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 3-line extender
 Frank Grundstein 215-668-6434
 Audio/Video Consultants 215-642-0978

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

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

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

Sci Atl 7300/7325 dig rcvr w/(2) 15 kHz, (1) 7.5 kHz, (1) 3 kHz cue cards, crystal switch assembly, fact manuals, \$5500; **LAUX** analog rcvr, SMN-country w/DNR option, \$600. E Stolz, KWOD, 1425 River Pk Dr, Sacramento CA 95815.

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

Want To Buy

Marti CR-10 on VHF band. P Bassert, KSPK, 516 Main St Walsenburg CO 81089. 719-738-3636.

Gentner VRC2000/comparable. Mark, WHBQ, 483 S Highland St, Memphis TN 38111. 901-458-8255.

15-30 W solid state such as **Marti RPT402-R-30**, 160-170 MHz or 455 MHz. B Rathman, KRVM, 200 N Monroe St, Eugene OR 97402. 503-687-3370.

Telfax 31 VGC, new side panels, meter & loop sw, works good, clean, \$375/BO. J Schloss, KICD, 2600 N Hiway Blvd, Spencer IA 51301. 712-262-1240.

ATS equip. J Bumgardner, KQRO, POB 864, Cuero TX 77954. 512-275-3430.

Marti STL-8 & STL-10 equipment. Will buy or trade for new equipment. Jon Hall, Hall Electronics, 1305-F Seminole Trail, Charlottesville VA 22901. 804-974-6466.

SATELLITE EQUIPMENT

Want To Sell

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Wegener 1601-50 rcvr w/boards for SMN real country, \$1000. L Caldwell, KRLW, Hwy 412 E, Walnut Ridge AR 72476. 501-886-6666.

Wegener 1816 ku-band freq agile rcvr w/2.8m dish, LNB, \$1000. P Wahl, WWIB, 5558 Hallie Rd, Chippewaugus WI 54729. 715-723-1037.

Wegener 1615 demod, 15 kHz, 6.30 MHz, exc cond, \$200. D Morris, WKUN, 702 E Spring St, Monroe GA 30655. 404-267-6558.

Wegener 1601-50 (2), 1 down converter, 2 sets of cards, 1684-04, 1610, 1610-01, 1644-02, 2046-07, 1605-03, BO. W Long, LM Comms, 1300 Greendale Rd, Lexington KY 40511.

Adcom 7550 (2) rcvrs, one w/CNN card, \$3500, one unused w/o demod card, \$2800. 614-286-3023.

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Want To Buy

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Wegener 1601 mainframe & pwr sply w/1608-22, 1689, 1610 & 1630 Panda II cards. B Moore, 213-463-3800.

Fairchild Dart 384 15 kHz, stereo, DATS, audio card. T McGinley, WPGC, POB 10239, Washington DC 20018. 301-441-3332.

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Rood/Marcom 203 stereo gen/test set, \$300; Moseley SCG-2 185 kHz subcarrier gen, \$100. P Wells, KJQY, 625 Broadway #1200, San Diego CA 92101. 619-238-1037.

TAPES/CARTS & REELS

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C&W & southern gospel (350) albums, 1955-1985, \$1.25 ea/\$300 all. D Morris, WKUN, 702 E Spring St, Monroe LA 30655. 404-267-6558.

5" hubs in white boxes, (90), large NAB & small centers, BO. C Scherer, 216-696-0123.

Capital xcription library, BO. D Brennan, Brennan Prods, 3596 Lorna Ridge Dr, Birmingham AL 35216. 205-823-0088.

AOR radio (15) on 7" reels, classic DJs from 1969-1983, \$75. D Pulwers, 703-751-9346.

Pams Jingles ref tapes, 1951-1976, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625.

Fidelipac Mdl 3000 (1000) carts, \$500. 702-386-2844.

260 10 1/2" reels beautiful music, Cent 21 format w/1984 lists, gd shape, low passes, \$1500/all, will part. T O'Brien, WTYS, POB 777, Marianna, FL 32447. 904-482-2131.

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CHAP 120 CD music library. J Leon, Leon Rcdg Studio, POB 51, Jackson Hghts NY 11372. 718-383-7212.

TAX DEDUCT EQUIP

Small college carrier-current station w/o budget & failing cart machs, nd cart mach. Doug, WQBR, 129 Quirk Bldg, Ypsilanti MI 48197. 313-487-2228.

Theatre/music hall seeks donation of vintage mic like RCA 77DX/44BX/equiv. B Coffman, Old Town Music Hall, 140 Richmond St, El Segundo CA 90245. 310-322-2592.

Studio equip, working, educ radio, rcpt & s/h; low pwr AM/FM/carrier current xmtrs. Dr Newcomb, Grand River Radio, 19130 Nelson-Parkman Rd, Garrettsville OH 44231. 210-548-2053.

Eng student desiring donation of old bdc equip (anything in repairable cond, will pay all shipping charges, EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Monte Vista Christian School, would appreciate any donations of used radio equipment along with used TV broadcast equipment. T Quinn, 408-475-0423.

TEST EQUIPMENT

Want To Sell

Fidelipac 390 wow & flutter meter, very gd cond, \$300. P Wahl, WWIB, 5558 Hallie Rd, Chippewagun WI 54729. 715-723-1037.

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HP audio test set, gener, AC voltmeter, patch panel, \$250; URM-26B RF signal gener, \$100/BO. K O'Malley, 804-446-2731.

HP 206A audio osc, working w/manual, \$100. E Konwinski, WSOY, 1100 E Pershing, Decatur IL 62524.

Tek FG507/TM515 func gen w/road-case, \$750; Sounder phase check set, \$60; Pulse Dynamics pulse gener, \$40. P Wells, KJQY, 625 Broadway #1200, San Diego CA 92101. 619-238-1037.

HP 333A dist analyzer, top cond, svc manual, \$450. D Harris, Harris Cstg, POB 254, Woodacre CA 94973. 415-488-1137.

Want To Buy

Boonton/any 0-450 MHz gener, AM & FM, will repair. J Cunningham, KEOR, Rt2 Box 113B, Stonewall OK 74871. 405-265-4496.

GR 1602B admittance meter access, reasonable. C Scott, WKYU, Western KY Univ, Bowling Green KY 42101. 502-745-3834.

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Rockwell/Collins 310Z-2 FM exciter w/stereo gener & composite STL input cards, used few hrs, mint cond, \$1800. B Watson, KSAK, 3352 Honebrook Way #7, Ontario CA 91762. 714-947-8440.

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Visual Electronics medium wave, 1 kW output w/4-400 A type PA valve, manual & circuit diagram. A Gallagher, KISS, Harmony Hghts, Mayo Ireland. 011-094-23576.

McMartin AM/FM xmtr, any model, exciter or stereo modules. Goodrich Ent., 11435 Manderson, Omaha NE 68164. 402-493-1886.

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Technics SP-10 (2) w/mounts & AT1 10" tone arms, exc cond, \$150 ea. B Brinitzer, WDNC, 1000 Park Forty, Durham NC 27713. 919-361-1429.

Micro Trak 303 tone arm, new, \$60. T Devine, WVVK, 300 W Vine St, Lexington KY 40507.

Russco Studio-Pro (2) 12", gd cond, \$100 ea. J Swett, 602-526-1975.

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*Closing for listings is the first and third Fridays for the next month's issue. All listings are run for 2 issues unless pressed for space or otherwise notified by listee.

Broadcast Equipment Exchange

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