

RadioWorld

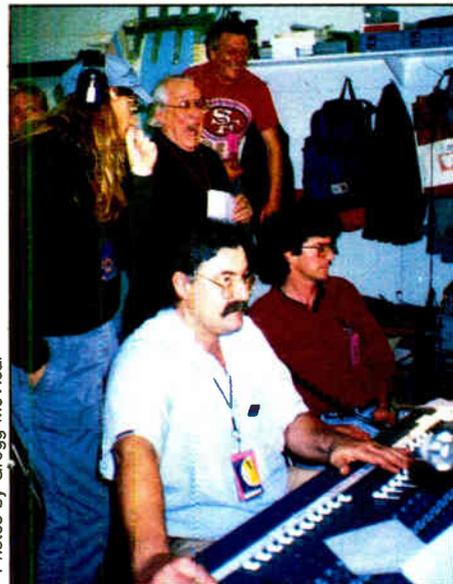
3-D for Your Ears

John Sunier
Explains Binaural
Broadcasting.
See p. 27

Vol 16, No 3

Radio's Best Read Newspaper

February 5, 1992



Photos by Gregg McVicar

Live "Dead" Broadcast Goes Digital

by Nancy Reist

SAN FRANCISCO Dressed as an Uncle Sam skeleton, the Dead Head was hoping his costume would bring him the coveted "miracle ticket" that would get him inside the Oakland Coliseum to hear the Grateful Dead usher in 1992.

But Uncle Sam skeletons were far more common than extra tickets, so he wound up joining the hundreds of Dead Heads in

the parking lot who danced in the new year by listening to the New Year's concert live on the radio.

More than a hundred stations around the country carried the seven-hour stereo broadcast, which included four sets of live music, backstage interviews, a live telephone interview with the people living in the experimental Biosphere in Arizona, and prerecorded features and spots. Rather than use a broker, Grateful Dead Productions

created its own network, bringing in commercial and non-commercial stations ranging from New York's WNEW to a small station in Barrow, Alaska.

Grateful Dead sound engineer Dan Healy was the show's executive producer. He has produced and mixed live concert broadcasts for the band for over 20 years and continually experiments with the newest technologies to improve the sound. This year, Healy said they crew wanted to reduce the conveyance distortion inherent in traditional transmission systems by staying digital whenever possible.

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NEWSWATCH

Radio Board Endorses In-Band

LA QUINTA, Calif. The NAB Radio Board has decided to formally encourage development of an in-band digital audio broadcasting (DAB) system.

The board action came at its winter meeting here in mid-January. In making its decision, the Radio Board adopted a plan presented by the NAB Task Force on DAB. The plan stated, "Given the current position of the U.S. government on new frequency allocations for DAB, the development of in-band DAB solutions presents the preferred option for broadcasters.

"The number of groups working to develop in-band DAB solutions has given encouragement that a system can be developed which will meet the need of broadcasters without requiring any additional spectrum," according to the task force plan.

Long-term DAB goals adopted by the Radio Board include establishment of technical standards, development of industry consensus and minimization of "competitive dislocations." The goals also provide for accommodation of existing AM and FM service, and oppose satellite delivery of DAB.

Last year, the Radio Board endorsed the Eureka 147 system. No official mention was made of the NAB's negotiations with Eureka partners regarding implementation of Eureka 147, or a modified narrow-band version of the system, in the U.S. Calls to the NAB were unreturned as of press time.

Look for complete coverage of the Radio Board's actions in the Feb. 19 issue of *RW*.

continued on page 2 ►

WARC Eyes DAB Issues

by John Gatski

TORREMOLINOS, Spain The U.S. delegation to the 1992 World Administrative Radio Conference (WARC) joined other telecommunications specialists here Feb. 3, but key broadcast issues, such as satellite DAB and international shortwave spectrum allocation, will likely take center stage late in the conference.

The 52-member delegation is meeting with representatives from other countries during the month-long WARC to consider international radio regulations changes including spectrum. WARC's are composed of members of the 160-member International Telecommunications Union (ITU).

U.S. broadcasters are mainly interested in any digital audio broadcasting (DAB) spectrum allocation agreements that may emerge from the conference.

Currently, the U.S. appears at odds with other countries in its support of satellite DAB on the S-band (2310-2360 MHz). Canada, in addition to various European countries and

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Drivin' That Train:

Engineers share a light moment while bringing the Grateful Dead's New Year's Eve concert to radio.

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NEWSWATCH

► continued from page 1

Midwest Conference Set
LANSING, Mich. A variety of radio programming and technology sessions, featured speakers and equipment manufacturers will highlight the Great Lakes Broadcast Conference and Expo, Feb. 25 and 26.

The area's Society of Broadcast Engineers (SBE) chapter will sponsor several "how to" engineering sessions including EBS, new technologies, tapeless studios, radio start-up, digital audio carts and processing.

On February 25, Irwin Pollack, president of Irwin On Radio in Boston, will be the featured radio speaker. He is a renowned authority on radio sales and management. On Feb. 26, Bob Edwards of National Public Radio's Morning Edition will be the featured speaker.

The conference and expo will be held at the Lansing Center and the Radisson Hotel downtown. Registration is \$75 before Feb. 17 and \$80 after Feb. 17. One-day and individual registrations are also available. For more information, call 517-484-7444.

NAB Awards Announced

WASHINGTON Robert Hammett and Edward Edison, principals in the San Francisco-based radio engineering consulting firm Hammett and Edison, have been selected as the NAB's 1992 radio engineering achievement award winners.

The two partners were recognized for their excellence in radio engineering, notably in their firm's pioneering improvements in transmitters and antennas.

The NAB also has chosen Advanced Television Systems Committee (ATSC) Chairman James McKinney as its TV engineering award winner. McKinney has been instrumental in guiding the

ATSC in its HDTV policy, the NAB said. McKinney also has headed three bureaus of the FCC.

The three winners will receive their awards April 15 at the 1992 NAB convention in Las Vegas.

FCC OKs CBS Purchase

WASHINGTON The FCC has approved the assignment of several Midwest radio and TV station licenses from Midwest Communications Inc. to CBS Inc. The stations are: WCCO-AM-TV and WLTE (FM), Minneapolis; KCCO-TV, Alexandria, Minn.; KCCW-TV, Walker, Minn.; WFRV-TV, Green Bay, Wis.; and WJMN-TV, Escanaba, Mich.

The Commission also granted CBS a waiver of the "one-to-a-market" rule as the assignment of license will result in CBS owning radio and television stations in Minneapolis.

CBS also has been granted an 18-month waiver of the maximum ownership allowed (CBS currently owns 12 FMs) so the company can divest itself of an FM station.

NAB Opposes Hoax Action

WASHINGTON The NAB has asked the FCC to reconsider the adoption of a rule regarding broadcast of hoaxes.

According to the NAB, problems with the rule include the vagueness of the language, which includes the definition: "broadcast of material which the licensee knows to be false." In a news release, the NAB said that under that definition, dramatic programs (that can be both fictional and intentionally provocative) could violate the proposed rule.

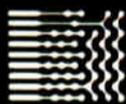
WMMS, WMJI Enter LMA

CLEVELAND, Ohio Malrite Communications' WHK(AM)-WMMS(FM) and Legacy Broadcasting Partners' WMJI(FM) have entered into a joint sales and marketing venture, Radio Marketing One. The companies announced that Pinnacle Media President, Errol Dengler, will join Radio One Marketing as the VP of sales and marketing.

"The venture is basically an equal partnership between Malrite and Legacy," said Charles Bortnick, VP and general manager, WHK(AM)-WMMS(FM), "that

continued on next page ►

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NEWSWATCH

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WMMS(FM) is a long-time dominant Cleveland presence, with an AOR format and registered station mascot, "The Buzzard." WHK(AM) carries an all-news format. WJMI(FM) programs an oldies format. Combined, the three stations dominate the 18-34 and 25-54 demographic, according to Bortnick.

Dengler's experience in the industry includes advertising agency management (Pinnacle is the media buying division of Wyse Advertising, Chicago), as well as local radio and television shows.

Candidate List Released

WASHINGTON The NAB has announced the roster of candidates for its 1992 election cycle. Initial ballots were mailed on Jan. 3, and final ballots will be mailed on Feb. 14.

Candidates for radio seats include Mark Bench, WNSR(FM), Bonneville International Corp., New York, N.Y.; William O'Shaughnessy, WVOX(AM)-WRTN(FM), New Rochelle, N.Y.; John R. Quinn, WJDM-AM-FM, Elizabeth, N.J.; and Elizabeth Satchell, WNJR(AM), Newark, N.J. for District 2. District 4 candidates are Gerald J. Hroblak, United Broadcasting Co. Inc., Bethesda, Md.; T. David Luther, WBTM(AM)-WAKG(FM), Danville, Va.; and David L. Owen, WCVA(AM)-WCUL(FM), Culpeper Media, Culpeper, Va.

District 6 candidates are: Diane S. Flowers, WPNC-AM-FM, Elizabeth City, N.C.; George Francis, WMYI-FM, AmCom General Corp., Greenville, S.C.; Jon Sinton, WROQ(AM)-WAIM(FM), ABS Communications Inc., Marietta, Ga.; Carl Venters, Jr., Voyager Communications Group, Raleigh, N.C.; and Michael Whalen, WMKG(FM), Greensboro, N.C.

In District 8, candidates are: Roger Cavaness, KKZN(FM), KVOL-AM-FM, Cavaness Broadcasting Inc., Lafayette, La.; Bill Hickman, WMFM-FM Hattiesburg, Miss.; Judy W.S. Karst, KRRV-AM-FM, Alexandria, La.; Alan Perkins, WNAT(AM)-WQNZ(FM), Natchez, Miss.; John Peroyea, Narragansett Radio Inc., Baton Rouge, La.; and Raymond Saadi, KHOM (AM)-KTIB(FM), Houma, La.

District 10 candidates are Char Binkley, Fort Wayne, Ind.; and Charles A. Blake, WIKY-AM-FM, Evansville, Ind. (incumbent).

District 12 candidates are: Vincent King, KJEZ, ACI Broadcasting, Brentwood, Tenn.; Gene Millard, KFEQ(AM), St. Joseph, Mo.; and Edward Santee, KJLA(AM), Overland Park, Kansas. District 14's candidate is Don Seehafer, WOMET(AM)-WQTC(FM), Seehafer Broadcasting Corp., Manitowac, Wisc. (incumbent).

In District 16, candidates are Pati Hoth, KRDO-AM-FM, Pikes Peak Broadcasting Co., Colorado Springs, Colo.; and Ray Lockhart, KOGA-AM-FM, Ray Lockhart Group, Ogallala, Neb. District 18 candidates are: John Hiatt, KMMX(AM)-KCHL(FM), Hiatt Communications Inc., San Antonio, Texas; Dick Oppenheimer, Signature Broadcasting Co., Austin, Texas; and Bryce Taylor, KEYS(AM)-KZFM(FM), Malkan & Associates, Corpus Christi, Texas. District 20's candidate is incumbent Alan Harris, KUGR(AM)-KYCS(FM), Green River, Wyoming.

District 22's candidates are: Sanford B. Cohen, KIHx(FM), Prescott Valley Broadcasting, Prescott Valley, Ariz.; J.D. Freeman, KMLE, Shamrock Broadcasting Inc., Phoenix, Ariz.; and Lee R. Shoblom, KBBC/KFWJ, London Bridge Broadcasting Inc., Lake Havasu City, Ariz. District 24's candidate is incumbent Robert Fox, KVEN-AM-KHAY-FM, KVEN Broadcasting Corp., Ventura, Calif.

Final election results will be available on March 16, according to the NAB.

International Broadcast Study Looks at New Technologies

by John Gatski

WASHINGTON Although new technologies for international broadcasting, such as direct broadcast satellite (DBS), are not likely to be implemented for another five years, the U.S. should begin its planning now, according to a Presidential Task Force Report on International Broadcasting.

Eventually, the report said, international broadcasting will be impacted by the new technologies such as DBS and single sideband, (SSB) radio. "The U.S. should plan for the advent of widespread direct broadcast by satellite by participating positively in the frequency allocation process in the International Telecommunications Union . . ."

Once implemented, the new technologies would likely be used in Eastern Europe, the Middle East and Asia, the report explained. Although tensions have decreased in Eastern Europe, the Task Force has recommended a continued presence there as well as stepped up presence in Asia and the Middle East.

Much of the U.S.'s international broadcasting investment should remain committed to shortwave because it will remain the "most efficient method" of broadcasting until beyond the end of the century, the report noted. The Voice of America (VOA),

for example, relies heavily on shortwave. Other suggestions to take advantage of existing technology include leasing satellite space from private companies or leasing private transmitters.

Digital not desirable

As far as international digital broadcasting in the tradition of VOA or Radio Free Europe, the report said the limitations of transmitting equipment (shortwave) and the necessity for special digital receiving equipment does not make it desirable at this time. Also, production and duplication of compact disc and digital tapes for international broadcast purposes is considered more expensive and cumbersome than the widely used analog tapes.

Other areas discussed by the task force include Radio Marti and TV Marti, the audio and video services that beam news and information to communist Cuba. Radio Marti, an AM broadcast service, has been transmitted to the island since 1983. In 1990, TV Marti was launched in a limited hour (3 a.m.-6 a.m.) broadcast using a blimp-mounted transmitter tethered in south Florida.

The Cuban government retaliated by transmitting a TV jamming signal and promised intentional interference to U.S. radio stations. The controversial service

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NAB's DAB Reversal Long Overdue

by Alex Zavistovich

WASHINGTON If you've been following the changing tides of digital audio broadcasting (DAB) very closely, you probably saw this one coming from a mile away. As *RW* was going to press, the NAB Radio Board was adopting a new strategy for DAB—advocating in-band development.



The board, which met in La Quinta, Calif., based its decision on a draft plan from the DAB Task Force. Among other things, the plan notes, "The number of groups working to develop in-band DAB solutions has given encouragement that a system can be developed which will meet the need of broadcasters without requiring any additional spectrum."

What *wasn't* said was what that means for the NAB's negotiations with Eureka. Word on the street is that it probably spells the end of those talks. I suppose you can read that between the lines. For example, consider the phrase: "the number of groups working to develop an in-band system . . ."

Think about it: the bulk of in-band DAB work is being done by U.S. companies; the Eureka partners are only *talking* about an in-band solution, and they aren't too sure that they'd even want to get into it without some American money. By acknowledging in-band work, the Radio Board has to be conceding the impact of U.S. systems in the DAB race.

All I can say is, if the NAB does drop the Eureka negotiations, it would be a reversal that's long overdue.

Only a year has passed since the NAB Radio Board threw its support behind the

Eureka I47 system at its winter meeting in Naples, Fla. Shortly after that decision, however, the first grumblings were voiced: that Eureka was not a U.S. system; that it was proposed to operate at L-band, which some engineers felt was unworkable; and, most importantly, that the NAB's decision didn't reflect the opinions of the majority of U.S. broadcasters.

Oh, it was a heated debate, all right, and Eureka had some eloquent and determined detractors. Among them was Randy Odeneal of Sconnix, whom the NAB named to its DAB Task Force as the voice of the loyal opposition, or perhaps as a containment measure.

Far from being contained, Odeneal's greater visibility as a member of the task force gained more publicity for his in-band stance. When he spearheaded a letter-writing campaign critical of the NAB's endorsement decision, you could almost feel the tide turning against Eureka.

For their part, the Eureka partners weren't exactly bending over backwards to accommodate U.S. broadcasters—or even the NAB, for that matter. And why should they? After all, they've got a good thing going with European broadcasters, where Eureka is the only DAB player. People love them over there.

If Eureka really wanted to get involved with the U.S., the partners would have to throw a bunch of money at a narrowband DAB solution, and if they succeeded they'd be competing against several domestic alternatives.

★★★

It isn't just the technical side of the issue that has made the NAB's position feel a little seamy, either. Once it was revealed that the NAB was aiming for a stake in Eureka domestically through its for-profit subsidiary, even a casual observer could see the apparent conflict of interest.

What was hard to believe about all *that* was how reluctant the NAB was to acknowledge even the appearance of a conflict of interest. DAB Task Force Chairman

Alan Box did make such a concession in Hill hearings on the matter, but only after having been walked through the perceived conflict.

I know that no one from the NAB or its DAB Task Force is morally deficient—I believe they want to provide the U.S. with a technically solid DAB system. I really do. But if you want the best in technology, you have to maintain some objectivity and distance. When you start talking about money and your stake in a system, it's easy to get too close to the whole process.

The upshot of all this, though, is that you'd *have* to expect the NAB to change its official position on DAB now, even if there had been no controversy about Eureka. Even if there were no available in-band alternatives being developed. The Eureka system was planned for operation in the L-band, and there won't be an L-band allocation for it.

Out-of-band spectrum for DAB now is officially limited to the S-band—microwave

When you start talking about money and your stake in a system, it's easy to get too close to the whole process.

oven turf—which most people agree is only going to be useful for satellite broadcasting, not terrestrial. S-band is the U.S. position at WARC, period.

★★★

On one hand, that's a major setback for L-band DAB proponents, if such creatures exist here in the U.S. On the other, it's important to remember that the FCC's announcement of its WARC recommendation did hint at the possibility of revisiting frequency allocations after the conference.

What's more, it's doubtful that the issue will be resolved in Spain, anyway. Keep in mind that the actual description of DAB technology at WARC is Broadcast *Satellite* Service (otherwise known as "BSS (sound)"). So what if the U.S. wants co-primary status for terrestrial and satellite issues? I have a feeling we'll all be hearing more about allocations long after WARC is a memory.

For the moment, though, the smart money has to ride on in-band solutions.

And the *really* brainy gamblers have to be looking closely at USA Digital. Rumor has it that USA Digital Radio—which has already shown its adjacent channel DAB system, called "Project Acorn"—has finally overcome the crosstalk problems encountered in creating an in-band, on-channel system. If so, USA Digital has pulled ahead of the field in the DAB race. I guess we'll all have a chance to find out at the NAB spring convention: USA Digital has a presentation on Monday, April 13, during a session devoted to DAB.

With all this high-stakes game playing, it certainly is appropriate that the NAB convention should take place in Las Vegas.

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

Alex

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KSHE for the record

Dear RW,

In your year-end issue (RW, Dec. 12, 1991), you had as the Number 3 story of the year an article about the misuse of an EBS attention signal.

I am the chief engineer of the Missouri radio station in question and I feel compelled to advise you on an important inaccuracy in that story. While it is correct that KSHE was fined and a fictional skit about a nuclear attack was aired, the FCC ruled that a 1 kHz tone which preceded the skit was a fictitious attention signal.

The fact remains that the EBS attention signal was never activated. The fine was for airing a fictitious attention signal. Do we have to be careful putting a 1 kHz test tone on the air? As an engineer, it seems to be most unreasonable. It also appears to be unfair to include questionable information in your story in order to lend more impact to the headline.

Of course, there never was a disagreement about the poor judgment of the disc jockey involved, and steps have been taken to prevent a repeat of similar situations. It is in the interest of giving you the correct information that I write this letter to you.

Be assured that I still think very highly of RW and that I read every article, even the advertisements. It remains an important source of information to me, one I would not want to miss. Keep up the good work.

John Oelke, CE
KSHE-FM
St. Louis, Mo.

Solving radio's problems

Dear RW,

It always interests me to hear radio broadcasters complaining about the state of our industry. Who were the people who wanted deregulation of the broadcasting industry? I seem to remember it was the broadcasters. During the 1980s, we got what we wanted, only it has totally complicated the industry and may run the entire industry broke.

In the early 1980s, there were many class

"C" FMs in their actual "city of license" and providing a service to these cities. You could not move your studios and offices 40, 50, 60 or more miles into the larger, more lucrative market. Today, all of these FMs are competing for the dollars in the few larger cities while their operating costs increase, and they watch the value of the properties fall out of the ball park.

In many cases, the broadcasters that purchased these stations 10 years ago have lost their shirts, pants, and more as they continue to operate. Every market has so many fragmented formats that no station is dominant, but if one should get a decent "book," two more will change to that format the following day.

Let's look at the owners. Remember when a station buyer had to keep the property three years, or at least two? Guess what? These guys actually had to be broadcasters, and not act like "brokers." They had to have operating capital for one year. Today, many of the buyers do not have the capital to buy a soft drink.

Then there are some large multistation owners who believe that any investment above the initial price is not to be considered. They operate on junk and continue that way. Then the crooks hit the street and rape the advertisers until there is not one in the market who will consider trusting a "radio sales person." Once this is done, these owners sell and move into another market where they try the same approach again.

Deregulation has taken the sting out of double-billing by letting it move to civil court without any broadcast reprimand. The actual honest broadcast sales person is caught in the middle of a den of thieves.

I also enjoy the problems of AM radio. We got deregulation but who would have thought that there still is no standard for receivers that will give some of the quality frequency response of a 1930s tube-type receiver? FM was designed to be a superior medium for listening, but I did not realize that one way to do it was to set standards for FM and eliminate any quality standards for AM. The good gets better at the expense of the competitor.

Back to the FM situation for a moment. In some ways I guess this mess is good. I can think of one city of roughly 50,000 in a county of over 200,000 in the Southeast that had one FM and four AM stations. Today, one AM is more powerful than the others and it is "news-talk." The other three are all religious formats, and so is the only other AM in the county located in an adjacent city.

The lone FM operator now has three large FMs competing and two more on the way. It shows how a market can go from famine to feast, or really the other way around.

There is also a potential Docket 80-90 FM going into another town adjacent to this city. Then there is another Class "A" Docket 80-90 licensed some 15 miles away, which will also possibly attempt to enter this market with a slight move. Add to that the potential for another FM in the Class "C" range to be built within some 40 miles, and I believe that shows what competition is.

I still would like to see a station required to maintain studios and utilize these in the city or town of license, to give these cities or towns more than just a mention in the

The Right To Vote

The campaign year has begun. Even in the broadcast industry, the message is the same: Exercise the right to vote. In this case, however, the vote won't decide the country's next political leader; it will decide the fate of the Emergency Broadcast System (EBS).

The FCC has extended until the end of March the comment deadline on its inquiry into EBS, based on a request by the Primary Entry Point Advisory Committee (PEPAC). PEPAC is an association of stations formed to give the president rapid over-the-air access across the country during times of national emergency.

The group is now working on a signaling system for EBS and WRSAME (a weather emergency alerting system) on AM that could enhance EBS. An FSK data stream is modulated below the EBS two-tone signal; radios outfitted with screens to decode the data stream would provide listeners with detailed information about the nature of the emergency warning to come.

Such an enhancement might enable EBS to emulate many of the alerting functions available in Radio Data System (RDS) subcarrier signaling. For the members of PEPAC, however, the enhancement is preferable to RDS because it would not make the current EBS network obsolete, and because subcarrier signaling on AM has never been without its problems.

On the other hand, RDS has served the European community well, while EBS has drawn criticism for having outlived its usefulness. RDS is now a proven technology abroad, while the enhancement to EBS proposed by PEPAC is still being tested, and faces the process of being refined in the field once testing is completed.

It cannot be denied that the country needs a dependable emergency notification system. There will always be a need for access to official information in times of catastrophe, whether it's provided by EBS, RDS or some other technology.

Once again the question is put to the engineering community: Which is preferable, replacing an aging system with a new technology that some feel is the wave of the future, or finding a way to improve the usefulness of the far-reaching EBS, and thereby prevent the uprooting of a system in which some broadcasters have invested thousands of dollars?

For engineers with an opinion, the window of opportunity is still open. Tell the FCC what should be done with EBS. The Commission's decision will be based in part on the comments it receives, and broadcasters can play an important role in the process if they just exercise their right to vote.

—RW

weather forecast to constitute a legal identification. Since this is doubtful, maybe a standard for AM receivers that will allow them to pass the NRSC standard instead of sounding like a telephone would give the smaller communities some identification with AM stations.

A good look at some standard for AM stereo would be nice, but shouldn't quality be as important as the name on the brand of the receiver?

It would also be nice to utilize the technology to eliminate fades and drop-out in AM signals including phase shifts in directional patterns. If AM stereo is just going to sound like two poor quality AM signals with minimal separation, it really isn't worth the time.

Any way you want to look at the broadcast industry for radio in the 1990s, we have some problems and hopefully some will be solved. Technical standards that are on the books are now being enforced for the first time in recent years. Maybe some of the other things that were forgotten in deregulation will return.

It may seem hard to believe, but possibly decent language might someday return to rock radio. I'm far from an angel, but I do feel that the listener deserves respect when I come into their homes or cars. Maybe the return to radio is just a dream, but then again, who knows. The political mood constantly swings, so maybe broadcasting can get caught up in a swing back to regulation.

I always think of the "independent truckers" who pushed for deregulation to get the loads of the regulated carriers. Now they can, but the rates are so low they can't hardly make the fuel bill and truck pay-

ment. A lot of radio broadcasters have found themselves in the same boat. They expanded when station values were high, and now owe more than the property is worth on the market.

I still love radio and look forward to it returning to a great business again. I just hope I am around when it does.

Bob Fee
Orangeburg, S.C.

Put it in writing

Dear RW,

I'm a longtime subscriber to RW and want to protest the exclusion of addresses for the writers who contribute articles and features to your newspaper.

The use of phone numbers alone implies that the authors are willing to drop everything and yak on the phone. This philosophy of being at everybody's disposal at any moment pervades radio, TV, and advertising, and I'm convinced that it's the major reason so many media professionals suffer from so many stress-related illnesses.

How rapidly my own business fell off when I took better care of myself than my clients. But how much better I felt because of it!

Please do us all a favor and substitute addresses for phone numbers. There is rarely little of such significance in a follow-up correspondence that it cannot wait, nor cannot wait to be written in a letter. That is, if broadcasters know how to write or sit still long enough to do it.

Joel Martin Newman
Industrial Strength Voice
Newport, R.I.

Radio World

Vol 16, No 3 February 5, 1992

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Radio World (ISSN: 0274-8541) is published semimonthly by Industrial Marketing Advisory Services, Inc., 5827 Columbia Pike, Suite 310, Falls Church, VA 22041. Phone: 703-998-7600, Fax: 703-998-2966.

Second-class postage rates are paid at Falls Church VA 22041 and additional mailing offices. POSTMASTER: Send 3579 forms and address changes to Radio World, P.O. Box 1214, Falls Church VA 22041. Copyright 1992 by Industrial Marketing Advisory Services, Inc. All rights reserved.

Next Issue of
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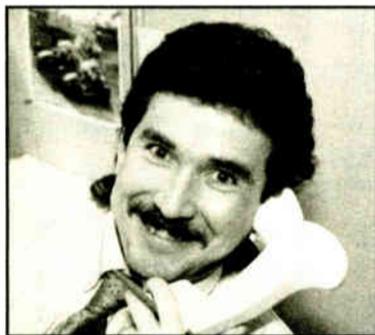
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FM Tower May Elude Wrecking Ball

by John Gatski

MANCHESTER, Tenn. A mobile broadcast company may be the saving grace for an unused radio tower that was ordered taken down by the FCC in December.

According to the FCC's Enforcement Division, the 750-foot tower, formerly used by WKQD in nearby Tullahoma, was to be disassembled and removed by its owner, Procom Towers of Hixson, Tenn., within 60 days from Dec. 19.

The FCC considers the tower an air navigation hazard and has contacted the owner several times since late 1990 about inadequate lighting and painting. The tower is

located in a rural residential area of eastern Coffee County, Tenn.

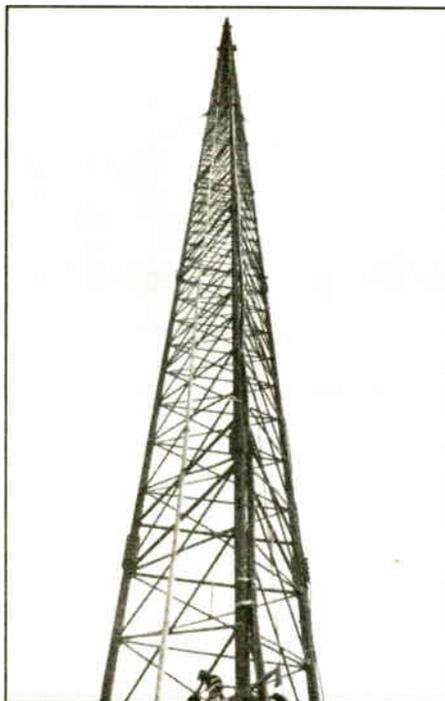
FCC Enforcement Division Spokesman Wayne McKee said Procom must comply with the order unless another licensee is found. "I think the only possibility (for the tower to remain) is if there would be a licensee on it," he said.

At press time, Dwight Holder, a spokesman for Southern Mobility, a local mobile broadcast services company, said he was negotiating with Procom to lease the tower.

Holder said Procom had informed him that adequate lighting had been restored in late December, and he noted that South-

ern Mobility was working to secure a license for that site.

Procom originally acquired the tower from Fortune Media, a company that had moved WKQD (now WHVK) to Huntsville, Ala. FCC records show that the tower has not been used since April 30, 1990.



Will It Stay or Will It Go?

The FCC has ordered this 750 ft. tower dismantled, but the owner said he has found a user.

Photo by the Tullahoma News

A local newspaper, the Tullahoma News, reported in 1990 that the power had been shut off May 30, 1990 because the company reportedly was filing bankruptcy.

On Sept. 21, 1990, the Federal Aviation Administration (FAA) issued a warning to aircraft pilots flying in the area that the tower was unlit and posed a hazard. Authorities noted a near-collision with the tower by a helicopter on Sept. 20, 1990.

The FCC's Atlanta Field Office was noti-

fied, and it sent Procom a letter on Sept. 27, 1990, asking for information about the tower lighting. The FCC received no response and sent an inspector to the tower site on Nov. 27, 1990. The inspector said he found the tower unlit and unpainted, which are violations of FCC tower maintenance requirements.

After sending a second letter, the FCC issued a citation on Dec. 13, 1990. Procom finally responded, but said it was not financially able to restore lighting to the tower.

Procom later advised the FCC it would restore "some lighting," but did not specify whether it would be the type the FCC required. An April 4, 1991 FCC field inspection revealed that a white light had been installed on top of the tower and a red light was working about one-third of the way down. At that time, the tower had no licensee and still was unpainted and inadequately lighted, the FCC said.

Int'l Study Looks at Technology

► continued from page 3

has been criticized as ineffective by the NAB and some members of Congress.

The task force did not urge outright elimination of the TV service, but recommended it be turned off if better hours are not found. It also suggested taking Radio Marti and TV Marti from the United States Information Agency (USIA) and placing them under the Board for International Broadcasting, as are the other "surrogate" broadcast services, Radio Free Europe (RFE) and Radio Liberty.

On the U.S.'s international broadcasting structure, the report noted that Voice of America (VOA), Radio Liberty, Radio Free Europe and TV Marti should maintain their different missions for several more years, but by the 21st century the separate services should be streamlined into one service.

A continuing presence

"Radio Free Europe and Radio Liberty . . . have a continuing, albeit somewhat modified, mission, which will continue to be very important for some years," the report noted. "We believe the

new role of alternatives, as opposed to surrogate broadcasting, is to assist newly democratic nations in establishing and developing democratic institutions, particularly a free and unfettered media."

On the China issue, which continues to defy the European anti-communism trend, the task force recommended increasing VOA broadcasts. Task force discussions also noted a "desirability of establishing a Radio Free Asia" to China, Vietnam, North Korea Laos, and possibly Cambodia.

If established, this service could share VOA facilities, the report added.

Detractors of a Radio Free Asia point to increased costs and the potential to create instability, especially in China, leading to chaos and violence.

Opponents also point to the difficulty and expense in finding transmitter sites, estimating as much as \$80 million to construct and expand broadcasts into China. Operations would run about \$24 million per year, according to one estimate.

Alternative, less costly proposals, would include utilization of current VOA facilities for expanded China broadcasts.

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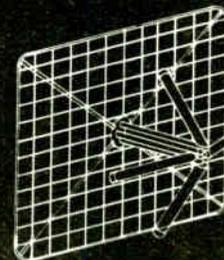


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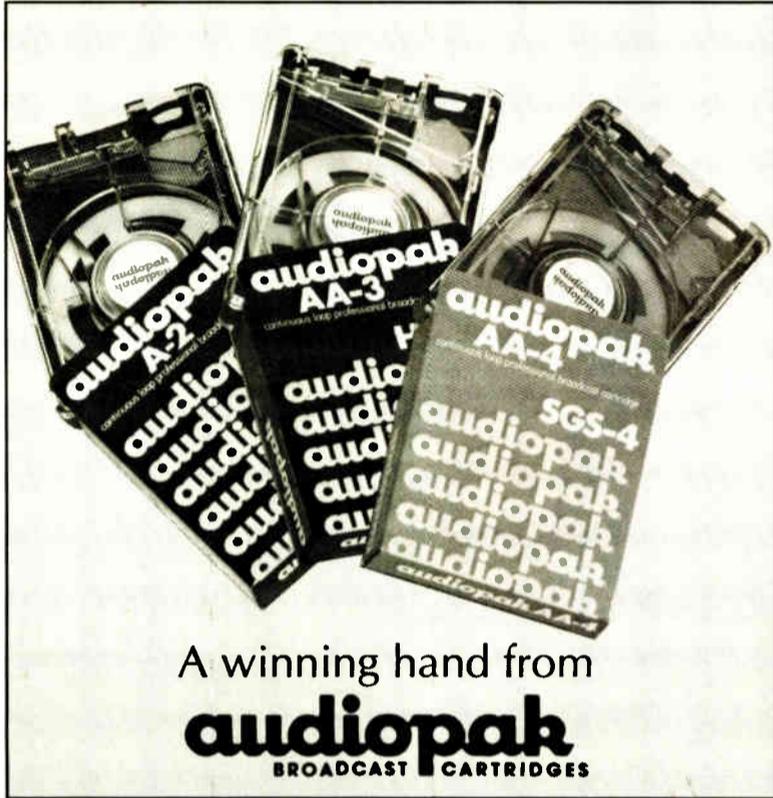
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Rete 105 Tops Italian Networks

By Dario Calabrese

MILAN, Italy Italy's largest privately owned radio network, Rete 105, also is the country's most popular, serving about 3.2 million listeners each day through its 20 affiliates.

In the 15 years since Rete 105 was put on the air, the service has become very successful at utilizing its resources to become the dominant Italian network.

Unlike the U.S., private commercial stations in Italy were unregulated until a media law passed last year. The regulations, however, have not yet been fully implemented because of the complexity of technical issues, particularly concerning frequency allocations.

Rete 105 has applied for licenses under the new law, and president and owner Edoardo Hazan is confident that a license's added legitimacy will further enhance the network's lofty status. Hazan also manages the Italian language service of Radio Monte Carlo, the official broadcaster of nearby Monaco.

A former pirate

Developed by a company of 10 friends, Rete 105 began in February 1976 as a local Milan station. At the time, government-run radio was the norm. "There was a monopoly law at the time; strictly speaking, we were pirates," Hazan said.

Rete 105's main studios are in Milan. Studio 1, is used for live broadcasts and recordings. Studio 2, filled with equipment of various models and makes, is used for recording only. In Studio 2, national com-

mercials are inserted onto tape. Local commercials are recorded with cue codes on the tape, through a Cepar automatic system, to alert operators at the local stations.

Cue tones are sent from Milan to the various network members to alert them as to which commercials, national or local, are to run.

Other Studio 2 activities include listening to music and developing the programming, using the Selector system made by Radio Computing Services. In addition to Studios 1 and 2, there is a relatively large room, used to broadcast programs before a live audience.

Finally, in addition to two vehicles used for pop concerts and other remotes, there is an off site studio located in a large and famous downtown music store, Ricordi. Here, Rete 105 broadcasts some live programs when, for example, a pop star will sign copies of a new record.

Radio Monte Carlo

Radio Monte Carlo broadcasts live from 6 a.m. to 10 a.m. and from 9 p.m. to 12 p.m.; from midnight to 6 a.m. it broadcasts recorded music. Throughout the rest of the day, programs are originated from the main studio in Monte Carlo, getting to Milan through two radio links. One is the same 14 GHz link used by Tele Monte Carlo, the principality's TV station.

The radio operation uses one of the audio subcarriers of this link, manufactured by Thomson and owned by Tele Monte Carlo. The other one, used as a backup, is a 900 MHz FM link made in Italy by

continued on page 11 ►

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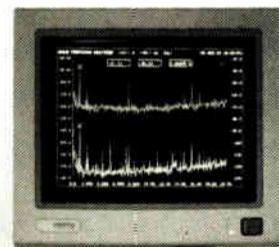
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EBS Group Wins Comment Extension

by Alex Zavistovich

WASHINGTON An association of broadcast stations looking to improve emergency notification without abandoning the Emergency Broadcast System (EBS) has successfully petitioned the FCC to extend a Notice of Inquiry (NOI) on new EBS technologies.

The FCC has extended the comments deadline for its EBS inquiry (Docket 91-171) from Dec. 31, 1991 to March 31, based on a request by the Primary Entry Point Advisory Committee (PEPAC) for more time to complete its testing of enhancements to EBS. The extension for comments, however, will run until March 31, 1992, instead of PEPAC's requested June 30 cutoff date.

The earlier-than-requested extension was approved because the FCC wants to present comment summaries to the national level EBS Advisory Committee at its April 23, 1992 meeting in Washington.

The order also notes that any test results and comments filed after the closing date also will be considered, although the deadline for reply comments will be June 30, 1992.

PEPAC is a group of 30 radio stations in the continental U.S., organized to provide the president a means of primary access to the country in the event of national emergency. Seven more stations are soon to come on line.

The group has experimental authorization to conduct AM band on-line experiments for EBS enhancements. During the

tests, EBS tones and Weather Radio Specific Area Message Encoder (WRSAME) messages are broadcast over KCMO (AM) in Kansas City, Mo.

The tests are being conducted because PEPAC believes that the current two-tone EBS system should not be replaced, but altered to allow better interpretation of the type of emergency warnings that are broadcast.

PEPAC's attorneys filed for the deadline extension in late 1991, maintaining that additional time would "greatly facilitate firm recommendations by PEPAC and others for revision and improvement of EBS technical facilities."

PEPAC's president, KCMO CE Lloyd

Collins, said testing is going well so far.

The tests involve an FSK signal mixed into a data stream of the EBS two-tone signal with the WRSAME codes. The relative level of the tones is still being decided, he said. Test messages have been "all the letters, all the numbers, and punctuation," Collins said. Messages have been received under a variety of conditions, he added, including long distance skywave.

The system will allow a user, whose receiver has been equipped or modified with a display screen, to read messages indicating the type of emergency information to be provided by EBS.

At press time, the engineers involved

with the tests were planning a simpler system for operators to set up and send the FSK messages; failures during the tests have been traced to "pilot error," Collins said.

Despite minor user errors, Collins feels this signaling system should "travel at least through CPCS-1 stations automatically," as it allows for enhanced EBS service with little operator intervention. Decoders for either EBS or WRSAME alerts will receive the enhancement signal, Collins added.

For Collins, an advantage to this system over others is that it is an in-band solution. Reliable, inaudible subcarrier messages have been difficult to implement for AM, he said.

Some industry observers have proposed abandoning EBS, and replacing it with another system, such as the Radio Data System (RDS).

WARC Eyes DAB Issues

► continued from page 1

broadcast groups, have leaned toward other spectrum including the L-band (1500 MHz). Still, another European bloc, the Conference for European Postal and Telecommunications Administrators (CEPT) has expressed interest in the 2600 MHz range.

Indications are that the U.S. will not budge from its S-band allocation position on satellite DAB. The U.S. government vetoed the L-band proposal—based on military objections.

With the divergent spectrum proposals on the table, WARC watchers are waiting to see how much clout the U.S. has in rounding up support for its position. Before the conference began, Canada expressed confidence that it could rally support for its L-band position.

U.S. delegation spokeswoman Judy Jamison said the U.S. would not discuss any backup or alternative positions to S-band prior to the issues being discussed at the conference.

Terrestrial DAB for the U.S. will not be a focal point at WARC, delegation members said. The FCC, however, indicated in its WARC position last summer that terrestrial DAB spectrum could be dealt with as a post-WARC issue.

With a government lock on L-band and S-band's unsuitability for terrestrial broadcasting, the U.S. is likely to emerge with some type of in-band terrestrial system.

Other WARC spectrum issues to be discussed include opening up more spectrum for shortwave broadcasting, which has become overcrowded in recent years.

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"Radio Waves—Life and Revolution on the FM Dial"
Jim Ladd
St. Martin's Press, N.Y.

by Frank Beacham

NEW YORK Whether you work in the production, engineering or business side of radio, an occasional self-examination might raise the question, "What attracted me to the medium in the first place?" The answer can

be revealing.

From my first radio "experience" in the 1950s—listening with my grandmother to the live soaps beside the big glowing RCA console, to this very day as a writer and producer of programs—I've been attracted to radio because of its magical quality.

Along with the magic of radio always came its breathtaking power. When used in creative ways, radio was—and still is—a force to be reckoned with. As I see it, there were two great creative periods in radio. For AM, it came in the late 1920s and lasted maybe 15 years. For FM, it be-

gan in the mid-1960s and was gone in less than a decade.

Glory days

Two excellent new books examine the early creative days of AM and FM radio in America. Though Garrison Keillor's "WLT: A Radio Romance" (Viking, N.Y.) and Jim Ladd's "Radio Waves—Life and Revolution on the FM Dial" (St. Martin's Press, N.Y.) cover two distinct periods in history, the similarities of what made great radio are strikingly close. Both books helped me refocus on the magic that attracted me to radio in the first place.

Keillor's book charts the course of the mythical WLT (With Lettuce and Tomato), the Minneapolis creation of the brothers Ray and Roy Soderbjerg, who started the station in 1926 to rescue a failing restaurant. For the next quarter century, the "Friendly Neighbor" station produced a dazzling array of shows and stars, including Leo LaValley, Dad Benson, Wingo Beals, Slim Graves and his son Little Buddy, chain-smoking child star Marjery Moore, blind sports announcer Buck Steller, and "The Homemaker's Hour," with LaWella Wells giving household tips—reportedly in her underwear.

Through the antics of these characters comes a message about

the medium. Keillor laments that radio "was a raw primitive gorgeous device that had unfortunately been discovered too late. In the proper order of things, it should have come somewhere between the wheel and the printing press. It belonged to the age of bards and storytellers who squatted by the fire, when all news and knowledge was transmitted by telling."

Coming after the development of literature, radio was imprisoned. "Literature had taken radio and hung scripts around its neck, choking the free flow of expression that alone could give radio life. Scripts made radio cautious, formal, tight, devoted to lines. But radio is not lines—radio is air!" The medium, Keillor writes, is "dreamlike, precognitive, primitive, intimate. It has less to do with politics or society than with sex, nature and religion."

Along came FM

Eventually, the fly-by-the-seat-of-the-pants performers of WLT were done in by television and big money. The first "Golden Age of Radio" was dead. But then, in the mid-1960s, when nobody was looking, a new creative renaissance emerged on the then "worthless" FM dial. Just as before, radio again took on a "free form" style and became the storyteller and cultural link for a generation of young people who found mindless Top 40 AM hopelessly out of touch with their lives.

Jim Ladd, later to become one of the nation's top modern radio storytellers (he calls it beating the "tribal drum"), traces the creative history of FM from the first free-form station in San Francisco, which was invented by a 350-pound wild Irishman named Tom Donahue. Donahue eventually became the driving force behind San Francisco's KSAN, one of the most studied FM radio stations in history.

"We always called it free form," Ladd wrote. "Free-form radio was an approach to the music and the show itself, which resulted in a highly personal and completely spontaneous new art form."

"Radio Waves" chronicles the explosion and then the fall of free form radio. Ladd describes his own career and rise to stardom at L.A.'s KMET and his continuing fight with consultants who eventually turned FM into what he called "the format."

Just as the creativity of AM was snuffed out by "big money," the demise of free-form FM met the same fate when words like "format," "research," and "demographics" began to dominate the radio lexicon. One of Keillor's characters summed it up nicely:

"We amounted to something. Radio spanned the continent and radios were built to pull in signals from far away. The Zenith had a tuning knob as big as a grapefruit. These little dinky plastic pisspot radios you buy today won't get a signal from 30 miles away and why should they?"

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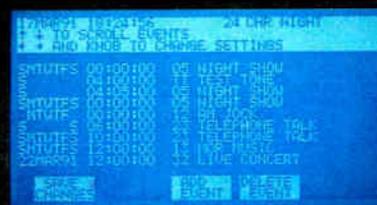
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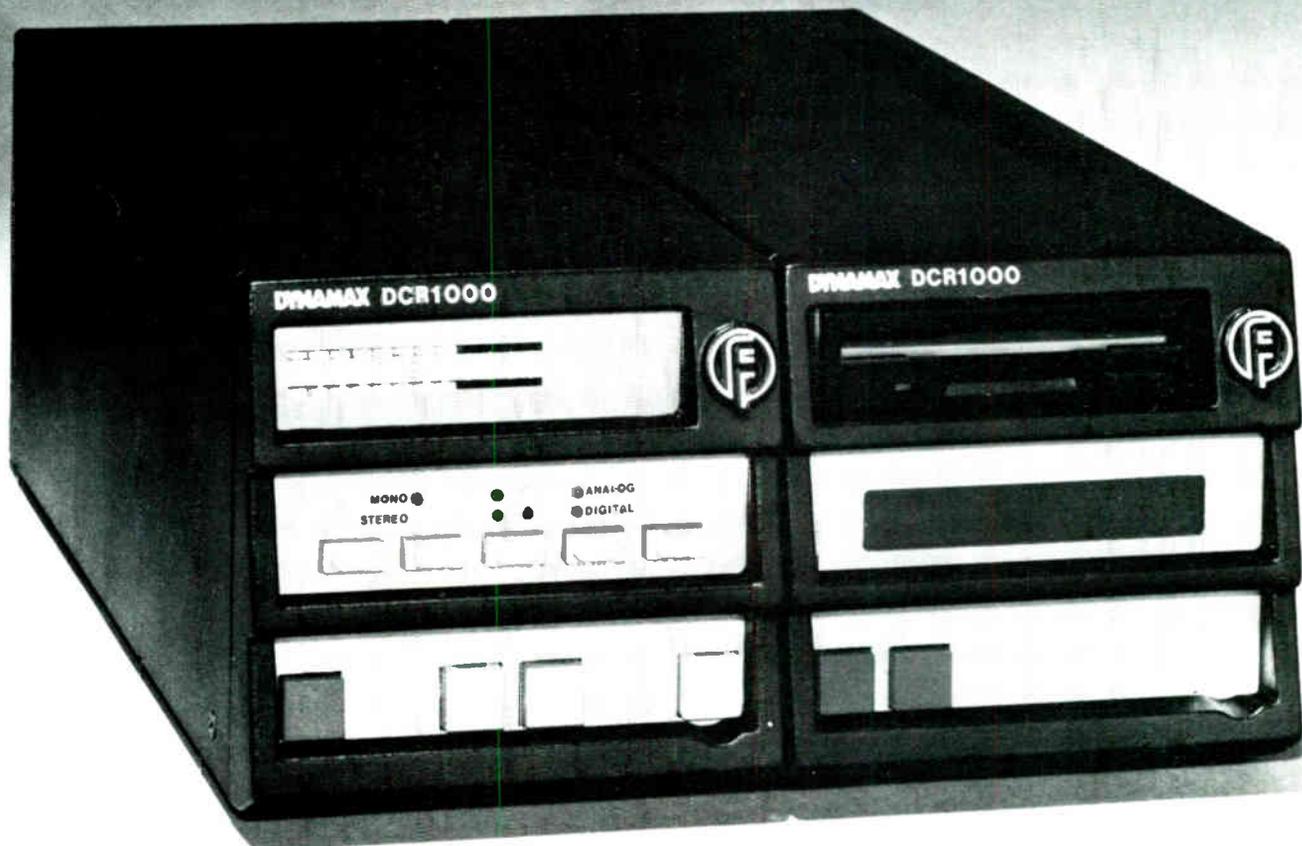
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The record unit features extended scale peak metering with digital overload indicators. Sampling rate may be selected from the front panel or slaved to the standard AES/EBU digital input. Secondary and Tertiary cues are standard. Dubbing is made easy with the START ON AUDIO feature which allows a variable threshold audio detector to begin the process automatically. Adding a readily available PC/AT keyboard permits titling carts, editing their "cue tones," end checking, and looping. A Centronics parallel

printer port is provided for automatic generation of cart labels.

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DCR1025 Subplayer (Available Spring 1992)	\$1,650
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World Radio History

Grateful Dead Broadcasts Live Digital

► continued from page 1

"This was an attempt to try to stretch out, to break away from the mold of what you might expect to hear in a live broadcast and replace it with phenomenal sounding audio," Healy explained.

Improving live audio

For the commercial stations, they used Sony F-1 units with phase linear filters to feed digital pulse code modulation (PCM) into an established fiber video link between

tions was microwaved to NPR's San Francisco uplink at KQED via a relay station in San Bruno and the Sutro Tower. The NPR system is analog, but the signal remained digital until delivery at the uplink.

KKSF's Chief Engineer Tim Pozar was technical director of the broadcast. He was pleased with the results and said the quality approached "pristine audio." Although everything went smoothly this time, he emphasized the importance of redundancy in a production this elaborate and expensive.

The delay matches the time exactly, so there's no echo. "The object is that you get the perspective of the room and the audience, but you also get the audio quality of a direct board mix," Healy said.

An intricate mix

The breaks between the sets included live interviews and several complex pre-produced segments. Pozar said this aspect of the production was both hectic and rewarding. "We built a production facility on the 26th and were in production until the night of the 30th," Pozar said.

Again, the prevailing technology was digital. The production studio included two Sound Tools digital workstations, Panasonic and Sony DAT machines and CD players. Myriad microphones were used, including a Neumann U47 tube microphone that Healy brought out of his personal collection for word jazz artist Ken Nordine, one of the show's hosts.

Another host, David Gans, also was responsible for several of the prerecorded segments. Gans has accumulated years of production experience putting together his nationally-syndicated program, "The Grateful Dead Hour." This time, however, he worked in conjunction with two editors who operated the digital workstations, Gregg McVicar and Bob Ohlsson.

Gans was extremely impressed with the results. "Personally, I fell in love with that whole thing. I enjoy editing on quarter-inch tape, but I discovered the versatility of digital editing.

"I'd walk in and say, 'Oh, no, no, this

phrase is a little too long, we intended to stop here.' If I had been doing that on multitrack it would have been tear your hair out time. It would have meant re-editing the two-track on that particular cue and laying everything else in again.

"Here, all he had to do was shorten the cue that we were talking about and everything else just laid itself back in sequence. The versatility of the tools and the skill of the editors were a real joy from a creative standpoint. It enabled things to be done that a year or two ago would not have been possible."

Once the productions were finished, they were transferred to carts for broadcast on modified Pacific Recorders & Engineering Tomcats. This was one of the few analog links in the production system, but Pozar said if they do it again next year, they plan to use digital storage, too.

Rete 105 is Top Italian Network

► continued from page 8

Elca (whose products are distributed in the Western Hemisphere by Bext. of San Diego, Calif.).

During live broadcasts of Rete 105, one or more disc jockeys are at the console and an engineer is in the control room, with the DJ sometimes breaking in. Often the engineers separate the local and national commercials.

Centralized operation

As for the other network stations, they are not equipped with elaborate studios because production is carried out in Milan. Processing is centralized throughout the network using the Optimod FM processor.

Major maintenance and installations are provided by a ten-member team called the Radio Engineering Co., based in Milan, and owned by Rete 105. Routine maintenance sometimes is conducted by local contractors.

Radio Engineering Co. Chief Engineer Marco Cavestro said the network used a lot of Elpro transmission equipment in the past, but now that the company has closed, equipment comes from Siel, Elenos and Sira—all Italian companies.

"The final stage on this roof is made by IRTE and all the 900 MHz links by Elca, also Italian manufacturers. In general, we try as much as possible to have more than one supplier—not to depend on just one," Cavestro said.

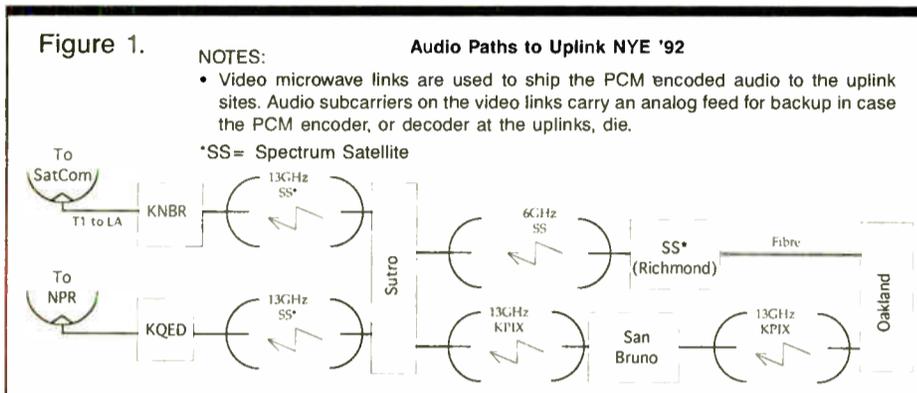
Rete 105 uses some foreign equipment, including Rohde & Schwarz stereo and RDS encoders as well as studio equipment manufactured overseas.

Cavestro said that large equipment purchases such as transmission equipment are budgeted through the network, but with less expensive studio equipment, there are no strict limits. The 1991 equipment budget for Rete 105 was slightly more than \$2 million, he added.

Rete 105 relies on a regular maintenance schedule to avoid technical problems.

"If there is a sudden malfunction, the same engineer working in the control room will try to solve the immediate problem in the best possible way—for example, by replacing the defective machine with one of the backup devices that are always kept available," Cavestro said. "The defective machine itself will then be fixed later, by other people in the engineering company, or sent to the manufacturer for repair."

Hazan is proud of his unique engineering department. "If there is a lightning strike or any other technical emergency anywhere in Italy, our engineers will be there within 24 hours."



the Oakland Coliseum and a station in Richmond, Calif., where it was microwaved to the SatCom uplink in San Francisco at KNBR/KFOG via the Sutro Tower.

Since SatCom is a digital system, the commercial stations received a signal that was effectively digital throughout the entire transmission process, though it went through a brief analog phase during the digital to digital conversion at the uplink. The digital PCM for the non-commercial sta-

"If any of the links failed there were a number of backups," he said.

The crew also kept a backup F-1 unit at each coding and decoding site.

Of course, the music was the focal point of the broadcast. Healy chose not to use a remote truck. Instead, he fed the stereo house mix through a modified TC Electronics delay and blended it with the output of a Sony stereo matrix microphone located near his custom-designed soundboard.

Audio Design Winners Recognized by Sony

by Frank Beacham

NEW YORK For decades, the Sony Corporation has been an international leader in the design of innovative consumer audio products. But the five winners in Sony's Design Vision '91 student competition from the Americas had a few criticisms and suggestions for the venerable Japanese company about the next generation of home sound systems.

Out are boxy, stackable stereo components tied together by cables. In are elegant, compact, wireless, interactive devices of different shapes and sizes, which communicate among themselves through infrared light.

"Right now most sound systems are black boxes. Musical instruments and sound are so beautiful; why is it when it comes to reproduction of music we have this black box?" asked Brian Channell, an industrial design major at the Art Center College of Design, Pasadena, Calif.

Channell is one of the top five winners, who come from North, Central and South America. He submitted a winning design entitled MILO. Using the elements of African culture, music and art, he designed a new way of hearing and seeing sound.

"People are losing their identity. There is no culture," Channell said. "I wanted to design a product with a history behind it. It relates to history but is high tech. It has tension and form."

The team of Eduardo Sciammarella and Norio Fujikawa, production design majors from the Institute of Design, Illinois Institute of Technology, were winners for SOUNDANCE, a cybernetic home audio visual environment.

"It can be interactive or passive. You can conduct music with an infrared wand. You just tell the computer you want to control the violins in a CD and you can. It also has bio-electric sensors which strap onto your body. These synthesize the electro-chemical signals your brain sends to the muscles and that synthesizes the music. You can become the violin and when you dance and move you can create original music," Sciammarella said.

SOUNDANCES also features a virtual reality component that allows a dancer to record a partner on a special video tape and dance with that three-dimensional partner at any time by simply playing back the tape. One can even dance with a 3-D replica of oneself.

"All of this technology is available today. It is not blue sky," Sciammarella said.

The digital audio workstation concept is transformed to the home in Adam Richardson's POST-ANALOG AUDIO SYSTEM. "This is very much a hands-on device. It has plug-in modules and allows a lot of user input," he said.

"I'm predicting that what happened to personal computers will happen with audio," Richardson said. He is an industrial design major from the California College of Arts and Crafts.

SONY HANGMAN is a wall-mounted modular system of graphically interactive sound components, designed by Ernesto Villabolos, a product design major at Pasadena's Art Center College of Design.

"Components now stack on each other. I thought why not make a system more dynamic. My project is a type of sculpture on the wall. From far away you see these forms connected and its kind of abstract. When you walk up closer you see it's a stereo," Villabolos said.

A consumer would buy only the HANGMAN components needed and can configure them in many different ways. The speakers, also wall mounted, communicate with the other components via infrared light.

Max Herr's OPUS 01 also attacks traditional box-like stereo components. "With boxes we experience just the front—the knobs—and never the back or what's going on inside," Herr said.

OPUS 01 has a very thin front that serves as a two-dimensional interface and the back is three-dimensional, organic, alive and aggressive.

"Someone said while viewing it, 'my grandmother would love the front of this and my 10-year-old son would love the back.' That's perfect. That's exactly what I want," said Herr, a product design major from the Parsons School of Design, New York.

The five winners from the Americas were to travel to Japan in late 1991 to compete in the grand finals with students from Europe and the Far East. One previous winner in the competition also ended up winning a job with Sony as a product designer.

"Every chance I get to use the Auditronics 400 is a real treat,"

Clay Freinwald
Chief Engineer
KBSG-FM 97.3
Seattle, Washington
Viacom Broadcasting



says Vic Orlando, Production Director at Seattle's K-Best. "I use the 400 mainly for station promos, and I find its ease of operation simply incredible. Though most of my energy goes into our own work, there's a lot of commercial production done here as well. In fact, many of our advertisers and agencies prefer to use our facility to produce their commercials. For a work load like ours, the 400 is the ideal production console."

"We wanted all modular consoles for our new studios here in the Metropolitan Park, East Tower," says K-Best chief engineer Clay Freinwald. "The serious contenders were Pacific Recorders, which there's a lot of in our region due to its being a west coast brand, and Auditronics, which our corporate director of engineering, Frank Kramer, said Viacom had good success with at WLAK in Chicago, and WMZQ in DC."

"So we went to NAB and talked to everybody, including Duncan Fuller at Auditronics. And dollar for dollar it seemed to us that Auditronics was equal to or better than anything else out there. So we bought two 218s for on-air and a 424 for production. It's nice equipment. I got just what I wanted, the "Best for K-Best".

"The operators love the consoles. They're insanely simple to run. And there have been no failures to take us off the air. Factory support has been good. The bottom line question is would I buy Auditronics consoles again? Yes, I'd buy them again."

Call Auditronics today for information on the consoles
Clay Freinwald specified for K-Best - (KBSG).

auditronics, inc.
3750 Old Getwell Road, Memphis, TN 38118
901 362-1350

Vic Orlando, Production Director, KBSG-FM 97.3, Seattle Washington, Viacom Broadcasting



Assembling a Simple Series Circuit

This is the eighth in a 10-part series called DC Fundamentals. 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 Director of Continuing Education, Annandale Campus, 8333 Little River Turnpike, Annandale, Va. 22003, or call 703-323-3159. The fee for the course is \$30.

by Ed Montgomery

Part VIII

ANNANDALE, Va. Previous to this lesson, voltage, current, resistance, and power have been discussed. Now it is time to assemble a simple circuit and analyze how Ohm's Law and Watt's Law actually work.

Figure 1 is an illustration of a series circuit. Note that all of the components are connected end to end or in a series beginning with R1 connected to the negative side of the battery and then connected to R2 and subsequently R3 which is connected to the positive side of the battery.

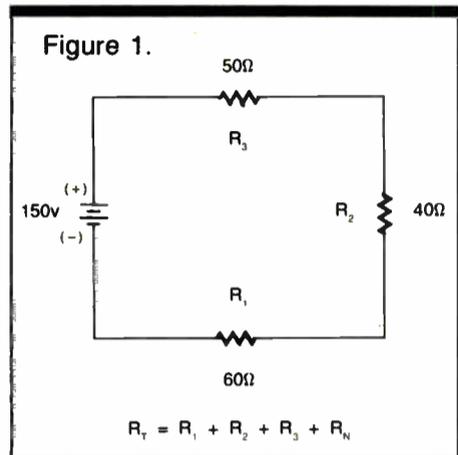
Go with the flow

Observing Figure 1, you will note that there is only one path for electron flow throughout the circuit. Current must pass

through all of the resistors to travel from the negative terminal to the positive terminal of the battery.

If the current path is opened, or disconnected, at any location between the negative and positive terminal, all electron flow ceases.

The current flowing through the circuit in Figure 1 will be limited by the



amount of resistance contained in the circuit. In a series circuit, the total resistance is equal to the sum of all the individual resistors in the circuit.

In this example the total resistance is equal to: 60+40+50 ohms or 150 ohms. This is the total amount of resistance for which the battery will have to supply current. The total resistance is often described as a load.

Current in a series circuit will be the same value in all of the components because it is determined by the total resistance of the series circuit. Using Ohm's Law, the total current can be determined: (150 Volts)/(150 Ohms)=1 Ampere.

Voltage drops

As current flows through the circuit, a certain amount of potential is necessary to move the electrons through each resistor. In Figure 1, 150 volts is the total applied potential to the circuit.

This total voltage will be expended, or used up, as the current passes through the resistors. This is known as Kirchoff's Voltage Law. It can be calculated using Ohm's Law, $V=IR$:

$$V_1=(1 \text{ Ampere})(60 \text{ Ohms})=60 \text{ Volts}$$

$$V_2=(1 \text{ Ampere})(40 \text{ Ohms})=40 \text{ Volts}$$

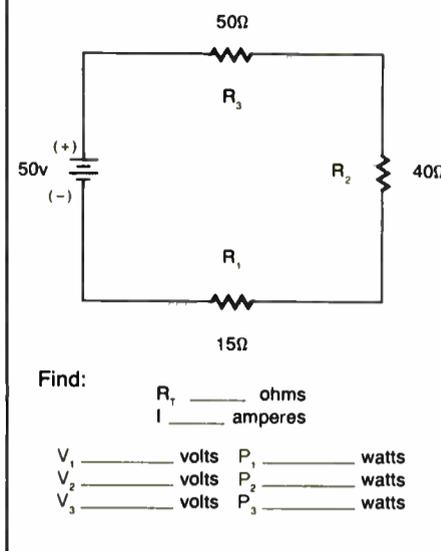
$$V_3=(1 \text{ Ampere})(50 \text{ Ohms})=50 \text{ Volts}$$

If the individual voltage drops are added up, they will equal the source voltage of 150 volts. The sum of the voltage drops across each resistor subtracted from the source voltage will equal zero.

This is *always* the case and confirms Kirchoff's Law. Any answer, in DC circuitry, that does not add up to the source voltage or subtract to zero is wrong.

Power consumed while passing current through the resistors can be determined using Watt's Law: $P=(I)(V)$.

Figure 2.



$$P_1=(1 \text{ Ampere})(60 \text{ Volts})=60 \text{ Watts}$$

$$P_2=(1 \text{ Ampere})(40 \text{ Volts})=40 \text{ Watts}$$

$$P_3=(1 \text{ Ampere})(50 \text{ Volts})=50 \text{ Watts}$$

Total power dissipated in the circuit is equal to the sum of the individual powers—in this instance, 150 Watts.

Figure 2 is an example for you to check your knowledge of a series circuit.

Answers from Lesson 7 are: 45,000 Ohms ± 5 percent, and 7.5 Ohms ± 10 percent.

□□□

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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DIGITAL DOMAIN

Synchronization: Locking the Binary Bits

by Mel Lambert

STUDIO CITY, Calif. It's a fact of life that digital technology represents a two-edged sword. While, on the one hand, digital recorders, processors, workstations and transmission channels offer higher fidelity than their analog equivalents, there can be no denying that life in the digital lane is far from uninteresting.

As I have pointed out in recent columns, digital interfacing needs to be addressed with care and attention to detail. Within larger facilities—particularly when linking multiple workstations and other digital components—the subject of synchronizing the timing references of each sub-system becomes of paramount importance.

Consider a situation where several different digital sources are to be combined within a digital mixer, or transferred via several processors from one side of an all-digital facility to another. For reasons that soon become obvious to any chief engineer who has attempted to perform such a simple feat, timing references are of paramount importance.

It's a different animal

In the analog domain, certain talented individuals may accurately detect timing and/or phase differences between sources as low as several milliseconds. One might assume that just so long as we ensure that digital path lengths—and processing delays for more complex systems—are kept below, let's say, 1-2 mS, then we can combine different sources with complete impunity.

What we are overlooking, however, is that to ensure appropriate sample values are maintained, each *individual* bit within these component digital data blocks needs to arrive simultaneously.

Consider the case of our preferred use of correctly implemented AES/EBU I/Os, preferably ones that conform to the new AES3-199X Recommended Practice.

For a sampling frequency of 32 kHz, each individual data bit within the 32-bit AES/EBU bitstream occupies 488 nanoseconds. In other words, a timing error of just under 0.5 microseconds can result in a 50 percent reduction in signal level.

To see how this could occur, consider that a single displaced or offset data bit is equivalent to an arithmetic shift right within the serial data stream. Timing errors greater than these values can result in even more unpredictable results.

Internal traffic jams

While we can utilize digital I/O cable lengths that fall within this tight 488 nS tolerance window, consider the case of component units that incorporate variable amounts of internal processing delay; say a digital equalizer or reverb unit that has been inserted into one signal path.

It is now highly likely that digital inputs will arrive asynchronously at the input of a multichannel digital mixer. Several technical solutions come to mind as possible work-arounds for such dilemmas.

Maybe a massive RAM bank could be

used to buffer each input, while a high-speed computer calculates the most reliable source and then re-times each of the other bitstreams against this "absolute time reference."

It makes greater sense, however, for a broadcast complex to use a common digital synchronization signal within a multiroom facility, and then ensure that every system component locks the master clock of each internal processor to this highly accurate "sync standard."

Each system component that is outputting a digital signal—multiple DAT machines, for example, or several pro-

duction/air studios connected to a master control suite—can now maintain a highly defined timing accuracy to a master synchronization source.

Put succinctly, such digital sources will use the time-slot references contained within the master sync standard to accurately time the generation of AES/EBU-format digital samples in terms of both channel and bit synchronization.

Intelligent data

Now all we require is a small amount of intelligent data buffering at each digital mixer input, for example, to ensure

that each sample is slipped in time to be bit-accurate compared to our master timing reference.

A single frame of an AES/EBU-format signal at a 32 kHz sampling rate occupies 31.25 microseconds, a period that can be easily buffered and/or frame-jogged using a small amount of RAM and a simple DSP chip.

Depending on cable lengths and other factors, some inputs might arrive a few microseconds ahead or behind the sync reference, but these timing differences can be adjusted and each input brought into perfect sync.

To greatly simplify life in the all-digital studio, technical specifications for such timing references already exist. Last year, the Audio Engineering Society published AES11-1991, "AES Recommended Practice for Digital Audio Engineering—Synchronization of

continued on page 17 ►



LINE OUT

Sound Advice for Room Treatments

by Bruce Bartlett
with Jenny Bartlett

ELKHART, Ind. When you listen to an announcer or a group discussion on your station, is the sound boomy and muddy? If so, you need to upgrade the acoustic treatment of the studio. This article will tell you how to do it yourself.

First, shorten the reverberation time by adding sound-absorbent materials. High frequencies are best absorbed by porous, fibrous materials such as fiberglass insulation, acoustic tile, foam plastic, carpeting, and curtains.

Space these materials several inches

from the wall—instead of on the wall—so as to extend their absorption into the mid-bass region. Low-frequency absorbers called "bass traps" can be formed of flexible surfaces such as wood paneling or linoleum mounted over a sealed air space of several inches.

Soak In some waves

It's important to have equal sound absorption at all frequencies up to about 4000 Hz. Here's why: Suppose a room is highly absorbent at high frequencies, but not at low frequencies.

The highs will be quickly absorbed but the lows will continue bouncing around the

room. Consequently, the reverberation time will be short at high frequencies and long

Figure 1.

Height	Width	Length
1	1.14	1.39
1	1.17	1.47
1	1.26	1.41
1	1.28	1.54
1	1.45	2.10
1	1.47	1.70
1	1.60	2.33
1	1.62	2.62

at low frequencies.

If you pick up speech in such a room,

the sound is likely to be bassy, boomy and muddy, due to the persistence of low-frequency reverberation.

Let's translate that into material terms. If your studio has a lot of fibrous absorbent materials but has no bass traps, you can expect dull and muddy sound. Tacking carpet or acoustic tiles to all the walls is *not* the way to create a good-sounding studio.

Bass Notes

Try the following treatments instead: carpet the floor, or attach open-cell acoustic-foam wedges (such as Sonex™ or Cutting Wedge™) on or near the walls. The thicker the foam, the better the low-frequency absorption. Four-inch-thick foam on the wall absorbs frequencies from about 400 Hz up. Install a floating acoustic-tile ceiling (the airspace absorbs low frequencies).

For bass trapping, you can make some panel absorbers as follows: nail 1/4-inch and 1/8-inch thick plywood panels to two-inch furring strips (battens). Put fiberglass insulation in the air space behind the panel. Cover about half the wall area in this manner.

Alternatively, you can buy ready-made bass traps, such as ASC Tube Traps™. The company's address is P.O. Box 1189, Eugene, Ore. 97440, phone 503-343-9727.

For wide-range absorption, nail some pressed fiberglass board (Owens-Corning Type 703, 3 lb/cu. ft.) onto 2×6 studs, spaced four feet apart on the existing wall, with fiberglass insulation in the air space. Putting the absorbent material in patches, rather than all together, promotes an even

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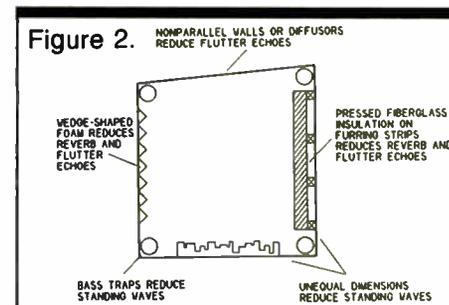
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distribution, or "diffusion" of sound in the room.

This acoustic treatment will also reduce flutter echoes. So will making the walls non-parallel, or using diffusors such as made by RPG. RPG Diffusor Systems Inc. is at 12003 Wimbledon St., Largo, Md. 20772, phone 301-249-5647.

Controlling standing waves

Frequencies at which the room resonates, most noticeable below 300 Hz, are called "room modes" or "normal modes." Resonance peaks of up to 10 dB can occur. Room modes occur in physical patterns called "standing waves." They give a tubby or boomy coloration and should be minimized.

The frequencies at which the room resonates depend on the dimensions of the room—its length, width, and height. If these dimensions are identical, the same modal frequencies will be reinforced in all three dimensions, greatly emphasizing certain low frequencies.

Conversely, if the dimensions are not multiples of each other, the modes will be different for each dimension. Then each room mode will be reinforced in only one dimension and there will be a more even distribution of resonance frequencies.

Figure 1 shows several ratios of room dimensions that uniformly distribute the modal frequencies. Taking the top ratio as an example, if the ceiling height is 10 feet, the room width should be 11.4

continued on page 19 ►

FEED LINE

What Are the Hazards of RF Exposure?

by W.C. Alexander

DALLAS Ever since the first AM station signed on the air, tower workers have been climbing "hot" (energized) towers. The trick is to get onto the tower either in a leap or from an insulated platform (such as a wooden ladder) so as not to form a shunt to ground with one's body. Once on the tower, climbing and moving around are, for the most part, painless.

I have climbed hot towers many times since I got into this business. The only unique hazards that I have observed are the occasional RF burn from sharp-edged hardware or a

poorly bonded piece of coax.

My eyes did not swell and pop out of my head, both my children have the right number of fingers and toes (each has only one head), and I am quite healthy. So is there any danger in climbing a "hot" tower?

RF guides

In its RF Protection Guide (RFPG), the American National Standards Institute (ANSI) sets the maximum permissible power density, electric and magnetic field strength limits for stations operating in AM-band frequencies at 100 mW/cm², 400,000 V²/m², and 2.5 A²/m², respectively.

These limits seem pretty high if you compare them to the 1 mW/cm² power density limit set for stations operating at FM frequencies. Still, for a 1 kW station, the minimum distance that the general public must be kept from a radiating antenna element is about three meters.

A man climbing an energized AM tower is going to get a lot more intimate with it than three meters. According to the RFPG, climbing a "hot" AM tower is a definite "no-no."

The predicament is that it is thus impossible to carry out necessary maintenance and repair work on AM towers without shutting down completely. Very few stations have the luxury of a separate, auxiliary antenna system, so in most cases workers are still climbing the towers "hot."

How can a broadcaster certify that exposures do not exceed the ANSI limits when workers are actually on the tower?

FCC study

To answer the question, the FCC's Office of Engineering and Technology (OET) commissioned a study last year. The study was undertaken by Richard Tell and Associates and a report submitted to the OET.

The document is titled, "Induced Body Currents and Hot AM Tower Climbing: Assessing Human Exposure in Relation to the ANSI Radiofrequency Protection Guide." It is available from the FCC's copy contractor and others. Within is some very interesting reading.

Tell's study is based on the concept that by determining the amount of current flowing through the worker's body, the localized value of the specific absorption rate (SAR) in the wrist (typically the narrowest point in the "circuit") can be determined and compared to the SAR limit of the ANSI standard of 8 W/kg averaged over any one gram of tissue.

Both loop currents (currents produced by magnetic fields fluxing through the aperture of a loop formed by the body and the tower) and eddy currents (produced as circulating currents within the body cross-section when the magnetic field is incident normally to the cross-section having the largest effective radius) were also considered in the study.

To measure the current, a test jig was constructed. This jig consisted of a standard, thermocouple-type RF millimeter meter movement mounted on a piece of plywood. A fuse was used to protect the meter, and electrodes were provided that were suitable for holding by hand and making electrical contact with the tower structure.

The "guinea pig" of the test climbed to a specified height on the tower—measured with either a tape measure or by reference to a known point—safetied off with a non-conductive life-line, held the current measurement jig in one hand and made contact between the tower structure.

Live wire act

The RF current flowing into the arm of the climber caused by capacitive coupling between the electric field and the body was then read on the meter and noted. It is interesting to note that in these 1 kW tests, the maximum currents were in the order of 250 mA.

The report contains pages of data and continued on page 19 ►



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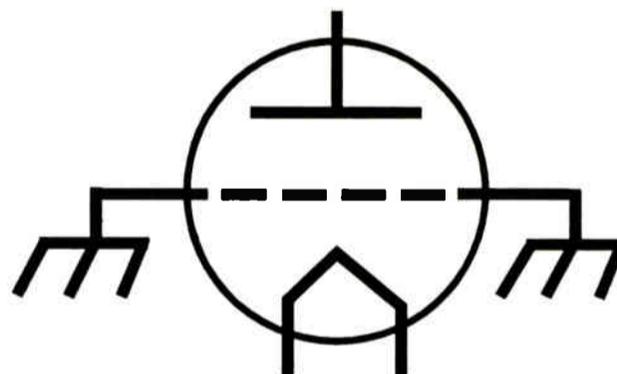
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OFFBEAT RADIO

KUPD Gets Rock Rolling On British Doubledecker

by Dee McVicker

TEMPE, Ariz. Arizona's KUPD-FM has been riding high since Nov. 15, 1991, thanks to its new doubledecker bus.

The two-decker Bristol FLF Lodekka, a 27-year-old authentic British bus, rolled into town during the rock station's 20th anniversary celebration and has been seen motoring through the streets



Can I Ride Your Magic Bus?

Arizona's Real Rock KUPD takes to the streets in this refurbished English doubledecker.

being called the Red Radio Express.

The bus was completely refurbished by British Promotions, of Norfolk, Va., which imported the bus from England for resale in the United States. The classic doubledecker originally served for 20 years in the city of Bristol, England.

In 1984, after serving on the local and express routes in Bristol, the bus was purchased by a small local operator in Lincon, England, and later went to British Promotions for refurbishment.

The bus is estimated to have carried some 2.6 million passengers approximately 1,290,000 miles. Prior to its purchase by KUPD-FM, the pre-1968 vintage bus had its original engine rebuilt and received a complete overhaul.

"Everything is brand new on the inside," said Norris. A wet bar, custom-made out of Honduras Mahogany wood, was also added to the bus by KUPD-

FM. And, on the outside, the doubledecker displays the KUPD-FM call sign in a bright neon art design.

Currently, the two-story bus is undergoing even further renovation by KUPD-FM's chief engineer, Mike Malo, to make it usable for remote broadcasting.

What's In store

In addition to remote broadcasts, the British classic will be used for transporting KUPD-FM listeners to special events.

continued on page 23 ►

of metropolitan Phoenix ever since.

Why the doubledecker bus? For one, said KUPD-FM President Jack Norris, "It's English, and we play a lot of English groups. It ties in with what we're doing."

Maglc bus

The bright red bus also ties in with the station's trademark color of red, which has symbolized KUPD-FM's "red hot rock" format for almost a decade. In its new capacity at KUPD-FM, the bus is

Locking the Binary Bits

► continued from page 14

Digital Audio Equipment in Studio Operations." AES11 contains definitions of techniques for implemented reliable digital interconnections based on the current AES3-1985 and newer AES3-199X Digital I/O Standards.

The new AES11 Recommended Practice recommends that a stable, highly regulated Digital Audio Reference Signal (DARS) be provided within all broadcast and production facilities, for use in synchronizing digital hardware. Format and electrical configuration of the Reference Signal is identical to the existing two-channel AES3-1985/199X format, running at any or all of the essential 32, 44.1 or 48 kHz sampling rates.

AES11 defines two grades of timing signals: a Grade 1 Reference, which offers a long-term frequency accuracy within ± 1 ppm; and a Grade 2 Reference (less than ± 10 ppm, as specified in AES5-1985).

A Grade 1 DARS might serve as an accurate signal for synchronizing large systems within a multiroom facility, while a Grade 2 DARS would be more appropriate for single studio, or in situa-

tions in which there's no technical or economic benefits to be gained from implementing Grade 1 standards.

At the input port of each item of digital hardware, AES11 recommends that a sync-lock circuit be provided to offer a capture range of ± 2 ppm for Grade 1 equipment, and ± 50 ppm for Grade 2 units plus other devices of a lower performance.

All in all, the recently published AES11-1991 Recommended Practice (available from the AES; call 212-661-2355 for more details) represents an invaluable source of practical information on techniques for setting up reliable, multicomponent digital systems.

Any RW reader contemplating setting up or upgrading a production facility should obtain a copy as soon as possible, if only to head off problems down the line.

□□□

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

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INSIGHT ON RULES

Beyond ANSI: Compliance with OSHA

by Harold Hallikainen

SAN LUIS OBISPO, Calif. This month, *Insight on Rules* will take a look at another aspect of electromagnetic radiation compliance—OSHA rules.

OSHA (the Occupational Safety and Health Administration) requires employers to provide a "safe and healthful workplace." Failure to meet the American National Standards Institute (ANSI) radiation limits for exposure may call into question an employer's compliance with OSHA requirements as well.

As I've pointed out before, FCC station

license renewal applications require a statement showing that operation of the station will not have a major environmental impact, including excessive RF exposure of the public or workers.

Know your limits

I'd suggest that a report be prepared that demonstrates what areas meet the ANSI limits, what areas do not meet the limits, and what actions are necessary to go into those "off limit" areas.

Merely putting a fence around the base of a tower is not sufficient. Someday, someone will unlock the gate and get

closer to the tower (perhaps even climb it). A sign on the gate should warn of the radiation hazard and refer to a procedures manual at the transmitter site.

This procedures' manual should indicate what action should be taken prior to going into the area. This action would typically be a power reduction or transmitter shutdown. The report should include sufficient measurements and calculations to support the procedures.

Educate everyone

Even though *you* may know to shut off a transmitter before going inside a fence, does the person who takes your place when you're on vacation? I think sufficient documentation is *required* to comply with FCC and OSHA requirements.

When a worker is in an area that would be dangerous if power were applied, OSHA requires the circuit breaker be "locked" into the off position. This way, someone unaware that the work was being done can't power up the equipment.

This requirement has generally been applied to potential shock hazards, but could also be applied to RF radiation hazards. When someone is working on your antenna, make sure that no one can accidentally power up a transmitter either locally or by remote control. Procedures to lock out control should be documented in the procedures manual.

Tower climbers have been climbing hot towers for at least 50 years, yet I've heard of no permanent damage due to RF, other than occasional local RF burns.

I spoke with Bob Curtis of OSHA (phone 801-524-5896) about this. He pointed out that tower climbers are a relatively small population, and any adverse health effects may not be readily apparent unless you "go looking for" the problems. He said it is very difficult to gather data that correlates a cause of death with occupation.

It took, Curtis said, 30 years to find the

adverse effects of asbestos. RF exposure is a health area currently being investigated. I'd previously thought the exposure limits were based entirely on heating effects—since the limits are expressed in watts per kilogram—but apparently the limits take into account observed adverse effects at the cell level that are not apparently based on heating.

Comfort zone

There is a tendency for those of us employed in the business of generating RF to believe it is perfectly safe. There are others who believe quite the opposite (including the possibility of hazardous effects of 60 Hz radiation from power lines and 15 kHz radiation from computer monitors). I imagine the truth lies somewhere between the two positions.

Another area of consideration is the risk associated with some environmental conditions (including RF). A recent article in the San Luis Obispo County New Times gave some numbers on various causes of death.

The article argued that spending a lot of money to bring old buildings up to current earthquake standards was a waste of money, since, historically, very few people have died due to unsafe buildings. More people had died due to collapsing roadways. This, however, was still a very small number compared to those whose death could be attributed to smoking.

Most risk reductions involve economic costs. As a particular risk is reduced, the cost of further reduction increases. Perhaps we could establish a current incremental cost of one death per 1,000 population reduction in risk for a variety of existing risks (RF radiation, smog, traffic accidents, smoking, household chemicals, etc.)?

This year's project would be to reduce the risk that has the lowest cost. Eventually, further reduction would result in a higher cost than another risk, so some of the resources would be shifted to the risk reduction that has now become economically feasible.

Thanks

I'd like to thank the several people who gave me information and ideas for this article. These include: Richard Tell, Richard Tell Associates (phone 702-645-3338); Robert Cleveland, FCC (phone 202-653-8169); and Bob Curtis, OSHA (801-524-5896).

Next month, we'll get back to the FCC Self-Inspection Report. In addition, I've been asked to do an "inspection" of an AM/FM station that was just sold. I'll pass on some ideas I pick up from that.

□ □ □

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

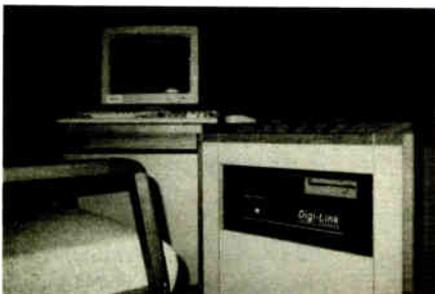


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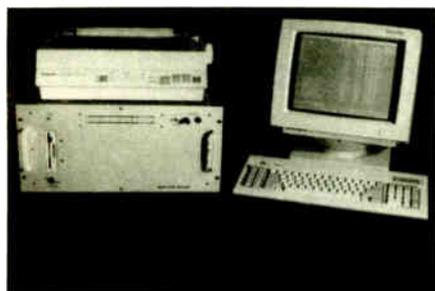
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Hazards of RF Exposure

► continued from page 16

references describing how the SAR was determined from this measured RF current data. Taken into account was wrist size, percentage of bone mass, marrow, water in the tissues, and other factors that are decidedly unpleasant. The conclusions, however, are even more unpleasant. Somewhat paraphrased, they are as follows:

- Hot AM tower work subjects the climber to very strong electric and magnetic fields, which can result in induced body currents that can be significant in the context of RF burns and the development of excessive SAR.

- Body currents flowing through the arm of a climber are directly related to the strength of the surface radial electric field component.

- While the location on the tower where the body current is a maximum is a function of the electrical height of the tower, the maximum value of body current appears to be relatively independent of tower height. This permits a more simplistic approach to applying the measured data to a range of tower heights used by broadcasters.

- Induced current appears to be related to the tower cross-sectional size. With other factors remaining the same—such as tower current—the surface electric fields appear to be less for larger cross-sections and appear to result in lesser values of body currents. Work inside large cross-section towers equipped with ladders may result in substantially lower exposures.

- Induced body current is directly proportional to the frequency of the station. The range of frequencies within the AM band can account for a three-fold difference in the body current and a nine-fold difference in the resulting wrist SAR, with all other factors remaining the same.

- Wrist SAR depends strongly on wrist size. Studies have shown that the variation can be as much as a factor of 2½.

- Considerable power reductions are required to ensure that the peak SAR limit of the ANSI RFPG is not exceeded during hot tower climbing. Depending on frequency, radiated powers as low as a few tens of watts may be necessary to comply with the ANSI recommendations. Use of protective gloves, not yet adequately characterized, will likely allow higher—although still greatly reduced—powers for

broadcasting during tower work.

- RF burns can easily occur while working on hot towers, even at the low power levels, especially if inadvertent contact with guy wires is made. Paints with superior electrical insulating properties may prove to be a useful mitigation material to reduce this hazard.

- Pending the development of additional insight to the issue of body currents and exposure mitigation for hot AM tower work, broadcasters should be very careful when authorizing routine tower work while the tower is energized. This same cautionary statement applies to certification of compliance with FCC-administered regulations on station license renewals and CP applications for facilities where hot tower work may occur.

No surprises here. I suppose that the tower will have to be de-energized while the insulating paint is applied?

So what happens now? This is a question that Harry Cole is better able to answer, but I can guess. There will soon be some sort of rulemaking (more likely just a policy statement in a Public Notice) that addresses the issue. The statement will probably be accompanied by a technical bulletin from the OET, and will probably spell out—with tables, charts, and graphs—the maximum power for a given height, cross section and frequency while workers are on the tower. The broadcast community will probably be cut out of the loop on this proceeding.

The bad news is that, in black and white, we will know how far down our power must go before we can change a beacon bulb. In the past, perhaps we reduced power to some fractional-but-listenable value while John Steeplejack was aloft. Now, we may have to drop to twenty watts.

The good news is that we can, in good conscience, certify compliance with the RFPG standards if we comply with the forthcoming guidelines.

So are there any long-term health dangers in climbing “hot” AM towers? The best we can do is follow the advice of the guys with the thick glasses and err on the side of caution.

□□□

Cris Alexander is director of engineering for Crawford Broadcasting Co. in Dallas.

Sound Advice for Room Design

► continued from page 15

feet and the length should be 13.9 feet for best distribution of modes.

A common misconception is that non-parallel walls eliminate standing waves. Actually, low-frequency standing waves are not significantly affected by surface irregularities less than ¼ wavelength in size.

For example, waves of frequencies below 280 Hz do not “see” a skew of one foot in a non-parallel wall. A better solution is to use bass traps tuned to the resonance frequencies of the room.

Reducing noise

Here are some tips on quieting any noises from outside the studio:

- Weather-strip doors all around, including underneath.
- Replace hollow doors with solid doors.
- Put several layers of plywood and car-

pet on the floor above the studio, and put insulation in the air space between the studio ceiling and the floor above.

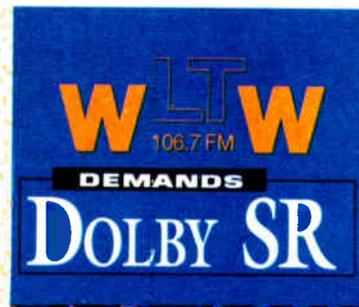
- When building a new studio, reduce noise transmission through the walls by using plastered concrete blocks, because massive walls reduce sound transmission.

- Alternatively, nail gypsum board to 2×4 staggered studs on 2×6 footers. Staggering the studs prevents sound transmission through the studs. Fill the airspace between walls with insulation.

By applying all these acoustic treatments, you can get the boom and noise out of your studio.

□□□

Bruce Bartlett is a microphone engineer and technical writer for Crown International, and the author of Stereo Microphone Techniques published by Focal Press. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.



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Audio Performance- Routing Switcher

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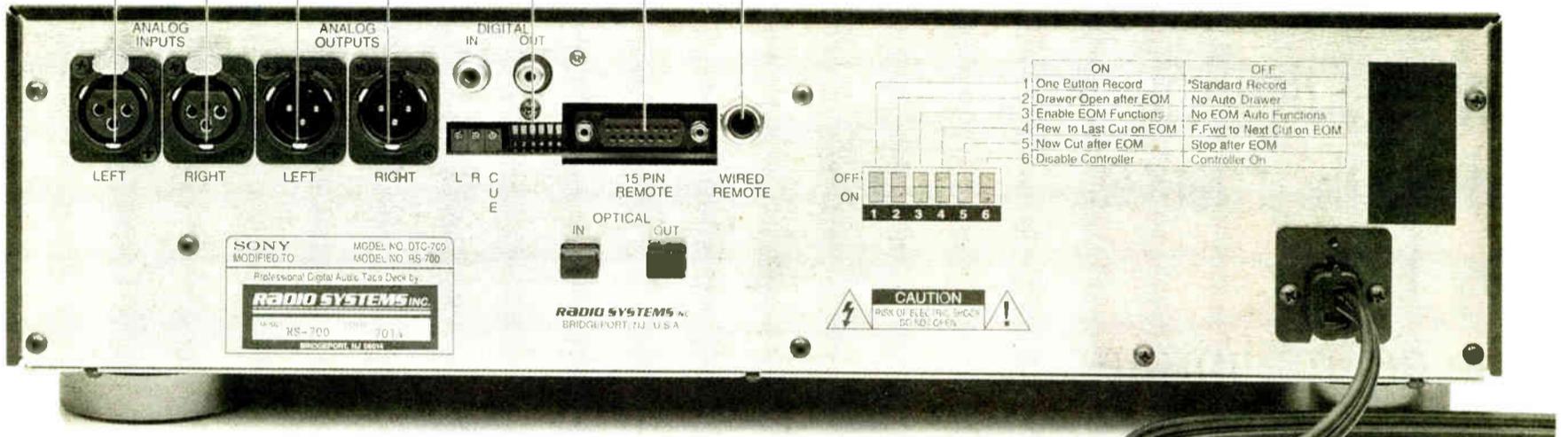
Tape Auto-Cue on Insertion Tapes cue up to the beginning of cut start-ins and park in pause-play automatically after insertion.

Drawer Open On Cut End Dip switch settings allow the drawer to open automatically on cut completion, signaling the operator to change tapes.

Cue to Next Cut on Cut End The RS-700 can be programmed for multiple end-of-cut functions. The next cut option automatically fast forwards the tape to the next cut and parks in pause play, and awaits the next start command.

Re-Cue to Cut Beginning Programming allows tapes to automatically rewind on cut end, and re-cue to the beginning of the cut to facilitate special one-cut-per-tape applications.

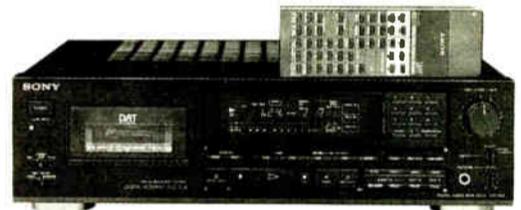
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World Radio History

KUPD Gets Rock Rolling

► continued from page 17

So far, said Norris, the bus has been used to transport 50 winners of a KUPD-FM promotion to a sports event. A few weeks later it was on its way again, this time to a Rod Stewart concert as part of a British-themed concert promotion with a local pub.

Its most celebrated promotion, however, was on the evening of Nov. 15, 1991, when KUPD-FM unveiled the bus during its 20th anniversary party. Although KUPD-FM received the bus in June, the station decided on the November celebration to reveal its British classic.

To kick off the station's 20-year

in British style along with 30 friends. KUPD-FM provided the driver and a fully stocked bar of beer and wine.

A rare sight amid local traffic, the bus

A wet bar, custom made out of Honduras Mahogany wood, was also added to the bus by KUPD-FM.

is one of only 1,000 such buses in the United States today, according to British Promotions' Lauren Hunt. Even so, the buses have gained notoriety in the United States for "businesses that need to either transport people or promote business," said Hunt.

A rare sight

The British classics are being used in a variety of businesses, ranging from restaurants and hotels to banks and independent bus operators. "We've even sold them to realtors who have put a mobile realtor's office in them," remarked Hunt.

More and more radio stations are boarding the doubledecker bandwagon. "It really has taken off at the radio stations because it's a great way to promote," observed Hunt. "And it's such an ideal for doing a remote broadcast."

Moreover, she added, the bus is more readily accessible to radio stations than many other types of businesses. Having the advertising contacts that most do not, she said, some stations are hedging against the cost of the vehicle by "selling advertising space on the side of the bus."

The limited number of these authentic relics in existence ensures that the probability of doubledecker buses rolling down the streets of every market is unlikely. But for stations like KUPD that have invested in such a vehicle, that is part of their charm and promotional allure.

□ □ □

Dee McVicker is a free-lance writer and regular contributor to RW. She can be reached at 602-545-7363.



The KUPD crew (from left): J. David Holmes, Mary Alice Johnson, Lori Jordan, Rob Trygg, Sue Cook, Dave Pratt.

anniversary party—and to promote the bus—invitations depicting the queen were sent to local media types and KUPD-FM listeners. In keeping with the British theme, the station also hired actors to portray the evening's king and queen—as well as a town crier.

Along with bus rides during the event, KUPD-FM party-goers were able to sign up for a drawing for an evening out with the bus. The lucky winner, an employee with local advertising agency E.B. Lane, spent an evening touring metro Phoenix



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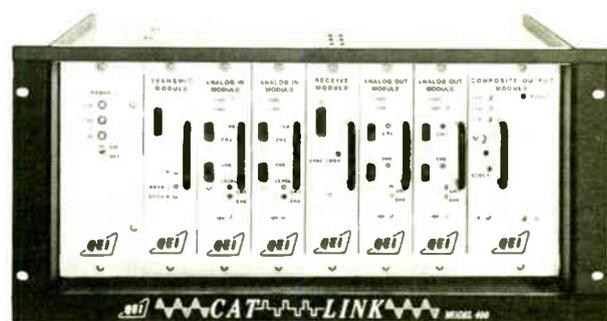
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A Pilgrimage to the Great Salt Lake

by George Riggins

SALT LAKE CITY Helen and I had the pleasure of going from late summer to early winter in a 24-hour period. The weather was cloudy and starting to drizzle as I walked from the Howard Johnson Hotel at Temple Square to the studios of KSL in the Triad Center. By the end of the day the snow flurries had started, and before the evening was over, there was a thin coating of snow in the Temple Square area of the city.

The accompanying picture really says it all about KSL. The old RCA trademark is the first thing that a visitor sees

as he or she enters the lobby of the AM portion of the Triad Center Building. The TV facilities occupy the majority of the center.



A short but enjoyable tour of the KSL AM facilities was conducted by John Dehnel. One interesting thought that was put into the studio layout was to use cabinets

to make one wall of the maintenance area. The hallway that is on the back side of the cabinets goes to a small area of limited activity and poses no problem of bleed-through noise.

Maximizing space

By making the rear of the equipment cabinets accessible from the little-used hallway, space was conserved in the work area, yet full access to the rear of the equipment is available.

Perhaps I will give one of the technical secrets away when I mention the trade mark that appears on one or two pieces of custom equipment. The name just happens to be the same as the frequency of KSL in meters. If you have the opportunity to visit the station, keep your eyes open!

The KSL transmitter site is located approximately 15 miles west of the Studio

complex on the edge of the Great Salt Lake, perhaps three-quarters of a mile north of U.S. 80. The slender Blaw-Knox tower can be hard to spot, depending more on the weather and cloud conditions than anything else.

As it was explained to me, the main tower had been scheduled for painting and other



RCA's Nipper keeps watch at KSL studio.

maintenance when someone apparently decided they needed the feed line to the auxiliary tower more than KSL. Under normal circumstances, ordering a new feed line would be considered an irritating

continued on next page ►

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62 YEARS AGO

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

STATIONS FIGHT IN INDIANA FOR CLEAR CHANNEL

Washington. A contest between two Indiana broadcasting stations, for the right to a cleared channel with the maximum broadcasting power of 50,000 watts, developed before the Federal Radio Commission, during hearings of the applications of the stations. WOWO, at Fort Wayne, Ind., now using 10,000 watts power on the 1,160 kilocycle channel, one-half time, sought full time on that frequency with an increase in power to the 50,000 watt maximum. WWVA, at Wheeling, W. Va., occupies the channel for the other half of the time. Everett Sanders, secretary to former President Coolidge, and Frank D. Scott, of Washington, appeared as counsel for the Fort Wayne station.

WFBM Wants Same Concession

Also applying for the 1,160 kilocycle frequency with the same power was WFBM, operated at Indianapolis, by the Indianapolis Power & Light Co. The station was represented by Thomas F. Littlepage, Washington attorney. It operates at present on the 1,230 kilocycle channel with 1,000 watts. It was explained, says "The United States Daily," that the 1,160 kilocycle channel, under the Commission's allocation of radio facilities, is assigned to the Fourth or Middle-western Radio Zone as a cleared channel, but that one-half of the time on it was assigned to the Second or East-Central Zone, to WWVA, in return for the 1,020 kilocycle channel, which has been loaned outright to the Fourth Radio Zone, and is used by KYW, at Chicago. Scott brought out that, under the compilation of the Commission, designating the quota of each State to broadcasting facilities, pursuant to the Davis equalization amendment, Indiana is entitled to .95 of a cleared channel, based on its population. It now has only one-half of a cleared channel, he said.

Can't Get the Habit

C. R. Durbin, sales manager and vice-president of the Main Autom Supply Co., which operates WOWO, said the station subscribed to the chain programs of the Columbia Broadcasting System, and is the only station in the territory offering it. National Broadcasting Co. programs, however, he declared, can be heard from many stations on cleared channels. Because the station is restricted as to its hours of operation, he declared, it is "impossible" for listeners in the territory to get the "listener habit" and tune in on the station

ANNOUNCER HAS VITAL JOB NOW IN BROADCASTS

While radio announcers continue to be the subject of jokes and comic sketches and the occasion for letters to the newspapers, the fact remains that without announcers there wouldn't be any programs. So far, no technique of radio presentation has been evolved that eliminates the announcer, according to program makers of the National Broadcasting Company, and there is little likelihood that such a drastic change in broadcasting methods ever will be made.

The announcer is the peg on which the program is hung, as one program builder phrased it. When a continuity is written, the first speeches to go on paper are the words of the announcer.

The public depends on him, too. He must tell them the names of the selections to be played, what the program is about and the other details impossible to get across in any other way.

First Recognition

The medal awarded by the American Academy of Arts and Letters for excellence in diction on the radio, won last year by Milton J. Cross of NBC, had its effect on the status of announcing in radio. It signified the first recognition given radio as an allied academic art and served to stimulate announcers everywhere to improve and clarify their speech.

During the past year a school for announcers was established by the NBC and all its staff spokesmen were given lessons in diction and speech several times a week.

That the job of an announcer is regarded highly by young men is indicated in the tremendous number of applications received by NBC for positions on the staff.

100 Men a Month Apply

More than a hundred men a month—and quite a few women—call to take the tests necessary to qualify as an announcer. Thousands of letters from all parts of the country asking: "How can I become a radio announcer?"

"The radio announcer is definitely established in American life," Graham McNamee said. "I believe he is accorded more respect than ever before and that he regards his work with a decidedly professional aspect."

Cross is making announcing his life work, but he doesn't encourage too many young men to do the same thing.

► continued from previous page
expense. In this case, however, the feed line taken also was not the usual nominal 52 ohm line.

The purloined line had been custom made for a slightly higher impedance, so there is no off-the-shelf replacement. When I last talked to John, the final decision had not been reached as to whether to retune the auxiliary tower, or attempt to reconstruct the feed line as it was originally installed.

And yes, the main tower painting and maintenance was postponed due to circumstances beyond the station's control.

Near the Great Salt Lake

The station's transmitter site is on the edge of the Great Salt Lake. That caused a problem several years ago when the lake surface rose several feet due to extremely heavy snow in the Wasatch Mountains—the eastern edge of the basin. The regular access road near an off ramp of U.S. 80 was under water for several months. That forced the use of a much more circuitous route using alternate roads and trails.

The original KSL building is still standing. One can see the cooling tower for the water cooled tubes used in the original 50 kW transmitter. And then there was the problem of keeping the entire plant cool enough for the operators that were on site 24 hours a day, regardless of the weather. One can still see evidence of the earlier facilities necessary to operate a 50 kW transmitter of yesteryear.

In contrast, the new building has a very well stocked screen room for any on-site maintenance or testing that must be conducted. The screen room also has complete living quarters if it is necessary for someone to stay for a prolonged period. (Also, RF protection for anyone on site.)

tection for anyone on site.)

One recent change in the KSL facilities involves the relegation of the tubed 50 kW transmitter to an auxiliary/standby status. The new transmitter is solid state. Lots of amps, but only about 70 volts running around on the inside.

Less power use

As related to me, the biggest advantage is the much lower monthly power consumption. I understand that the difference in the power bill would more than adequately make equipment payments.

One part of the transmitter site facilities that has survived the many years of service is the commercial power feed system. There is one 44 kV feed, and one 12 kV feed. The 44 kV feed is converted to 480 volts in one step. The 12 kV feed is also converted to 480 volts. The 44 kV feed is still using the original transformers installed in 1933. I understand that transformers of this size are no longer in regular service, and are not "shelf" items in the power business.

Yes, John and I discussed the difference in sound that we think we hear when comparing tube equipment and solid state equipment. As far as I am concerned, others can debate the subject. I have a couple of Williamson amps waiting to be put back in service, KT-66s no less! Just have to find space where Helen will let me put all that heat, then get speakers to handle the power.

□ □ □

George Riggins has experience in radio and electronics dating back to the 1930s. He is also a licensed ham operator and has had his own broadcast sales and service company, Riggins Electronic Sales, for over 20 years. He can be reached at 213-598-7007.

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Yours Truly,
Bill Payne
William H. "Bill" Payne
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January 9, 1992

Mr. Steve Claterbaugh,
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I would appreciate you passing my personal thanks on to Bill, and of course a very Happy New Year to you and everyone at Continental.

Best regards,
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ECLECTIC ENGINEER

Throwing a Spotlight on Station Security

by Barry Mishkind

TUCSON, Ariz. In this installment of *Eclectic Engineer*, we bring our current look at station security to a close with a few comments and notes from the field, where many of you deal with these matters every day.

We sincerely hope that by spotlighting areas where station security may be weak, you can avoid the problems of equipment loss and vandalism, as well as physical attacks on your staff. Given that a station can't make any money if it is not on the air, a secure site is really cheap

insurance.

Yet, a number of people reacted strongly to a statement made by Jim Bender of Boseman, Mont. He said that carrying a gun helped him "accept the risks of my profession." Regrettably, the SBE was not among the respondents.

Hired guns

Broadcast engineers are not lazy, flighty types. By and large, they're stable, hard working men and women, who strive to quickly analyze and solve technical problems at their facility. The trouble is,

too often, they work alone. This is bad for two reasons.

First, there is the health and safety issue. If an accident occurs at a remote transmitter site, the engineer may well suffer or die unless there is a backup to call for help or administer first aid.

Secondly, there is the personal security issue. The fact is, we just don't live in the 1960s any longer. Flower power is long gone. As many engineers have noted, today's reality is that a lone individual is viewed by some as "a victim ready to pluck."

Furthermore, knowing that "predators" will sometimes lure people out to an isolated transmitter site just to rob them adds unnecessary tension to an already pressure-packed job. Hence, Jim Bender's solution to get some peace of mind for himself and his family.

Are broadcast engineers destined to become gunmen? Should an employer ask for a certificate of marksmanship when hiring an engineer?

Alternate routes

While it seems clear that more and more engineers are starting to take personal control of their security with firearms, it'd be far better for the professional societies and local broadcasting associations to become involved in developing ways of protecting the staff.

In some locations, several stations have gotten together and are sharing the costs of having someone on site for security. It doesn't have to be full-time, but simply someone available to accompany the engineer while on site.

One of the suggestions made was to utilize your remote control and turn on the area lights while you are still in your vehicle. This and motion sen-

sors can give the engineer an opportunity to see whether there are any intruders.

The remote control system, however, can become part of the problem. How? Mark Persons related an experience to illustrate why stations need to pay attention to all sorts of seemingly minor details.

One of the stations that Persons services suddenly started dropping off the air. The transmitter went off, then on, then off, then on. The initial inspection failed to show anything was wrong. Yet, it happened again.

War games

Eventually, the problem was determined to be a computer hacker. The hacker had broken the default password on the telephone dial-up remote control unit. He continued to manipulate the control unit until the password was changed.

If you have a dial-up remote, don't discount the hacker. He can program his system to repeatedly redial your transmitter control and try different passwords until he succeeds. You must take defensive measures.

The first step is to regularly change the passwords. Check your system periodically for patterns of invalid password attempts. Should you discover repeated attempts to break in via the phone, sometimes changing the phone number will stop the problem.

If you discover someone trying to crack your password, you might seek help from the phone company or police to identify the caller.

Metal thieves

Last month we spoke of places where there are persistent copper theft problems. Many stations also have lost other sources of metal, including the arc gaps, that thieves then take to the scrap yard.

If this has happened to you, you might take note that several states and localities have recently passed stricter laws requiring scrap dealers to fully identify sources of scrap metal. In some cases this has resulted in the apprehension of the thieves.

Of course, some of these thieves don't even realize what they are doing. The chief engineer of one 50 kW station related to me his alarm at seeing the tower gate open one day.

As he approached the site, he saw the bottom ball was missing—a fairly heavy item. But the thing that caught his eye, and his breath at the same time, was the handprint clearly seen on the upper ball.

While we have not talked a lot about security as it relates to intruders, this experience bring up that—to the extent possible—we have to protect the public by preventing them from coming into contact with dangerous voltages and currents. True, a determined thief may even steal the fence, yet if we want to stay out of court, we need to make our site as secure as possible.

And here is one last note for now, actually a sign seen in a field: "Do not cross this field unless you can do it in under 9.9 seconds. Our bull can do it in 10."

□□□

Barry Mishkind, aka RW's "Eclectic Engineer," is a consultant in Tucson. He can be reached at 602-296-3797, or 325-9883 on MCI Mail, or 'barry@coyote.datalog.com' on Internet.

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Binaural Audio: 3-D for Your Ears

by John Sunler

ROSS, Calif. Most broadcasters probably are aware that binaural has something to do with headphones.

This certainly is a step ahead of many, who, if they have heard the term at all, assume it is synonymous with stereo. This confusion was created in part by recording pioneer Emory Cook, who called his ahead-of-their-time double-grooved stereo LPs binaural instead of stereo.

The gross differences between listening to any stereo source on stereo headphones compared to the same source on loudspeakers is immediately apparent. This is because few of the users of the more than 200 million headphones sold in the last decade are listening to material that was designed for headphone listening.

Left and right

An unnaturally exaggerated effect is created with headphones on stereo material, as though half of an orchestra is to the left of the listener's head and the other half is to the right, with nothing in the middle. Also, it's as if the sounds are all happening inside one's head rather than out in the room.

True binaural employs only two microphones—usually small condensers either set into the outer ears of an artificial human head, or at least spaced the same distance apart as an average pair of ears

and mounted on either side of a small baffle.

The two mics feed two channels that are kept entirely separated from the source all the way to the listener—whether live, a recording or a broadcast. Ultimately, the listener will be transported sonically to where the sounds originated, rather than attempting to bring the sounds into the listener's room, as with speakers.

Spatial placement within a 360 degree sphere is so realistic that even vertical placement can be perceived. Reproduction of the ambience or reflected sounds in a hall is so correct that acoustical engineers can listen to such tapes and identify in which hall they were recorded.

Beginnings of binaural

The first use of binaural sound was actually a wired broadcast. It occurred in 1881 in Paris. Inventor Clement Ader mounted a series of primitive carbon telephone transmitters along the front of the stage of the Paris Opera House.

The transmitters were grouped in pairs the same distance apart as human ears, with several pairs across. The leftmost of each pair were mixed together and fed to one telephone line, which listeners in their homes directed to their left ears using the ordinary phone earpiece.

The rightmost of each pair were likewise mixed together and fed to a second phone line, which each listener had to have installed in their home. The result was that

as opera singers moved about the stage, home listeners could "see" their movement while hearing the music with much greater fidelity than a single phone line could possibly provide.

It is fortunate that a wide frequency response is not the most important parameter for conveying the binaural effect; phase accuracy and correct channel balance is more important.

In 1925, an inventor named Kapeller made similar binaural tests at the Berlin Opera House, with an improvement on the Ader system. He called the effect "plastic tone reproduction," and claimed it made sound "fuller and sharper in every detail."

In that same year in the U.S., a Connecti-

cut station, WPAJ, experimented in binaural broadcasting. It was broadcasting on 1320 kc and secured an additional wavelength of 1110 kc for binaural transmission.

Separate transmitters

Two broadcast mics were mounted with a seven-inch separation between their centers, and each was fed to separate transmitters at the two dial positions. The program was not impaired for mono reception, since close to the same program was heard on each wavelength.

When two headphones were used, fed by the two different frequencies, the naturalness of reproduction reportedly was startling. Experimenters were told how to install the proper equipment for binaural reception. While listeners were enthusiastic in their acceptance of the new method of broadcasting, the project was all but forgotten as the

continued on page 32 ►



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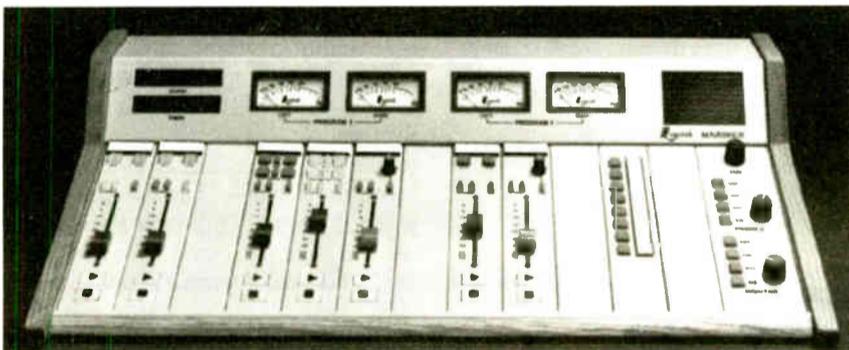


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O-TIPS

How Many Consultants Does It Take...

by John "Q" Shepler

ROCKFORD, Ill. How many consultants does it take to screw in a light bulb? As many as you're willing to pay for.

That's terrible to say, but it does reflect the thinking some people have about consultants—especially technical ones. In this column I hope to present the other side of the story and perhaps even convince you that a decent consultant may be exactly what you need right now. Let's see.

First of all, I don't want any of your money. I have enough to do already. Second, I'm not intending to plug any of my friends here. Sorry guys. Third, I agree. Consultants can be either good or bad. It depends on who you get and how well their abilities are matched to the problem at hand.

Good guys abound

There are some darn good people around. Let me illustrate with a couple of stories. The first one begins on the coldest day of the year. It's early January, and it's 2 a.m. I'm nestled soundly asleep when the bane of all chief engineers rings next to my head—the phone. A voice says: "The FM is off and *no*, it won't come back on."

As I stare half-conscious at the 20 kW transmitter, I notice the tripped plate breaker but am unaware of the constant *putt-putt* of the line dryer.

I reset the breaker and punch up the plates. The breaker snaps off instantly. The jump of the reverse power meter happens to catch my eye. Then that sinking feeling sets in. The antenna is "goners."

Am I going up that tower in -20 degree weather with ice on the members? Never. But, I cry enough to my antenna consultant at 3 a.m. to get him and a crack tower crew in action by noon.

What they found was a blown coupling section, probably caused by moisture. With no replacement on hand for such a specialized part and no backup transmitter, they

did what you pay these people the big bucks for: They improvised.

That afternoon, the station was back on the air with a somewhat cobbled coupler, repaired with sheet copper, some scrap tubing and hose clamps. Thank God for consultants. The replacement parts took weeks to arrive.

Another set of ears

Story number 2. The program director is upset, big-time. A ratings war is underway. His hide is on the line and the station just doesn't jump off the dial and grab the listeners. No amount of testing, tuning, or fiddling makes this man happy.

Now, many engineers would be sorely tempted to tell Mr. Bundle-of-Nerves to take a short jump off a tall stack of carts. That attitude, incidentally, is what helped to get the last chief out the door. No, I don't want to join him. I don't know how to solve this problem, either.

Enter the audio consultant brought in from a top station in a top ten market. You'd recognize the name. Does he have all the answers? Nope, but he does have the credentials. He also has more experience with this sort of thing than your local chief. In a couple of days it sounded pretty good. In a few weeks, it sounded great.

The happy ending is that I got to live. I also learned enough over the next couple of years to build a sound that could take any competitor. Eventually, I even set up a sideline to help other stations build their sounds. Once again, thank God for consultants.

Finding the right one

There are a few types of consultants that you should seriously consider.

First, the antenna consultant. Antennas, especially AM directionals, are such an arcane subject that you really need somebody good to call for major proofs, tuning, additions, and FCC paperwork.

Oh, yes. Legend has it that in the glory

days of radio every chief engineer could scratch-design a five tower array over breakfast and have it working by lunch. That's not so anymore. It probably never was. Antennas as a specialty is a rare talent. You need people with this talent only occasionally, so pay what it takes to get the job done right.

Where do you find them? The best have reputations that follow them. Call other stations and get their advice. You can also check the ads in the back of *RW*.

Credentials mean something in this field. A professional engineer's registration and a list of happy clients is a good indication that you're dealing with the right person.

Second, the audio consultant. These people have bigger reputations in the programming world than among engineers. You're looking for somebody who has already done it the way you want to sound. Audio is fickle. Describe a nuance of your station's sound to 100 engineers and they'll all hear something different in their minds. You want the one who hears what you hear.

Audio guru

I'm in favor of letting the programming and air talent pick their audio guru. They're the ones who have to deal with the consequences anyway. This is an emotional topic. Don't even bother trying to talk program directors out of their preferences. Just be careful to get somebody who can produce results as well as talk a good line.

The third type of consultant is not a specialist. This person is an experienced broadcaster who loves the industry and has been at it long enough to know a few tricks. It could be a chief engineer moonlighting from another station. It could also be somebody who has decided to go "contract" to try and make his/her fortune.

The general technical consultants have some advantages. They charge only when you need them. They have years of expertise that is hard to come by these days. They can handle emergencies in addition to your staff or even as your staff.

For a technical consultant or contract engineer you'll want sterling references from stations that care about their sound and their equipment.

Moonlighters may be squeamish about having you call a station manager who frowns on side activities. In this case, someone you trust should vouch for them.

So, are you sold on consultants yet? I hope you'll consider this option when you need specialized help not available within your staff. It can be a very worthwhile business strategy.

□□□

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DESIGNS THAT MAKE THE DIFFERENCE

WORKBENCH

Make Sniffers Out of Slugs

by John Blisset

FALLS CHURCH, Va. Finding new uses for old parts is always fun. For example, have you ever wondered what to do with those dummy aluminum slugs that are found in Bird or Coaxial Dynamics directional couplers?

The center of the slug can be bored out with a drill (although a friend at a

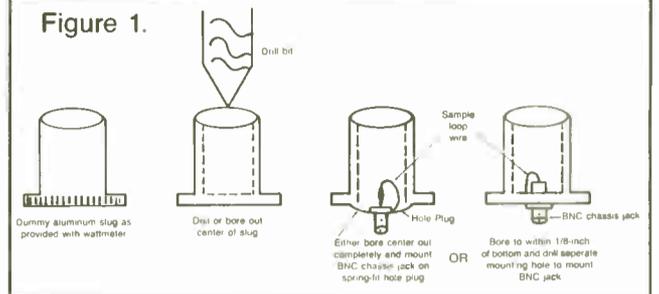
machine shop would make this a little easier). You can bore the center completely out and then fit a metal hole plug in the end, and then drill a smaller hole and mount the chassis-mount female bnc connector directly to the slug.

A small loop of wire soldered to the center conductor and then grounded to

the ground lug of the bnc turns the slug into an inexpensive RF sniffer. Note that the sniffer is not calibrated, and who knows what the frequency response is, but for trying to get relative RF samples for testing purposes, the slug does the trick.

We thank both Bud Aiello—former EZ Communications DE and now with Wheatstone—and Joe Davis, CE with

Figure 1.



WETA-FM in Washington for coming up with this novel idea. Bud can be reached at 315-455-7740. Joe Davis is at 703-998-2765.

★★★

Keith Arnett, VP of Marketing for Broadcast Services/EME writes to inform *Workbench* readers that ADC is discontinuing its stacked solder and wire wrap terminal blocks. This includes the PJ660-6.

Due to the popularity of QCP, sales in solder and wire wrap terminal blocks has dropped off, and the company cannot justify the manufacturing cost. Unlike solder and wire, the QCP terminations are gas tight and secure. If you are interested in receiving literature on the new QCP terminal blocks, circle Reader Service 16, or give Keith a call at 703-635-1413.

★★★

While we're on the subject of jackfields, Penny and Giles is the U.S. distributor for the new M&M jackfields. Of particular interest is their Flexipatch Series, which boasts of crosstalk figures in excess of -99 dB, from 20 Hz to 20 kHz.

Add to that the unique "pod" system, which substitutes printed circuit boards for the typical wiring that runs from the jacks to the termination block, and things get very interesting. For example, it's possible to reconfigure a jackfield from fully normalised to half normalised by swapping out pod cards.

Need a DA? The distribution amplifier pod turns a section of the jackfield into a two-input, 10-output DA. What's more, this pod can be easily reconfigured to serve as a mixer or buffer. Four of these pods can be mounted in a standard quarter-inch tip/ring/sleeve jackfield, taking up no additional rack space. For information on the Flexipatch system, circle Reader Service 132, or fax your request to Penny and Giles in Santa Monica, Calif., at 213-450-9860.

★★★

At a recent SBE meeting in Washington, there was a discussion over the use of Advanced Receiver Research RF Preamplifiers and how well they work for both STLs and RPUs. The discussion moved to what one does when the RF preamp dies.

The answer might surprise you. Turn to Radio Shack. Especially for the RPU band, the company's FM/VHF/UHF preamplifiers have specs reasonable enough to save the remote. It's nothing you'd want to use permanently, but it sure beats being off the air.

Try Radio Shack Catalog Number 15-1107, which is a four-set distribution amplifier. The amplifier offers 12 dB of gain at UHF frequencies, slightly more at

continued on page 32 ►

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Real Time Sequencer

The Real Time Event Sequencer can control up to eight outputs (open collector contacts) and store up to 200 events on a 7 day clock. Programming is done via a front panel keypad - the display is an attractive back lit LCD display. The sequencer can be programmed to provide latching outputs, or half/one second closures. In addition the eight outputs can be binary encoded allowing control of up to 255 addresses. The unit features a high accuracy crystal timebase and battery backup for program memory. In addition, the Real Time Event Sequencer recognizes leap years and can be programmed for daylight savings time operation. Have some time you need to control?

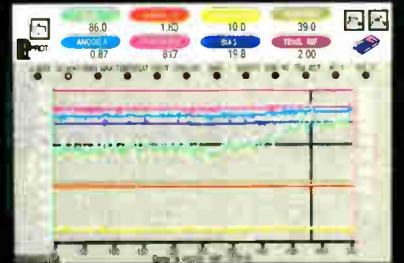
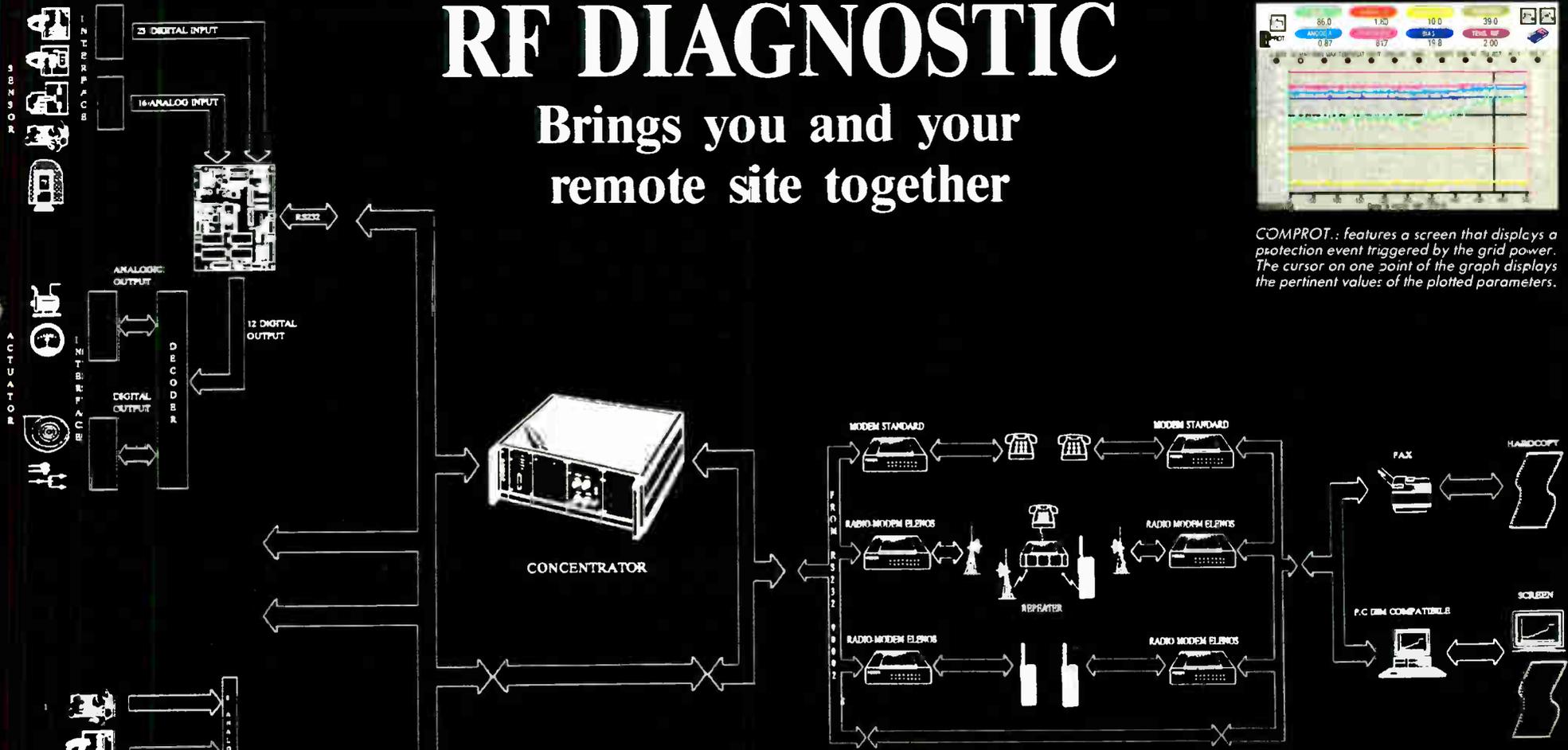
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COMPROT: features a screen that displays a protection event triggered by the grid power. The cursor on one point of the graph displays the pertinent values of the plotted parameters.

RF DIAGNOSTIC is a new telemetry and remote control system for tube-type power amplifiers. All the useful parameters needed to prevent malfunctioning or to intervene in the operation of malfunctioning equipment are transferred by either radio link or telephone to a personal computer (IBM or compatible with an MS-DOS operating system). A unique software system created by ELENOS, available in various languages, enables the user to obtain:

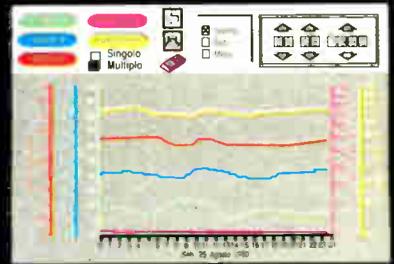
- CURRENT DATA
- PAST DATA
- GRAPHIC DATA

Moreover, if the amplifier in question is manufactured by ELENOS, the computer screen will produce a picture of its front panel (with high graphic resolution) including all current meter readings. Of particular interest to the engineer are:

- ◆ a ZOOM function which allows enlargement of any detail for easier reading.
- ◆ the HELP function: an online troubleshooting manual that guides the user to assess the causes of malfunctions, and in some cases comes up with solutions.
- ◆ the use of a MOUSE and icon representation which allows even inexperienced computer users to be able to work with the PC.

Direct access and automatic saving of data means that the readings of all functional parameters prior to an event are stored and therefore even occasional anomalies can be isolated and treated. It is also possible to send all data of such parameters directly to ELENOS, or to your service center to receive analysis, advice and diagnosis. Please call or write for more information on the ELENOS RF DIAGNOSTIC system today.

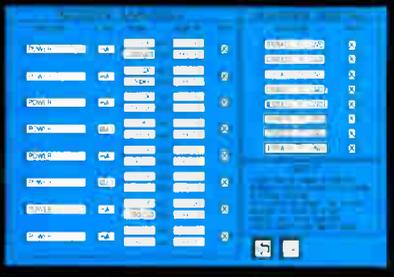
MULTI: features a plotted graph displaying the daily parameter readings. You also have the options of selecting weekly, monthly, for a single parameter or for every parameter simultaneously. It is also possible to have this in bar graph form and to print the data.



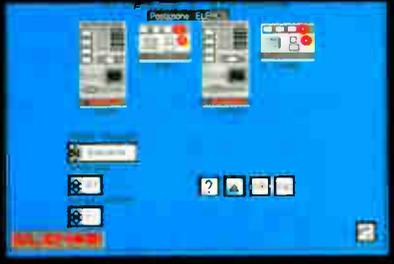
OTHERDAT, OTHER INP: with this feature you can display preset values. The green led shows that the values are within the set threshold limits. It is possible to redefine the scale and the alarm thresholds for maximum and minimum presettings on every analog instrument. It is also possible to define the description and the enabling and to disable the measurements.



RFSETUP: this feature allows a transmitting site with more than one transmitter to work on the same communication line.



T1800: if the transmitter controlled is made by Elenos, the monitor displays the front panel with the meters exactly as they are. In addition to the information displayed on the front panel, it is possible to have other functions displayed at the test points inside the transmitter. Some functions are remote controllable.



ALL THE LOGOS: this feature provides the possibility of adding your station's logo on installation of the software.

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DEALER INQUIRIES INVITED

Binaural: 3-D for Ears

► continued from page 27

demand for spectrum space increased and binaural required double the space.

More recently, a fascinating series of binaural radio dramas aired for a few years on public radio and later on community and college stations around the country. They were produced by Tom Lopez of the ZBS Foundation and are titled, "The Cabinet of Dr. Fritz."

The series of half-hour dramas grew out of an experimental binaural broadcast on Halloween 1982 of a horror story, "Sticks." Each program always started off with an actor speaking into and identifying first one ear

and then the other. This orientation is vital to the proper binaural effect and if reversed, the connections must then be reversed or the headphones reversed on one's head.

Lopez used a Neumann KU-8li artificial head, which has become one of several professional standards for binaural broadcasting and recording. Recording was done on a Sony PCM-F1 unit with a portable Sony BetaMax VCR. The naming of the dummy heads began with experiments in 1932 by Bell Lab engineers, who named their head Oscar. Lopez named his Fritz since it was German, hence the title of the drama series. Fritz's portability meant that original recording

could be done on location.

One ZBS production, Stephen King's "The Mist," provides one of the most astonishing and most accessible introductions to binaural available. It features 35 actors and is one of the most detailed radio dramas ever produced.

Scarer than King

When heard on headphones in a comfortable chair in the proper setting—such as at night with the lights out—the results can be scarier than a Stephen King movie. The 80-minute binaural cassette is available as a Simon & Schuster audio book for less than \$10 at major chain bookstores.

ZBS continues to create unusual radio drama series, but no longer in binaural form. While binaural reproduction of music sounds fine when reproduced through loudspeakers

(though of course without the binaural effect), the voices in radio drama often can sound off-mic and unintelligible.

Listener and station comments about this problem were a factor in future productions staying with standard stereo. The dummy head and electronic designs used over the last few years take into account the previous lack of compatibility with loudspeaker playback and, in fact, have been used for mastering a number of compact discs that do not mention in their notes that they were recorded binaurally.

There has been more interest in binaural in recent years in Japan and Germany than in the U.S. Various German stations have done binaural broadcasts, especially of "hor-spiel," or radio dramas.

The BBC in Britain also has dabbled in binaural. A recent BBC Third Programme documentary on the use of computers in music announced at the start that listeners should have their headphones at the ready for a binaural portion that was coming up in the program. That segment turned out to be not more than a minute long, and actually was a demonstration of the speaker surround sound system known as Ambisonics. Binaural was the only simple way to give listeners an idea of how the synthesized sounds could be whirled around one and even over one's head.

This points out the democracy of the binaural format—no special decoders or other equipment is required—just a pair of stereo phones.

My own syndicated radio program for audio buffs, "Audiophile Audition," began all-binaural broadcasts in the San Francisco area almost 10 years ago and continues them on a twice-annual basis nationally. The hour-long weekly program is carried on nearly 200 stations, both public radio and commercial classical stations. The week of Feb. 9 is my next All-Binaural Broadcast, including an interview with German binaural expert Gunther Thiele.

I also offer a mail order service, "The Binaural Source," which has assembled more than 50 albums in both CD and cassette form of hard-to-find U.S. and German binaural recordings.

For information on programs, station networks or the new binaural catalog, call 415-457-9052.

□□□

John Sunier can be reached at 21 Stetson Ave., Kentfield, Calif., 94904.

RF Sniffers

► continued from page 30

VHF, and includes a switchable FM band trap. The 15-1113A is a 20 dB amplifier that runs up to 890 MHz, but can be pressed to perform in the 950 MHz STL band if needed.

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□□□

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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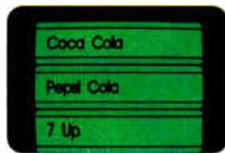


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Gates Criteria's R/P, mono, book, \$300.
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TEAC A1500U like new, \$275. J Parsons, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

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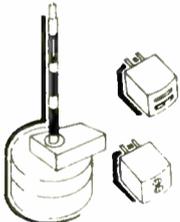
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Telex 235 (2) RP110 electronics & (1) 235 deck, \$250. J Parsons, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

TEAC 6010 (NMR) w/remote (1/4 trk stereo), \$75+s/h. M Muderick, 215-449-6970.

Ampex AG 440 w/console, 2 trk PB head, 2 repro amps, remote, 1 full trk head, 1 record amp, \$500/BO. M Muderick, 215-449-6970.

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Pyramid 8800 8 in, 2 out, new, \$400. J Parsons, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

Gately 18 chnl mixer/stereo, 18 in, 2 out, \$800. J Parsons, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

Pods to make up 2 control boards, modular design, new, \$10000. Peluso, KJUL, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

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Trident 65 32x16 w/stand & wiring harness, \$10000. J Diamond, Blue Diamond, Box 102C, Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Gates President, \$300; Ramko DC-8M Touch Control, \$450, both recently removed from svc in gd cond w/books. M Vanhooser, KSKY, 4144 N Central Expy #266, Dallas TX 75204. 214-827-5759.

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McMartin B-502 stereo 5 chnl in excel cond. Goodrich Enterprises, 11435 Manderson St, Omaha NE 68184. 402-493-1886 FAX 402-493-6821.

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dbx 155 (2) 4-chnl type 1 noise reduction unit, \$200 ea/\$350 both. P Cibley, Cibley Music, 138 E 38th St, New York NY 10016. 212-986-2219.

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Sony ECM-21 (6), \$100 ea; ECM-65F, \$225/BO; ECM-548 (2), \$175 ea/BO; ECM-56F (3), \$275; ECM-377, \$300; ECM-22 (9) \$150 ea/BO; C-22 (4), \$150 ea/BO; ECM-33P (8), \$200 ea/BO, all mint cond. J Diamond, Blue Diamond, Box 102C, Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Beyer M-500 cardioid ribbon, \$250. P Cibley, Cibley Music, 138 E 38th St, New York NY 10016. 212-986-2219.

AKG 451 EB (2) capsules, \$350 ea/BO; CK22 omni capsule, \$125/BO; (2) H-17A shock mount/windscreen for 414EB, \$150 ea/BO, all new. J Diamond, Blue Diamond, Box 102C, Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

EV-666 mint cond, \$200/BO. J Diamond, Blue Diamond, Box 102C, Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Fostex M55RP new, \$300/BO. J Diamond, Blue Diamond, Box 102C, Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Peerless MBC-520 (2) condenser w/pwr sply similar to AKG 451, made in Germany, \$400/BO. J Diamond, Blue Diamond, Box 102C, Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

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Triad HS-29 audio xformer. A Grundy, IAR, 64 Univ Pl, NY NY 10003. 212-677-7580.

Audio/RF tech manuals for Sparta Elec Corp, call/write for list. Peluso, KJUL, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

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Valley LZ precision mic preamp IC, \$15; Lambda 24 V lamp pwr supply, \$15; Cinch 32 pin male & female blue ribbon connectors, \$3.50, Microswitch momentary illuminated switch w/lens, \$2, all new. J Hall, 804-974-6466.

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TFT 760 AM EBS system new caps book, \$550. Wayne, Woollard Labs, PO Box 1097, Castroville CA 95012. 408-663-5512.

Gates M02639 AM mod, tube type w/manual, BO. Paul, KPCR, PO Box 1, Bowling Green MO 63334. 314-324-2283.

Gen radio GR 1931-B AM mod mon on 1370 kHz, McMartin TBM-3500 FM mod mon on 102.3 MHz, needs pwr xformer; Ampex 601 deck w/tube electronics, good for parts; Kori Conalnet II, BO. W Craig, WGOH, PO Box 487, Grayson KY 41143. 606-474-5144.

FM mod monitor package for mono, stereo * SCA, used, tuned & calibrated to your freq & guaranteed, all or part. Goodrich Enterprises, 11435 Manderson St, Omaha NE 68164. 402-493-1886 FAX 402-493-6821.

Want to Buy

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

RECEIVERS & TRANSCEIVERS

Want to Sell

McIntosh MR77 FM stereo tuner, excel cond, \$550. G Gabriele, WFOG, 215 Brooke Ave, Norfolk VA 23570. 804-622-6771.

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

Regency Carry-Com H5 wcharger, needs batt pack, \$50. W Craig, WGOH, PO Box 487, Grayson KY 41143. 606-474-5144.

SCA decoder, high quality micro-miniature 6792 kHz, prewired & ready to install, \$15. D Jackway, Backgrnd Music Eng, 5742 Fair oak, Springfield MO 65810. 417-881-1846.

Spitsburg IMTS telephone mobile, like new w/antenna, \$1500. V Fisher, RR2, Brighton IA 52540. 319-694-2574.

Motorola M100 mobile radio, 45W VHF, synthesized tuning w/mic & antenna adapter, 2 chnl xmit & receive, \$475. J Andrist, KOMW, Box 151, Omak WA 98841.

REMOTE & MICROWAVE EQUIP

Want to Sell

Micro Controls RCR-9 & RCT-9.9 chnl remote control, gd cond, \$1500/BO. C Conwell, KOMA, PO Box 6000, Oklahoma City OK 73153. 405-794-4000.

Micro Controls DLC 9 remote control system book, \$100. Wayne, Woollard Labs, PO Box 1097, Castroville CA 95012. 408-663-5512.

COMREX RENTALS
1, 2 and 3-Line Systems
Call Steve Kirsch for details
Silver Lake Audio
(516) 623-6114

Moseley MRC 1620 never used w/Task Master 2.0 SW, set-up for WIRE LINE, \$4000. Paul/Gordon, KZST, PO Box 100, Santa Rosa CA 95402. 707-528-4434.

Micro Controls RCR-9 & RCT-9.9 chnl remote, gd cond, \$1500/BO. C Conwell, KOMA, PO Box 6000, Oklahoma City OK 73153. 405-794-4000.

Andrew 23 GHz dishes 2-4' w/everything except wave guide & electronics, new, \$5000+ delivery. S Hooge/M Murray, K20AG, 9401 E Northern Lights Blvd, Anchorage AK 99504. 907-337-2020.

Burk ARC-16/SA demo unit in 'as new' cond w/2 Burk IP-8 interface panels, \$2995. J Hall, 804-974-6466.

TFT models 7610, 7630, 7640, 7832, 78410, 7841, ADS-01, FSU-01, PLC. G Jablonski, WHMI, POB 935, Howell MI 48844. 517-546-0860.

Marti RPT-40 xmitr & rcvr w/antennas, VHF, gd cond, \$1350. P Wolf, WSUV, 1400 Colonial, Ft Myers FL 33907. 813-574-5548.

Comrex PLX-II EXT single-line freq, port encoder and RLX rack mount decoder, excel cond, \$1000. R Walsh, WHCN, 1039 Asylum Ave, Hartford CT 06105. 203-247-1060.

Moseley Isocoupler ICU-1A 940-960 MHz, (2) Extel printers, Marti RMC-20 (partially works), J Heck, KGAK, 401 E Coal, Gallup NM 87301. 505-863-4444.

Want to Buy

Comrex 2-line send extender. E Faskowitz, 212-777-7900.

SOFTWARE

Want to Sell

FMStudy 2.2—FCC allocation/interference study (with "curves") on your IBM or compatible—\$49.95. FM database—\$35/first state, \$15 each additional state. **BEAM Software, 3N460** Coulter Lane, St. Charles, IL 60175, 708-584-1668.

FOR SALE: Ron Baionis' Broadcast Engineer's Computer Toolbox for IBM compatible computers. Send for details to **COMPUTER TOOLBOX**, 118 Rice Street, Trucksville PA 18708-1628.

STATIONS

Want to Sell

10000 W daytime lease w/option/buy, located in SW Alabama, near Mobile, gd investment opportunity. G Earls, WBCA, PO Box 426, Bay Minette AL 36507. 205-977-5596.

EQUITY PARTNERS

For FM station in central Shenandoah Valley, VA. 25,000 watts, very strong coverage area, best broadcast signal in two markets. Country format. Write to: Radio World, POB 1214, Falls Church, VA 22041. Attn: 92-02A-02 RW.

Non DA daytime, DA night, 50 KW low dial position, clear chnl, unlimited time, AM in capital city; also, 3 KW FM, can upgrade to 625/50 KW, owner financing. Glenn 501-470-1525.

VA location C&W, upgrade CP for 1800 W, owner will finance w/dwn payment. A Terry, WODY, POB 545, Bassett VA 24055. 703-629-2509.

EMPLOYMENT

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

HELP WANTED

PRODUCT MANAGER - Urban products. Minimum 5 years broadcast market experience, including both sales and station engineering. Conduct market research, create sales materials, respond to customers' applications needs. Send resume to: R.W. Smith, AKG Acoustics, Inc., 645 Bryant St., San Francisco CA 94107. EOE.

ANCHORMAN (News director, -caster, radio) Direct & coordinate activities news dept ethnic (Spanish) radio program station; confer w/executives & prod staff members re station policy, ethical norms newscasting, sources into, news coverage special events, prod prob & budget. Originate/approve feature idens based knowledge Colombian community special interests. Monitor news development for report local, national & intl events. Review edited copy in Sp; analyze & present news, sports, weather & commercials; interview guests & report on community activities; research & write scripts & ad-lib commentaries. Approve program content/direct changes. Coordinate news staff activities w/programming & traffic depts. Hires & evaluates performance news staff; perform prod duties. Supervise 7 employees. Must have min 5 yrs exp same job; Exc oral & written composition skills Sp (must submit original material); exc editing & research skills; Ability focus news on issues interest Colombian community; Knowledge current events, world & Colombian hist, politics, tourism, sports, econ, culture, music, lit, geog, High mobility short notice (travel 25%); Must audition; Verifiable refs. Hrs: Mon-Fri 9AM-5PM. Salary: \$35,000/yr. Submit resume Job Service or Florida, 701 SW 27 Ave, Rm 15, Miami FL 33155. Ref: JO#FL 0539976.

Volunteer avail for Rockland/Westchester area, a few days a week, to learn all phases of bdcgt, prod, on air engrg. Mark, 914-425-2225.

Announcer w/6 yrs exper seeks FT pos, small/med market in MOIA, any format, prod & prod exper. L Yates, 314-374-0617.

Looking for super tech engr/announcer weirdo who solves problems and is fun, friendly, normal? Seeking PTF/Tanywhere. R Vogel, Silverton OR 97381. 503-873-6743.

CHR PD for med market wants to help your station win, excel leadership skills, prod abilities, references. Jeff, 512-618-2824.

Mgmt consultant avail for workouts, reorgani-

zations, Chapter 11's & all troubled situations, well known, excel credentials, reasonable. D Israel, 5812 Alton Rd, Miami Beach FL 33140. 305-861-3814.

Take no prisoners morning team! Let Jeff & Dan boost your cumes, AOR/CR/CHR, serious inquiries only. Jeff, 813-624-2922.

Looking for new challenge 10 yr exper in programming, on-air & prod. D Moore, 713-448-9218.

Contract engr wishing to relocate to Southern CA area, not LA but close by, 25 yrs in radio, low rates & reliable 24 hr svc. Reply to: Radio World, POB 1214, Falls Church VA, 22041. ATTN: 92-02A-01RW.

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Communicator for med market high energy night time, looking to advance, dependable, hard working team player. Alan, 512-399-3887.

EMPLOYMENT SECTION

HELP WANTED: Any company or station can run "Help Wanted" ads for \$1.50/word or buy a display box for \$55/column inch. Payment must accompany insert, use your MasterCard or VISA; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$10. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for details.

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

Mail To: **BROADCAST EQUIPMENT EXCHANGE**
PO Box 1214, Falls Church, VA 22041

ACTION-GRAM

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Radio World's Broadcast Equipment Exchange provides a FREE listing service for all broadcast and pro-sound end users. Simply send your listings to us, following the example below. Please indicate in which category you would like your listing to appear. Mail your listings to the address below. Thank you.

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I. Mfg, distributor or dealer
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E. News operations
F. Other _____

WTS: WTB: Category: _____
Make: _____ Model #: _____
Brief Description: _____
Price: _____

*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.

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Want to Buy

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Want to Sell

CCA SG1-gd cond, \$250. Paul, KPCR, PO Box 1, Bowling Green MO 63334. 314-324-2283.

BE FC-30 generator 67 kHz SCA, book w/dta, \$650. Wayne, Woollard Labs, PO Box 1097, Castroville CA 95012. 408-663-5512.

Moseley SCG-8 subcarrier generator 67 kHz, \$650. Wayne, Woollard Labs, PO Box 1097, Castroville CA 95012. 408-663-5512.

Want to Buy

Optimod 8000A, will pay cash, leave message at 703-276-0125.

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TAX DEDUCT EQUIP

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Christian Ministry needs low pwr AM/FM xmtrs; cable FM & carrier current AM, CD plyr, cassette deck or duplicators; any & all appreciated. R Schoedel, ACE Ntwk, 6630 Monclova, Maumee OH 43537. 419-893-7968.

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Circle 7 On Reader Service Card

TRANSMITTERS

Want to Sell

RCA MI-560341-1 Plate xformer 208/240, 3 phase 50/60 Hz for RCA 20E xmtr, gd cond, changed due to single phase conversion, BO. B Earle, KZZQ, 7146 Webbwood Way, San Antonio TX 78250. 512-521-5035.

Exciters: McMartin B-910 tuned and calibrated to your frequency, guaranteed; Mono, stereo, SCA. Goodrich Ent. Inc. 11435 Manderson St., Omaha NE 68164. 402-493-1886 FAX: 402-493-6821

Collins 830 w/1 kW driver cabinet that could stand alone as a 1 kW xmtr, \$14000. Merrill, WROA, PO Box 2639, Gulfport, MS 39505. 601-832-5111.

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Circle 4 On Reader Service Card

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Collins 831 D 2 kW FM w/310Z-2 solid state exciter, 1 tube spare parts, in use, \$10000. D Atwood, WBRV, 7606 State St, Lowville NY 13367.

RCA BTA-10H 10 kW parts. WWMO, 234 E Meadow Rd, Eden NC 27288. 919-627-9966.

Harris MX 15 exciter, will put on your freq, excel cond, \$3600. G Gabriele, WFOG, 215 Brooke Ave, Norfolk VA 23570. 804-622-6771.

Continental 317C2 50 kW, installed 5-84, grt cond, new tubes, lw hrs (day time use only), vry reliable, no bugs, \$130,000. T Sittner, KSJL, 217 Alamo Plaza, San Antonio TX 78205. 512-271-9600.

RCA BTA-50H Ampliphase 50 kW parts. WWMO, 234 E Meadow Rd, Eden NC 27288. 919-627-9966.

3-5 kW FM, xmission line & CP antenna for docket 80-90 on 93.1 MHz. J Phillips, WBUK, POB 1484, Lima OH 45802. 419-222-1075.

Collins 831-01 2 kW, removed from svc due to pwr upgrade. J David, KMPL/KSTG, POB 907, Sikeston MO 63801. 314-471-1520.

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