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Voting Starts
 for
 Marconi
 Winners.
 See page 8.



Vol 20, No 16

Radio's Best Read Newspaper

August 7, 1996

Tests Begin in San Francisco

by Lynn Meadows

SAN FRANCISCO The newly outfitted digital audio broadcasting (DAB) test van began its journey around the crooked streets of San Francisco last month.

The start of the field tests provides hope: first, that the DAB testing process will actually end someday and second, that a standard might be selected from the resulting data.

However, the process, wounded by the loss of USA Digital Radio as a field test proponent, could simply yield a lot of data and no consensus on a U.S. DAB standard.

On the road

The Field Test Task group has been working on the field test plans for about 18 months. At the International Symposium on Digital Audio Broadcasting, Alfred

Resnick of Capital Cities/ABC Inc. talked about their plans.

Resnick pointed out that the field test task group basically has to collect two different types of data: position data and signal data.

The van will carry the equipment on several long and short paths. Each path was defined by an engineer familiar with the characteristics required on the path. The paths were kept secret from all participants until just before the testing started.

"Some proponents were feeling that the paths were selected and other system proponents were able to adjust their systems to maximize their performance for these paths," Resnick explained in Montreux.

Testers will take path point location by map grid, start point and distance along the path. Navigation landmarks will be recorded both by hand and by video means and the signal RF will be

continuously recorded.

The task group selected the short route to have some varying propagation characteristics. Resnick said both the short and long routes were established to test for line-of-site conditions, terrain-shielding conditions, significant shielding by buildings and vertical shielding such as tunnels and wires.

"In the downtown area, there are trolley buses ... and they form a very effective webbing of wires particularly for medium-wave stations. There is a great suffrage or loss of signal in a situation like that. There is also travel along the waterfront areas, significant foliage along part of the path," Resnick said.

The National Association of Broadcasters has thrown its support behind an IBOC (in-band, on-channel) DAB option. In

continued on page 13 ▶



Mission Control: Inside the DAB Test Van

San Diego Ready for Republican Convention

by Jerry Woods

SAN DIEGO Put together millions of dollars, millions of viewers, thousands of media people, hundreds of politicians and what do you get?

That is Ron Hacker's job. Hacker is chairman of the Broadcast Operations Coordination Authority 1996. Appointed by the "Big Four" television networks,

continued on page 9 ▶

am 1000
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 talk radio
 for san diego

The 1996 Republican National Convention in San Diego.

Mike Miller, director of media operations for the convention, said close to 15,000 radio, television and other media people are expected. That means more media than politicians.

Frequency coordination

This massive media event brings with it some unique challenges. Chief among them is finding spectrum space for everybody who wants to broadcast from the convention.

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INTERNATIONAL UPDATE

Satellite DAB from WorldSpace

by Jeff Cohen

LONDON Building a satellite system to replace terrestrial radio throughout the developing world is a massive undertaking. But what about a system that includes multimedia transmission that can be received over a home computer, too?

Construction costs for three satellites needed to implement the plan are expected to exceed US\$650 million. But Noah Samara, president of WorldSpace and the force behind the plan to bring satellite digital audio broadcasting (DAB) to 4.5 billion people in Africa, Asia, Latin America and the Caribbean, is confident the plan is progressing smoothly.

The idea has expanded from exclusively an audio service to a multimedia transmission. And there also seems to be a shift from a purely humanitarian service

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Circle (65) On Reader Service Card

World Radio History

NEWSWATCH

Clear Channel to Buy Tichenor Media

DALLAS When it completes its purchase of Heftel Broadcasting Corp., Clear Channel Communications plans to submit an agreement to merge Heftel with Tichenor Media System Inc.

Under the terms of the proposed merger, TMS stockholders will exchange the capital stock of TMS for approximately 5.68 million shares of Heftel Class A common stock and approximately \$3.2 million in cash.

If the merger is approved by the Heftel board of directors, stockholders, the Federal Communications Commission and the Federal Trade Commission, the New Heftel

would be the only Spanish-language radio company to own and operate Spanish-language radio stations in each of the top-10 Hispanic markets in the United States.

The New Heftel radio station group would reach approximately 17.3 million Hispanics — 63 percent of the total U.S. Hispanic population.

Eight New NAB Publications

WASHINGTON The National Association of Broadcasters added eight newly released publications to the over 100 that are currently available.

"The Antenna & Tower Regulation Handbook" addresses every aspect of

antenna towers from leasing to painting. "The NAB Guide to Unattended Station Operation," is intended to help broadcasters understand new rules regarding unattended operation.

"These Taxing Times: A Guide for Broadcasters" provides basic information on current tax issues affecting individual broadcasters and the whole industry.

"The Broadcaster's Guide to the Internet and the World Wide Web" explores the future of the Internet and helps broadcasters understand how their role will influence and be influenced by the new medium.

Papers published in the "Broadcasters' Law and Regulation Conference Papers

1996" review the changes in broadcast law that were presented by top legal experts in the broadcast industry at NAB '96. Likewise the "1996 Broadcast Engineering Conference Proceedings" is a recap of the 50th Broadcast Engineering Conference.

Members and non-members can also purchase the "1996 Multimedia World Journal" and a multicolored NAB spectrum chart.

Radio Revenues Continue Growing

DALLAS The radio industry enjoyed its 45th consecutive month of revenue gains in May. Combined local and national spot advertising revenue increased 6 percent over May 1995.

Local revenue increased 6 percent while national spot revenue posted a 5 percent

continued on page 3 ►

Lease a PhantomLite



for as little as \$281 per month*.

You know the world is crowded with digital audio systems. When you are faced with making a decision, it can be a confusing mess of features, reliability, and cost considerations that would frustrate any broadcaster. If you're looking for an answer that has the flexibility to give you total control, a gleaming track record to calm your nerves and a payment plan that won't break your checkbook, Harris and RDS have made it easy with the PhantomLite.

The PhantomLite is a trimmed down version of the reliable, industry benchmark Phantom system that has satisfied hundreds of radio operators over the past few years. The PhantomLite system has features that others would have you believe are either impossible, or are only available in the highest price range. For example, a single PhantomLite system can handle manual or automatic recording, network transfers, scheduling, logging, and other tasks all while it remains **completely** functional on the air, making you sound great.

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Circle (209) On Reader Service Card

World Radio History

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NEWSWATCH

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increase over the same month last year.

"Radio currently is pacing almost 40-percent higher than the U.S. economy and, with the Olympics and the presidential campaign coming up in the third and fourth quarters, respectively, we expect this pace to continue through the end of the year," said RAD President and CEO Gary Fries.

Chock Full 'O Sales

NEW YORK The New York Market Radio Broadcasters Association revealed that since Chock Full 'O Nuts made local radio its lead medium in January, its business has grown 10.5 percent in advertised markets.

Speaking at a NYMRAD breakfast meeting, Larry Orell, executive vice president at Lord, Dentsu & Partners, the coffee brand's agency, listed several reasons for shifting from television to radio.

Citing the 60-second length of radio commercials, production savings and promotional opportunities, Orell said it became clear that radio was the winner and would be for a long time.

"Radio was the logical choice for musical creative and the perfect place to run a jingle-based campaign," he said.

NRB Public Policy Conference

MANASSAS, Va. The National Religious Broadcasters will host its first-ever Public Policy Conference from Sept. 4-5 at the Capital Hilton Hotel in Washington.

The NRB invited President Bill Clinton to be the opening speaker on the morning of Sept. 4 and Presidential Candidate Bob Dole to be the final speaker on Sept. 5.

In between, the topics to be discussed include pornography in the computer age, affirmative action, restoring family values to our culture, abortion and euthanasia and what should the government fund. Richard Wiley, partner at Wiley, Rein & Fielding, will moderate a panel on "The FCC of the Future" and William Bennett, co-director of Empower America, will talk about "Politics and the Things That Matter Most."

Ownership Structure Shrinking

CHANTILLY, Va. BIA Publications released a list titled the "Incredible Shrinking Radio Ownership Structure" last month. In 1995, BIA reports, the 10,246 radio stations in the United States were owned by 5,222 different entities.

BIA noted that 127 fewer owners are competing for the \$10.5 billion radio market ad revenues.

Now, after a year full of consolidation, 5,095 owners operate the 10,333 radio stations in existence. According to BIA, the top 50 owners now operate 1,187 stations that garner estimated revenues of over \$5 billion. ☐

Petitions Stall Expanded Band Plan

WASHINGTON Eight petitions for reconsideration followed the March announcement by the FCC naming the AM stations that will be allowed to migrate to the expanded band.

Docket 87-267 began as an attempt to address interference problems on the AM band. Originally, stations petitioning to migrate to frequencies above 1600 kHz believed that 300 or more stations would get new frequencies.

When the first allotment plan was released in October 1994, fewer than 90 stations were on the list. Afterwards, four petitions for reconsideration led the FCC to generate a new list this spring.

In its petition, KQXI(AM) wrote, "something has gone very wrong in this proceeding" because only 87 allotments on 10 frequencies were made nationwide.

The station noted that the second allotment plan had produced a 41-percent

change "with no indication by the commission that whatever changes it made in the AM database, Improvement Factors and computer program would have such a devastating effect on the allotments made in Plan I."

Granted an expanded band frequency in the 1994 allotment plan, KQXI did not get one in March. The station was further disturbed that on the paper copy of the June 30, 1993, database used to determine the allotment, it was listed as having 166 W at night instead of its true 10 kW.

The Western New York Public Broadcasting Association wrote to ask why its station, WNED(AM) formerly WEBR(AM), originally approved for an expanded band frequency allotment in October 1994, did not make the cut on the March 1996 list.

The association wanted a specific explanation for a revision that changed the station's improvement factor from 0.3985 to 0.0552. The improvement factor is used by the computer program to calculate the final list.

Triad Network has a construction permit for WWBG(AM) at 1470 kHz. WWBG also was not selected in the March list. The network asked the commission to reconsider its decision to select only a small number of stations to migrate.

Of 10 available frequencies, Triad wrote, only two stations in North Carolina were selected for migration, although in the last run, four stations were selected.

"It appears that there would be ample room for more stations to operate in the expanded 1600 kHz band without any interference to other stations," Triad wrote in its filing.

Representative Curt Weldon (R-Pa.) wrote on behalf of WPWA(AM). He noted that not a single station in Pennsylvania or Delaware has received an assignment on the expanded band.

Weldon said he understood that the use of the 1610 kHz frequency by Traveler Information Service Stations had made it impossible to allocate that frequency.

"Now that you have expanded the band, it seems practical to reassign TIS stations to the 1710 frequency, allowing the 1610 frequency to be used by numerous radio stations throughout the country, such as WPWA," wrote Weldon.

Lloyd B. Roach, president of WPWA, wrote, "The usefulness of these TIS stations doesn't even come close to the service provided by a full-time 10,000 W AM stereo station."

The FCC must resolve the petitions before the allotment plan can be called final. ☐

On-site Olympics Broadcast

CHICAGO For the first time in Olympic history, spectators at some of the biggest events of the Olympic Games will be offered a closed-circuit, on-site radio broadcast featuring in-depth color commentary by expert analysts.

One-On-One Sports Inc. will provide this exclusive on-site radio broadcast for spectators attending the opening and closing ceremonies, as well as for those at the aquatic and track and field events.

The One-On-One broadcast teams will be stationed at the events to provide listeners with anecdotes on the athletes and background on the events being watched.

The broadcast will enhance how spectators view Olympic Games competition, said Chris Brennan, chairman, president and CEO of One-On-One Sports Inc.

In addition, the One-On-One on-site radio broadcast will help the Atlanta Committee for the Olympic Games (ACOG) meet requirements of the Americans with Disabilities Act (ADA).

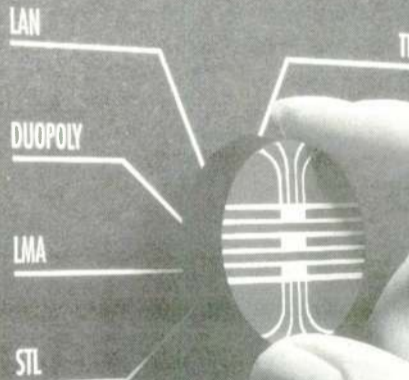
Using a lightweight AM/FM radio with a special built-in frequency that picks up the closed-circuit broadcast, spectators will be able to hear enhanced spectator commentary.

Both the headphones and radio unit, which sell for \$25, will have the official logo of the 1996 Atlanta Olympic Games on them.

"It will be a great Centennial Olympic Games keepsake," said Brennan.

Although the scale is larger, on-site broadcasts are not new for One-On-One Sports. Among others, the company has produced on-site broadcasts at 16 professional golf tournaments as well as at the Indy 500, Brickyard 400 and Churchill Downs. ☐

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Now Is No Time to Take It EASy

WASHINGTON By August, summer has usually worn out its welcome in swampy ol', muggy ol' Washington, but this year we've had a mixed bag of cool weather and lots of rain.



Rain from violent lines of thunderstorms and tornadoes, rain from the likes of Hurricane Bertha, and too much water from swollen rivers and ... it's been a tough summer for a lot of people.

Which leads me to write about the EAS. As you know, the deadline for compliance with the new EAS is Jan. 1, 1997. If you believe the rumor mill that says the Federal Communications Commission will extend you another deadline, you better think again.

We have checked and rechecked with the good old FCC, and it has made it clear that the January deadline is not up for discussion. If you think that a budget-lean FCC, which is fighting for its existence on the Hill won't have time to pursue broadcasters who are not in compliance, ponder this: An agency looking to justify its existence and prove it is an effective regulator could point to an effort like the new EAS as proof of what it has accomplished. Believe me, the FCC will find the staff and the money to monitor the broadcasters.

There may be (or not — this is speculation on my part) some leniency from the commission if you can prove that you ordered your EAS equipment in a timely manner and you are not in compliance because the manufacturers of equipment

are running a back-order list a mile long as of now.

Only two equipment manufacturers (Sage Alerting and TFT) have equipment that is FCC-certified available. Another two companies should receive their certification this month.

Don't wait to place your orders, the deadline is already only four months away.

Choose your EAS systems now and get those orders placed with the distributors. The issue is one of public safety and each station's charter to serve that public.

Jim Bradshaw just joined CCA Electronics Inc. of Fairburn (Atlanta), Ga. As senior sales engineer, Jim will sell CCA broadcast transmitters and associated vendor

products both domestically and abroad.

Jim joins CCA with 15 years of broadcast sales and training experience for major U.S. transmitter manufacturers. He earned a bachelor's degree in science from Michigan Technological University and an master's degree from Michigan State University. He has also taught electronics at Ferris State University as an assistant professor.

For more information, contact Jim at CCA at telephone: (770) 964-3530; fax: (770) 964-2222, or e-mail at www.ccaelectronics.com

It is time once again to start preparing for the fall radio show. If you haven't put it in your budget yet, make room for it. The industry is changing so much now that it is imperative to stay on that cutting edge of news and

technology about our business.

The fall NAB Radio Show is a good place to keep in touch with your industry friends as well as learn about the newest trends and issues. Of course, we've already reported on the keynote speaker, country music star and radio station owner Dolly Parton.

The Marconi Radio Awards will be awarded on Saturday, Oct. 12, the last night of the show, and if all that is not enough, just come on out to Los Angeles and check out the radio stations in the country's most car-bound market.

Don't forget that the NAB Radio Show is held concurrently with the SBE annual conference, the RTNDA annual conference, the SMPTE annual conference and, just added, TVB. All tied together by the World Media Expo Exhibit Halls.

A couple of issues ago I wrote about the WHFSers and their no-show at our scheduled softball game. We finally had our match with them, and well, I'll let TV Technology's Susan Ashworth and Matt Spangler tell the story:

The Bluelines Debut Tough, Scrappy Team

BELTSVILLE, Md.

After a cancellation, a near rain delay and a restrained urge to beat up the other team's pitcher, the IMAS Bluelines made their 1996 softball debut.

The score? Well, they lost 11-15, but only after a rousing last inning that was spearheaded by the entrance of Judy "The Tough Girl" Nelson, who intimidated the other team with her searing line drives to third base.

Nonetheless, the Bluelines gave up their first loss of the season to a team named the WHFS BallBusters. The pitcher wore his boxers for the occasion. The HFS roster showed an alarming lack of representation of any "real" on-air personalities (which, a source from the IMAS

squad later learned consisted mostly of ringers).

After a couple of slow innings, the Bluelines began showing their tough stuff: Second baseman Chris Joaquim scooped up each of the grounders that bounced her way; first baseman Matt Spangler, honored with the Tough Guy Award for braving the humidity in jeans, reached for a couple of off-base throws for the outs.

Only one homerun

Chris Nicholson, the Brady Anderson of Beltsville, smacked one high into the outfield, rounding each base with growing speed before racing into home for the team's only home run.

Steve Bowman and Rob Bader ran into one another in the outfield. But, in

high Blueline style, Bowman hung on to the ball, despite being tossed on the ground, for the out.

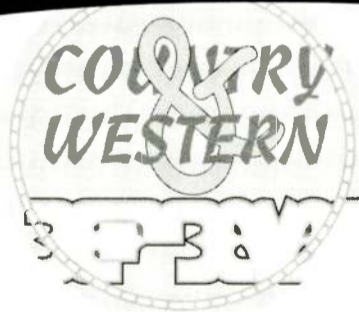
Suellen Rosetti and Heather Harris both rounded the bases as the first of several scores that marked the Blueline's struggle to take back control of the game.

Enid "The Brace" Palazzolo bravely covered home plate and nearly tagged out a 200-pound inebriated fellow racing straight toward her. Coach Lynn Meadows, who coordinated the event with the dastardly HFS-ers, caught a mean out at second base.

Two more innings (the game ended at seven) and the Bluelines would have made the comeback. But, in this sports writer's objective opinion, the HFS-ers (claiming weariness) were scared off by Robert Green's mean outfield drives.

Anyway, with their first exhibition game under their belt, the Bluelines are ready for a real season of terror. The streak starts now.

That's it for now.



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Christian broadcasters

Dear RW:

I read with great interest "CTRC Foils Single-Faith Stations" (RW, May 29). I was saddened to hear of so much misinformation about U.S. religious and particularly Christian broadcasters on the part of our Canadian neighbors.

You quoted Rene Barbin as saying that most religious stations in the United States are "fundamentalist and Baptist." Obviously these Canadians have not done their homework, i.e. the largest non-comm. Christian radio networks in the United States are conservative, but they would not classify themselves as Baptist. I am speaking of Moody Broadcasting, Family Radio, American Family Radio, Bible Broadcasting, Northwestern Radio (Skylight) to name a few. The "hate harangues" of the past are very rare these days, limited to primarily to the mom and pop "if-it-pays-it-plays" religious stations.

It is unfortunate that true religious tolerance (freedom) has not yet made it to Canada.

I just thought I would pass it along. Thanks for the article.

Leo T. Galletta

Network Operations Manager
Bible Broadcasting Network
Charlotte, NC

Marconi myth

Dear RW:

I was surprised to see RW uphold the popular myth that Marconi is the "Father of Wireless" on the front cover of the June 26 issue. Marconi was certainly able to get radio started as a successful commercial venture in the early 1900s, but he did not give birth. Nicola Tesla (1856-1943) demonstrated and lectured on the subject of radio in the spring of 1893, two years before Marconi produced his public demonstrations in 1895.

The uneasy issue as to who originated the process erupted in the years to follow. It was settled finally by the U.S. Supreme Court in 1943, who ruled that Tesla's wireless patents predated Marconi's and that the credit for the invention of radio should go to Tesla.

Even though most engineering and research societies have corrected this misconception in the years since this landmark decision, which came eight months after Tesla died, the Father Marconi myth still persists, as one can see by reading RW. You might want to correct it, unless you side with those who believe that hype is more important than fact.

James Hemingway

WGAM(AM)-WGAJ(FM)
Greenfield, MA

Wartime radio

Dear RW:

I read with interest the article "Broadcasting in a War-torn Zone" by Charles Recknagel in the May 29 issue. Seems we continue to re-invent the wheel.

Back in 1955, I was greeted by my friends and neighbors and in March of 1955 ended up in what was then called psychological warfare. Yes, I too wondered about it and why it was there. This was the beginnings of what is now called "Special Forces: the Green Berets." We were located on Smoke Bomb Hill.

I was assigned to the 4th Radio Broadcasting Company which I later learned had been in Korea and had been deactivated and the "numbers game" replaced the 8th RBC with the 4th RBC. This was all at Ft. Bragg, N.C.

I was also soon to learn that our wartime mission was to broadcast over enemy lines and that our equipment included a tractor trailer rig with a 5 kW AM broadcast transmitter, another containing a complete studio with a large compliment of LPs (yes, 1955) and a news room, a trailer with a three-phase 460 V 60 HZ alternator of sufficient size to run all the above. We also had several M109 trucks that housed shortwave receivers in diversity pairs and teletype equipment. And an AN/GRC-26 with the venerable BC-60 transmitter and associated gear.

Don't Delay On EAS

Station operators who have pinned their hopes on another Federal Communications Commission extension of the Emergency Alert System deadline for compliance should reconsider.

The FCC has made it clear that Jan. 1, 1997, is the date by which all radio stations are to have the new EAS equipment in place — and it has given no indication that the January deadline is flexible. Only two equipment manufacturers

(Sage Alerting and TFT) have equipment that is FCC-certified available. Another two companies should receive their certification this month. Distributors tell us that they have back-order lists a mile long already for EAS equipment, yet the bulk of stations have not decided on a system nor have they placed an order for EAS equipment.

Why wait to order when the deadline is only four months away?

Stations pinning their hopes that a smaller, less-funded FCC will not have the staff or the money to monitor compliance need only remember the agency's sweep of AM stations after the NRSC AM splatter deadline: a smaller FCC does not equate with a less vigilant one.

Choose your EAS systems and place your orders. The issue is one of public safety and each station's charter to serve that public.

Delaying your compliance with the new EAS could mean greater expense in the form of fines and a failure to fulfill your public service role if a real emergency (such as a Hurricane Bertha, or a tornado, fire or flood) were to occur.

Radio can and should do better than this.

—RW

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telephone: (703) 998-7600
editorial fax: (703) 820-3245

Lucia Cobo ext. 115	Editor in Chief
Whitney Pinion ext. 129	Managing Editor
Alan Peterson ext. 135	Technical Editor
Angela Novak ext. 144	Associate Editor
Lynn Meadow ext. 122	Staff Writer
Christine Joaquim ext. 138	Assistant Editor
John Bisset Thomas R. McGinley	Technical Advisors
Alan Carter	Assistant Editorial Director Audio division Editor in Chief (International)
ext. 111	
T. Carter Ross ext. 137	Managing Editor (International)
Rogelio Ocampo ext. 121	Latin America Managing Editor
Susan Gary ext. 130	Editorial Assistant
Linda Sultan ext. 141	Editorial Assistant
Marlene Lane ext. 128	Editorial Director

Contributors: Frank Beacham, Alan Haber, Bob Rusk, Lee Harris, Dee McVicker, James Careless (Canada)



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Next Issue of Radio World
August 21, 1996

In a field next to the motor pool where these vehicles were stored was a short tower with clearance lights. We also had several blimp-like balloons to hold up a wire antenna which allowed for mobility of the setup.

Because it was a peacetime unit, we didn't use it, but spent our time dusting the gear and once in awhile lighting the filaments to be sure they would.

Later in 1955, we went to maneuvers at Ft. Polk, La., "Operation Sagebrush," and being a resourceful group, we put the bucket-of-bolts on the air at very low power with a short wire antenna and played radio, giving our troops something to do and something to listen to around the main post area.

After I returned to civilian life, I met several people who had seen duty in Korea prior to 1955, who had listened to the 4th MRB when it was over there.

Besides broadcasting, we had leaflet (printing) and loudspeaker companies, let alone an active laboratory to generate new ideas and a school for officers and a complement of special forces teams. I imagine when President Kennedy implemented the "Green Berets," all of this went away. I have no way of knowing. So, as you can see, some of us "already done that," but of course without the degree of sophistication modern technology has given us.

P.S. Bet you can't guess what we used the AN/GRC-26 for? Fun, in between the fun.

Henry L. Schultz, Jr.

Erie, PA

Geller was winner

Dear RW,

I would like to congratulate both RW and Richard W. O'Donnell for the fine article "Radio Station Was Life For Simon Geller" (RW, July 10). It was about time that someone recognized the many contributions this great man brought to this business.

WVCA(FM) in Gloucester, Mass. was the bread and butter for Simon Geller. Even after the FCC shamefully ripped his license away from him in favor of a

"well-endowed" applicant, Simon was not going to just sit there and watch his whole life be stolen away. Bitter? You bet he was, and with good reason.

Everybody I know was on his side throughout that entire fiasco from start to finish. Because people cared and Simon never gave up the fight, he won.

Even though he sold WVCA to Doug Tanger in 1988, he made sure that the station was in good hands with the new owner who promised Simon that classical music would always be on 104.9 FM (now WBOQ). Doug Tanger has kept his promise.

I had many long telephone conversations with Simon over the years. I am thankful for that. Though I never had the pleasure meeting him face to face, I always had the utmost respect and admiration for this great man who stuck to his guns and came out a winner.

And by the way, though Simon hated anything to do with rock and roll music, WVCA started life on September 14, 1964, as a rock and roll station using a used FM transmitter he bought from WCRB (102.5) in Boston. When he found (the hard way) that a stand-alone FM would not make it with top-40 music in that period of time, he decided to dump the rock and replaced it with public domain classical/symphonic music (mainly from dead composers) to bypass the ASCAP and BMI fees. Since that time, from 1967 to 1988, Simon was WVCA's only jock and played nothing but classical music. You've got to respect a man with that integrity.

Peter Q. George
Randolph, MA

CORRECTION

On page 60 and in the index of the June 26, 1996, edition of RW, Marty Riemenschneider, executive vice president of Mitchell Broadcasting, was mistakenly identified as Mary Riemenschneider.

County May Sell Station for Buses

Last in a series

by Alan Haber

YORKTOWN, Va. In 1996, the pressure on high school students to make decisions that will affect the rest of their lives is enormous.

Each class and elective is another step on the path to succeeding in the "real world." The training that radio-minded students are getting at high schools across the United States makes careers in the medium seem possible.

For 30 years, students at York County High School have had an opportunity to get that training at WYCS(FM), 91.5 MHz. Now, in a trade-off guaranteed to please no one, school board officials are considering selling the station in order to buy 10 school buses.

At WYCS, as at more than 200 high school radio stations in the country, many an engineer, many an on-air talent and many a radio aficionado have experienced the thrill of going "on the air" for the first time.

Thirty years

A couple of "real world" chief engineers have not forgotten the training they got at York High School nor have they forgotten what it means to them.

Steve Johnson, chief at WGH-AM-FM and WLTY(FM) in Virginia Beach, said his time spent in the school broadcast

electronics program "was a great opportunity." He said he would not be where he is today without WYCS and Bill Swartz, the man who has put his heart and soul into every nook and cranny of the station for more than 25 years.

Ernie Warinner, chief at WWDE-FM and WNVZ(FM), Virginia Beach, and WXEZ(FM), Yorktown is another WYCS veteran. As a student, he said, the idea of a high school radio station had seemed natural to him.

"At that stage of the game when I first started hanging out there, I thought every school system had a radio station," he said and added WYCS "is my career." Without it, he said, "I would not be where I am today."

WYCS, six studios strong and a shining example of what high schools can do for kids interested in radio, has been on the air since May 1966.

The station is manned by students during the day and by adults at night. Electronics courses, formerly given at the school, have been incorporated into a regional program.

While WYCS pumps out 21 kW and uses its subcarrier to broadcast to blind and handicapped listeners, one of the objectives of the York County school board is becoming a road block that is threatening the station's lifeline.

Around 10 new buses are needed to transport students to a new county school opening this fall. Thanks to a

loan from the York County government, the buses have been purchased. But the loan has to be paid back and where that money will come from has not been determined.

What has crystallized — at least in the mind of Richard Hixson, Deputy



Learning the trade at WYCS

Superintendent of the York County School District — is that WYCS is finding itself in a "in a delicate state of health."

Open to discussion

While station funding for the 1996-1997 school year is set, beyond the coming year, "it's open to discussion as to where the money is going to come from to support the station," said Hixson.

The realities of this bottom line have followed WYCS like a plague: The school board is looking at a shortfall in money to pay the first year of a lease-purchase agreement on the buses, according to Hixson.

At first, the Board had planned to sell the station and use the proceeds to offset the expense for the buses.

The board has not decided whether WYCS is still up for sale, said Hixson. Now, the board — and everyone else concerned about the fate of the station — is waiting on a decision from a large corporation on a grant that would help operate the station for the coming school year. The anticipated federal, state and local funds have already been earmarked for other budget items.

One possibility is that the money for the buses could be taken from the WYCS budget, which is around \$100,000, according to Hixson, for the coming school year.

A Save Our Station (SOS) committee has formed to guarantee that the station will stay with the county. The committee, helmed by station volunteer Steve McNulty, whose two sons went through the WYCS program, has seen its efforts pay off to the tune of about \$45,000 in potential revenue, earmarked for the 1997-1998 school year.

Both Swartz, stalwart and trusted guide to students for over a quarter of a century, and McNulty, who worked in radio in Kansas in the 1960s, harbor a positive outlook for WYCS.

Swartz, a radio veteran, has sold underwriting for nearly the entire Sunday morning block of programming putting about \$10,000 into the SOS committee coffers.

Hixson did not sound as confident of the SOS committee fund-raising efforts for the 1997-1998 school year.

"We've seen lots of good intention, lots of enthusiasm, but that doesn't pay the mortgage, so to speak," he said. He added that the committee is "very enthusiastic and maybe a little bit naive. Having gone through (unrelated) fund-raising efforts myself a year ago, people talk the talk, but when it comes to writing the checks and actually making commitments, it's a totally different matter."

Twenty-eight students are signed up for radio classes in the fall. Enrollment in the radio curriculum has been steadily decreasing, said Hixson. "If all these kids show up, that is definitely an improvement over last year," he said. Hixson said there is a lot of loyalty for the station among school alumni.

Capable of supporting itself

If the hoped-for grant comes through, the board will be able to reallocate funds to pay for the buses and WYCS will stay.

Swartz said he believes the school board would like the station to keep operating.

"I don't think they would have gone to the trouble of appointing this committee and giving them the go-ahead to go out and raise money. I really don't believe that they would have done that if they didn't sincerely want to keep the radio station."

Swartz said he feels that the committee "can convince the school board that this station is capable of supporting itself, and we don't need to take taxpayers' money to do it."

Although the goal is to make WYCS self-sufficient, Swartz is not letting the school board off the hook.

"If the school is going to continue to use (the station) as an instructional tool, I think it's incumbent on them to contribute some money toward the operation," said Swartz.

"I think we have it under control," said McNulty. "I think the chances of us losing the station at this point are between slim and none."

Fundamentals

Stations like WYCS provide hope and experience for radio's future work force. Without such stations, where would radio professionals like Steve Johnson have turned for guidance at the high school level?

Johnson learned radio electronics in high school at WYCS; he performed maintenance on consoles, took meter readings, aligned turntables and tape decks and received three hours of classroom instruction a day on the fundamentals of "the whole spectrum of broadcasting," he said.

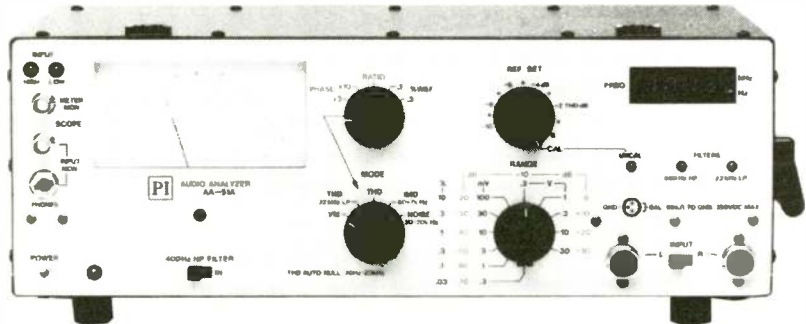
The fundamentals of radio learned by high school students will help them — the next crop of radio professionals — to move to the line that crosses over into the "real world."

Many will cross that line and set the wheels of their radio careers in motion, thanks to stations like WYCS and the others profiled in this Radio World series.

As Ernie Warinner, one person who crossed that line, explained, being at WYCS "was a good way to grow up. It was a great experience. I hope it survives. I really do. I'd like to see the radio station go on forever."

Meanwhile, across the land, stars in the night sky are alight with hope, shining on every high school radio station, good luck charms all.

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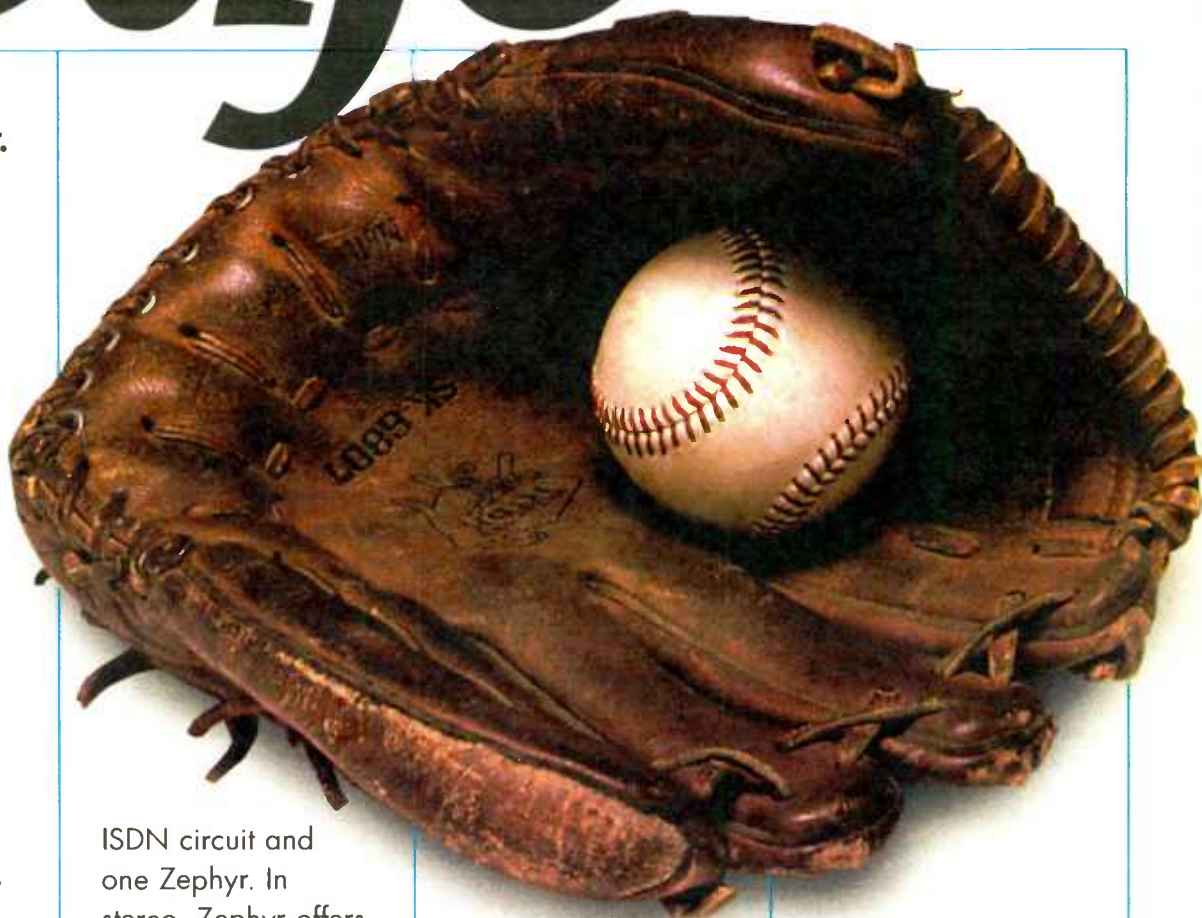
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Circle (81) On Reader Service Card

World Radio History

Communication Can Save Money

by Bob Rusk

Part II of II

MILWAUKEE, Wis. The focus of this two-part article is how engineers can help radio stations save money. In part one, Dwight Weller, Chapter 46 chairman of the Society of Broadcast Engineers, shared his expertise.

In part two, SBE President Terrence Baun shared his money-saving ideas based on his experience as a contract engineer. Baun stressed that communicating with management is critically important.

Two-way street

"We don't have all the answers, but we do know the nuts and bolts side of the business," said Baun. "I think managers have a tendency not to take advantage of that."

For a hypothetical example, Baun used a situation where a station's sales department sells a package of remotes to a car dealership on the other side of a 2,000-foot mountain.

"The Marti isn't going to make it back. So the manager will want to install a phone line, not realizing that will cost more than the entire remote package will bring in," said Baun.

Meanwhile, said Baun, "If the engineer had been consulted in the beginning, the problem could have been avoided." Possible solutions include doing a two-hop with the Marti, said Baun.

"If you don't have enough equipment for that, you could rent what you need. There are always cost-saving alternatives that can be explored."

Just as management needs to keep engineers informed, engineers have a responsibility to keep managers informed about potential problems.

"A 30-year-old transmitter might be holding on okay," said Baun. "The electrical parts can usually be replaced, but as the mechanical parts wear out, they aren't going to be replaceable. The engineer must realize these things and keep management

informed so there aren't any big surprises."

The manager may have resources that the engineer does not know about, said Baun.

"The engineer might need to buy a blower for the transmitter and the only place he can find one charges \$750. The manager may have a brother-in-law in the next town who owns a motor shop and can get one for less money."

Cart machines

Baun talked about cost analysis using cart machines as an example. For stations that still use cart machines, now might be a good time to switch to hard disk. Despite the initial outlay of cash, it will likely save money in the long run.

"As cart machines age, it gets to the point where parts are not only difficult to find — they may be impossible to find," said Baun. He said suppose the cart recorder motor malfunctions and a new one will cost \$600.

"Should you spend the \$600? What's going to be the ultimate return on that investment? Would you be better off replacing it with a used machine? Maybe you should look at the entire cart system and say, 'If this motor is going, we may lose another one soon.'"

Baun said instead of doing a short-term repair, replacing the cart system with a hard disk may be a better option.

"If you can replace 18 cart machines, that's a lot of maintenance work that goes away. Time no longer needs to be spent cleaning heads and rewinding tape."

Budget for EAS

With the deadline for installing new emergency alert equipment quickly approaching, engineers who have not discussed new equipment with their managers need to do so soon.

"The engineer should have informed management a year ago that they have to buy an EAS system by Jan. 1, 1997," said Baun. "There's a tremendous amount of confusion within the industry about that.

It's not an option. It's going to have to be installed by the first of the year."

Baun said the engineer must tell the manager that the best estimate is it is going to cost anywhere between \$2,500 and \$3,500 to purchase one of the two type-accepted EAS systems.

"That should not be a surprise," said Baun. "I don't like situations where I get a call from a manager who says he has not even heard about it. A lot of stations are running close to the budget. An unexpected cost can have a major impact."

In addition to EAS, Baun said he feels that engineers have a responsibility to inform managers about all of the technical changes and new FCC regulations that impact radio.

There are many ways for engineers to gather this information. Baun said attending industry shows and SBE meetings, going to seminars or reading trade publications like RW are good ideas.

"Doing the reading isn't just a pleasant exercise. It's an important part of the value-added that engineering can bring to management," Baun added.

Pinching pennies

Unfortunately, many managers look upon engineering as the department that drains the station of cash. There are ways to turn that around, however.

"We may not be a profit center," Baun acknowledged. But he said engineers can save money by being fiscally conservative.

"That includes doing preventive maintenance and being prudent in the way we budget expenses. These are proactive things that will help management look upon us as more of a partner instead of an adversary."

Negotiating diplomatically with management can also be invaluable when budget cuts are necessary, said Baun.

"If \$5,000 has to be trimmed from your budget, you may have to explain that you don't have \$5,000 to give," said Baun. "You might have to tell your manager that such a cut would mean there would be no

money to buy tubes this year and then the station couldn't predictably stay on the air."

The manager may not have realized that, said Baun.

"When you tell him, he may look at where else he can eliminate some expenses. Maybe there's a part-time employee who only handles remotes. Maybe you could teach the promotions person how to do that."

For that to happen, on-going communication is essential.

"It's easier to cut expenses than to make income," said Baun. "So engineering is a tempting target when it comes to budget trimming."

Baun added that engineering does not exist just to keep the transmitter on the air.

"That's a very short-term goal. The transmitter only exists because the business exists — because the audience exists. If we don't understand that whole process, we're going to take the short view of things. We can't afford to do that because we'll just end up patching and doing the quick fixes which in the long-term isn't going to save the industry." ☺

And the Nominees Are . . .

WASHINGTON The final nominees for the National Association of Broadcasters' Marconi Radio Awards competition have been selected.

Winners in each category will be announced Oct. 12 during the NAB Marconi Radio Awards Dinner & Show at the close of the NAB Radio Show this fall.

And the nominees are...

Legendary Station of the Year

KING-FM, Seattle
KNX(AM), Los Angeles
KSL(AM), Salt Lake City
WHAS(AM), Louisville, Ky.
WJR(AM), Detroit

Network/Syndicated Personality of the Year

Karl Haas, "Adventures in Good Music," Seaway Productions/WCLV(FM), Cleveland

Paul Harvey, "Paul Harvey News & Comments," ABC Radio Networks, Chicago

Don Imus, "Imus in the Morning," Westwood One Radio Networks, New York

John Boylesley and Billy James, "John Boy and Billy Big Show," WRFX(FM), Charlotte, N.C.

Dr. Laura Schlessinger, "Dr. Laura Show," SBI Broadcasting International, Newport, Calif.

Major Market Personality of the Year

Bob Collins, WGN(AM), Chicago
Jim Dunbar, KGO(AM), San Francisco
Hudson & Harrigan, KILT-FM, Houston
Mason, WJLB(FM), Detroit
Mike Roberts, WVEE(FM), Atlanta

Large Market Personality of the Year

Coyote Calhoun, WAMZ(FM), Louisville, Ky.

Roger Hedgecock, KSDO(AM), San Diego
Bob Reitman and Gene Mueller, WTKI(FM), Milwaukee

Glenn Scott, WSJS(AM), Winston-Salem, N.C.

John Ulett, KSHE(FM), St. Louis

continued on page 10 ►

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"The Sound Enhancer is an incredible box... It is a key part of our station operation and is the one tool that is indispensable for our music archiving." Paul Senstrom, KGVL-AM, Greenville, Texas, in *RadioWorld*, May 1996

"Philips has packed a lot of useful tools into this one rack-space unit." Don Jennings, Media Technologies, in *RadioWorld*, January 1996

"The decision to buy a Philips Sound Enhancer is a no-brainer. Just do it!" Roger Nichols, *EQ Magazine*, January 1996

"Although its functions are complex, the enhancer is very easy to use. We use it every chance we can." Frank Campbell, Bismarck Recording, in *Pro Sound News*, November 1995

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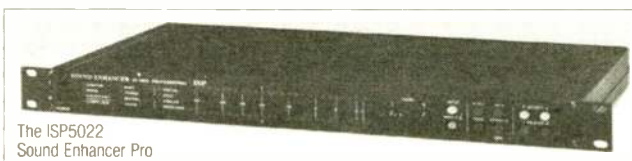
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INTERNATIONAL UPDATE

BT Announces End of Analog Lines

by Jeff Cohen

LONDON British Telecom (BT) served notice on all its radio customers that at midnight on July 31, 1997, virtually all existing permanent analog sound lines will be disconnected.

The bombshell came in a letter to selected station staff and, due to an out-of-date BT mailing list, it was some time before the impact of the announcement hit most organizations.

The decision affects every radio station in the country and many other organizations that maintain sound broadcast circuits.

Furious customers

With only about two weeks' notice, BT also ceased the provision of any new analog lines, instead offering two types of digital circuit as substitutes.

But customers were immediately furious with the telecom company, which has the monopoly on dedicated broadcast services in the United Kingdom, because the tariffs for the substitute services are up to 100 percent higher than those they replace.

For example, an analog mono 15 kHz circuit running a distance of approximately five kilometers would have cost about \$1,950 installation and \$2,100 annual rental.

But the digital replacement, Musicline 200, is about \$9,750 for installation and \$1,750 per annum rental.

BT said further provision of analog technology became an anomaly in the context of global digitization and the new types of circuit are more straightforward to supply and maintain.

They are based on standard 2 Mbps telecommunications circuits with the provision of digital encoders and decoders.

Higher cost

A further low-quality service providing 15 kHz circuits using aptX-100 bit-stream coding (largely for AM station radio-to-transmitter links) will also now be available from BT but also at a higher cost than previous analog service.

The only part of the old service to remain will be straight cable runs of distances less than about 1.5 miles, which do not involve any central office (telephone exchange) equipment.

But, BT stated the repair service on these will be reduced to a low-priority, seven-day response to faults, which makes them unsuitable for serious broadcast applications.

Controversially, BT will continue to provide its TV customers with low-cost analog sound lines as long as these are between centers with fiber-fed video circuits.

This led to accusations that BT values its TV business more than that of radio. BT Broadcast Services' annual accounts show that major TV organizations provide most of their revenue.

Predictably, the radio industry is furious and many large customers such as BBC Radio, NTL and the Commercial Radio Contractors Association (CRCA) took the matter to the government regulator, the Office of Telecommunications (OFTEL). And, as of press time, a judgment was awaited on whether BT was acting fairly.

The CRCA say the financial burden on many smaller radio stations of maintaining BT lines will be crippling.

methods such as radio links.

But there is not such an obvious alternative for permanent services as there was

Virtually all existing permanent analog sound lines will be disconnected.

Some months ago BT ended the provision of temporary Outside Broadcast lines due to most customers migrating to use of ISDN instead.

Industry sources believe BT had thought that, in the absence of the unprofitable analog sound lines, customers would simply seek out alternative

in ISDN for temporary ones, for instance there are not enough frequencies available to allow for widespread use of microwave.

Industry reaction

However, there are indications that the very strong reaction by the industry may

have some impact on BT.

This reached its peak when numerous foreign broadcasters came to the United Kingdom in June for the European Soccer championships and found they did not have sound circuits provided for TV and radio commentaries.

Angry scenes with many major broadcasting organizations were reported and within two days, BT provided all the required sound circuits.

Meanwhile, manufacturers of radio link, and various types of digital audio coding and multiplexing equipment are standing by to provide alternatives should these be needed by broadcasters when and if analog sound line finally cease next year.

□□□

Jeff Cohen is the director of World Radio Network and a contributor to Radio World. Contact him in the UK at telephone: 44-171-896-9007; or via e-mail: jeff@wrn.org

San Diego Spectrum for Convention

► continued from page 1

his job is to work with local Society of Broadcast Engineers to make sure stations do not interfere with each other on the band.

The job is a large one and the costs are enormous. That is why the bill for frequency coordination rotates between the networks every four years.

Full band

Dealing with spectrum in San Diego, the second-largest city in California, and in Los Angeles, the media capital of the nation, has not been easy because the band is very full as it is.

Normal FCC rules give most stations the right to come to an event and cover it. For the convention, however, the FCC suspended the rule granting that right and appropriated the authority to Hacker and his frequency coordination committee.

The frequency coordination committee is working with the local SBE and the Federal Communications Commission. Deciding who gets priority is one of the major factors that must be considered early. Hacker said his team took pains to make sure that local stations were protected by making sure no one was near the local stations on the band.

Because of the special authority granted by the FCC, the committee was allowed to use more of the spectrum. On the AM band, the only channel open for use between Los Angeles and San Diego was the 450 AM repeater channel. That channel has been reserved for use by the Republican National Committee.

Hacker said the committee has not had any problems with frequencies overlapping one another on the band. Local San Diego stations seem to agree that the frequency coordination committee is doing a good job.

Cliff Albert, program director for news/talk station KSDO(AM), San Diego, said his station has not had any problems with frequency coordination even though his station will broadcast

from several locations both inside and near the convention center.

KSDO will broadcast live from 6 a.m. until 11 p.m. primarily over a combination of ISDN lines. He said technically, this is the biggest event his station has ever seen and work space could pose some potential problems.

Cellular phones have long made remote radio relatively easy, but according to Albert, those will not be an option at the convention because of the amount of RF traffic.

Ready to go

Many stations will be using ISDN, fiberoptics or hybrid two-way calling set-ups. Other than another 15-state power outage like the one the first week of July, Albert said his station is ready to go.

Meanwhile, KCEO(AM) will produce its "Money in the Morning" show in coordination with local NBC affiliate KNSD live from the convention floor.

frequency coordination than the Olympic Games.

In San Diego, he said, his committee is coordinating with media from overseas as well as all across the United States. But in Atlanta, most of the major coverage is going through NBC.

Although he expects more international media will cover the Olympic Games, Hacker said the European Broadcast Union

will be covering the GOP convention. Hacker said NBC will have a lot more control as far as limiting what goes out in Atlanta. In San Diego, however, there will be many more audio and video frequencies to deal with.

While Hacker said most of the coordination is going smoothly so far, he compared running frequency coordination at the GOP convention to flying an airplane with no experience.

"Which switch do you throw first? On paper, it's a good engineering concept.

**KSDO
AM 1130
NEWS TALK RADIO**



San Diego will host the GOP Convention

KCEO Program Director John Van Zante said, "It definitely helps to be local. It's easier to get the lines you need."

Hacker, who also works for CNN in Atlanta, said the Republican Convention is actually a bigger challenge for

You are only 90 to 95 percent sure that it's going to work the way it should according to the paper. Still, even with all the efforts of all the companies, you're never sure that it won't all blow apart." □

The Marconi Nominees

► continued from page 8

Medium Market Personality of the Year

Bruce Bond, WNNK-FM Harrisburg, Pa.

Al Caldwell, KLVI(AM), Beaumont, Texas

Gene McKay, WSCQ(FM), Columbia, S.C.

Max Meeks, WMFR(AM), High Point, N.C.

John Watson, WILM(AM), Wilmington, Del.

Small Market Personality of the Year

Michael H. McDougald, WRGA(AM), Rome, Ga.

John Murphy & George House,

WAXX(FM), Eau Claire, Wis.

Bill O'Brian, KRKT-AM-FM, Albany, Ore.

Curt Teigen, KZZY-FM, Devils Lake, N.D.

Mike (James) Whitmore, WEOL(AM), Elyria, Ohio

Major Market Station of the Year

KGO(AM), San Francisco

KODA(FM), Houston

KQRS-AM-FM, Minneapolis

WFAN(AM), New York

WHUR-FM, Washington

Large Market Station of the Year

KIRO(AM), Seattle

WGAR FM, Cleveland
WHAS(AM), Louisville, Ky.
WTKI(FM), Milwaukee
WSIX-FM, Nashville, Tenn.

Medium Market Station of the Year

KASE(FM), Austin, Texas

KSSN(FM), Little Rock, Ark.

WEAS-FM, Savannah, Ga.

WILM(AM), Wilmington, Del.

WOKQ(FM), Dover, N.H.

Smaller Market Station of the Year

KGMI(AM), Bellingham, Wash.

KOEL(AM), Oelwein, Iowa

WAXX(FM), Eau Claire, Wis.

WGOH(AM), Grayson, Ky.

WRGA(AM), Rome, Ga.

AC/EZ Station of the Year

KCDZ(FM), Joshua Tree, Calif.

WALK-FM, Nassau, N.Y.
WHBC(AM), Canton, Ohio
WINC-FM, Winchester, Va.
WLTE(FM), Minneapolis, Minn.

Big Band/Nostalgia

WMMB(AM), Melbourne, Fl.

WMTR(AM), Morristown, N.J.

WQEW(AM), New York

WROD(AM), Daytona Beach, Fl.

WSCQ(FM), Columbia, S.C.

CHR

KDWB-FM, Minneapolis

KPWR(FM), Los Angeles

WBZZ(FM), Pittsburgh

WJMX-FM, Florence, S.C.

WSTW(FM), Wilmington, Del.

Classical

KING-FM, Seattle

WCRB(FM), Boston

WGMS-FM, Rockville, Md.

WQXR-FM, New York

WRR(FM), Dallas

Country

KEAN-AM-FM, Abilene, Texas

KMPS-AM-FM, Seattle

KSSN-FM, Little Rock, Ark.

KTTS-FM, Springfield, Mo.

WQCB(FM), Brewer, Maine

Jazz

KPLU-FM, Tacoma, Wash.

WBJB-FM, Lincroft/Middletown, N.J.

WKCD(FM), Pawcatuck/Mystic, Conn.

WUEV(FM), Evansville, Ind.

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KCBS(AM), San Francisco

KLBJ(AM), Austin, Texas

KNX(AM), Los Angeles

WBAP(AM), Dallas

WFAN(AM), New York

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KRTH(FM), Los Angeles

WCBS-FM, New York

WJMK(FM), Chicago

WOGL-FM, Philadelphia

WQSR(FM), Baltimore

Religious/Gospel

KWBI(FM), Denver, Col.

WAOK(AM), Atlanta

WAVA(FM), Arlington, Va.

WMBI-FM, Chicago

WMHK(FM), Columbia, S.C.

Rock

KATT-FM, Oklahoma City, Okla.

KISS-FM, San Antonio, Texas

KSHE(FM), St. Louis

WFBQ(FM), Indianapolis

WHEB(FM), Portsmouth, N.H.

Spanish

KGST(AM), Fresno, Calif.

KLTN(FM), Houston

KRMX(AM), Pueblo, Colo.

WOJO(FM), Chicago

WSKQ-FM, New York

Urban/R&B

WEAS-FM, Savannah, Ga.

WGCI-FM, Chicago

WIZF(FM), Cincinnati

WJLB(FM), Detroit

WUSL(FM), Philadelphia

In mid-August, NAB member radio stations will receive a profile booklet of the nominees and two ballots — one for the general manager and one for the program director. The ballots are due back by Sept. 6 for tabulations.

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Candidates Push for Free Air Time

by D.C. Culbertson

WASHINGTON Despite the diverse beliefs of the 1996 political candidates, nearly all of them — from Pat Buchanan to Bill Clinton — seem to agree on the necessity for broadcasters to grant free air time to candidates.

Free air time, proponents argue, would give viewers a better chance to form a fair and objective opinion about what candidate they want. Free broadcast time would also offset the ever-increasing amount of money — and fund-raising time — needed to run for office.

In June, the McCain/Feingold Campaign Finance Reform Bill was introduced in the Senate. The bill, subsequently defeated on June 25, would have granted federal candidates a half hour of free time and 50-percent off the current lowest unit rate.

Free time

On the same day, the Federal Communications Commission held an en banc hearing on a proposal filed by Rupert Murdoch, chairman and CEO of the Fox Broadcasting Company.

The Murdoch proposal would dramatically increase the amount of free air time allotted to presidential candidates including an hour-long program on election eve and up to 10 spots featuring responses to questions from an independent consulting or polling organization during the preceding six weeks.

The other major networks — ABC, NBC, CBS and PBS — have made suggestions of their own regarding air time along considerably more conservative lines.

Fourteen panelists participated in the FCC hearing including Murdoch, Senators John McCain, R-Ariz., and Bill Bradley, D-N.J., John Andrews of TCI News and representatives from the American Enterprise Institute and the Media Access Project.

Many favored the proposal, but some panelists expressed concern about handling requests for free air time from minor party candidates without being

accused of discrimination. The hearing ended without reaching any definite conclusions.

Current rules relating to air time for political candidates were last revised by the FCC in 1992. They basically deal with three elements: reasonable access, equal access and lowest unit rate.

Stations cannot turn down requests for air time by any legally qualified federal candidate and must offer all candidates — regardless of affiliation — the same broadcast rates and amount of air time.

Penalties for violating these rules are stiff.

Appearances by candidates on any bona fide news events or programs are exempt from this rule.

All candidates must be offered the

“lowest unit rate” of payment for their air time. The broadcaster cannot censor any candidate’s use of the station as long as that use fits pre-determined guidelines.

While noncommercial stations are exempt from rules relating to the sale of air time, they must observe the same rules relating to access. All requests for air time by or on behalf of candidates must be kept in the station public inspection file for two years and program logs must be reviewed periodically to determine if any candidates require rebates.

What the future holds

Penalties for violating these rules — even unknowingly — are stiff. They vary from a written reprimand from the FCC to fines up to \$25,000 per day. Complaints from candidates relating to any of these matters must be addressed directly to the FCC.

Because of the defeat of the Senate bill and the fact that the Fox proposal relates almost exclusively to television, there appears to be little chance of any change in the existing rules governing radio air time for candidates during this election year.

Barry Umansky of the National Association of Broadcasters said the organization is opposed to any rule mandating free air time to political candidates, feeling that the choice should be left exclusively up to broadcasters.

He said such a rule could create real

problems especially with regard to equal opportunity provisions and the possibility that a minor-party candidate might have to be eliminated from events like debates.

Frank Montero, a lawyer with the communications firm of Fisher, Wayland, Cooper, Leader & Zaragoza, whose clients are primarily broadcasters, said he feels that any effort to give candidates free air time is good because it eliminates

the economic element of a campaign.

He said the move is “a purely public service enterprise” although he did admit that the resulting lack of revenue could potentially hurt small-scale stations.

Neither the defeat of the McCain/Feingold bill nor the current debate over the Fox proposal is likely to be the last word in rules governing air time for candidates. But how or whether the rules will change markedly in the next few years is uncertain.

As Montero said, “Who knows? It’s like reading tea leaves.”

How the Groups Stack Up

CHANTILLY, Va. Plenty of shifting has occurred since the first BIA Consulting top 10 list was published in April (RW April 17).

In the new top 20 list from BIA, station counts and owner revenues include sales agreements as of July 8, 1996.

Owner	Stations	Revenue (\$000)
CBS Radio Station Group	83	973,500
Evergreen Media Corp.	36	293,550
Jacor Communications Inc.	57	271,350
ABC Radio	21	269,800
Clear Channel Communications	88	252,500
Chancellor Broadcasting Co.	39	202,150
American Radio Systems	55	201,050
SFX Broadcasting Inc.	66	193,300
Cox Enterprises	38	178,650
Bonneville International	20	123,900
Emmis Broadcasting Corp.	8	113,200
Viacom International Inc.	10	112,500
Susquehanna Radio Corp.	18	109,950
EZ Communications	23	108,500
Heftel Broadcasting Corp.	36	104,150
Gannett Company Inc.	11	91,200
Nationwide Communications Inc.	14	81,300
Secret Communications	14	77,050
Jefferson-Pilot Communications	16	77,000
Paxson Communications Corp.	38	72,075



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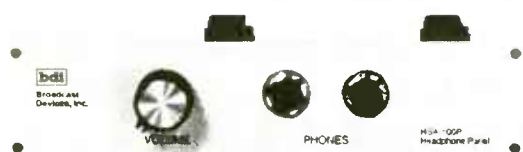
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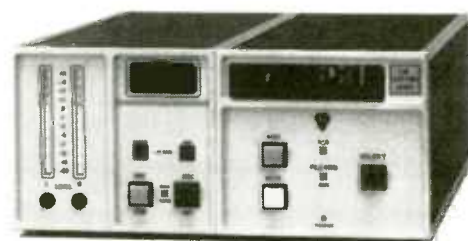
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Field Tests Finally Begin Out West

► continued from page 1

January and again in June, the board adopted a resolution emphasizing "its continued strong support for the completion of IBOC development with the aim of its expeditious adoption and deployment in this country."

The only IBOC system in the tests is that from AT&T/Lucent Technologies/Amati Communications. When asked if the NAB would still support the field tests without USADR, Eddie Fritts responded, "A deal is a deal with respect to those tests."

One part of the NAB deal was to find a

radio station that would agree to be used to test the IBOC system. Whether ownership changes, engineering changes or the IBOC lab test results have scared stations away is hard to say, but the NAB has yet to find a willing station.

The other systems being tested — AT&T/Lucent Technologies in-band/adjacent-channel (IBAC), Eureka-147 at L-Band and VOA/JPL satellite system at S-Band — will be using the EIA temporary station, KEIA, in the tests.

EIA Spokeswoman Lisa Fasold said the EIA has FCC permission to use KEIA for

IBOC tests just in case a station is not found. The out-of-band systems are being tested first.

While the DAB field tests seem to be progressing, many are wondering what will become of USADR.

When the contract negotiating began in December 1995, it quickly degraded to a "he said, she said" match between the Electronic

early and compared results between IBOC and the other systems.

She said USADR wanted a contract that would make sure the same thing did not happen after the field tests. When the EIA did not comply to the company's satisfaction, USADR withdrew from the field tests.

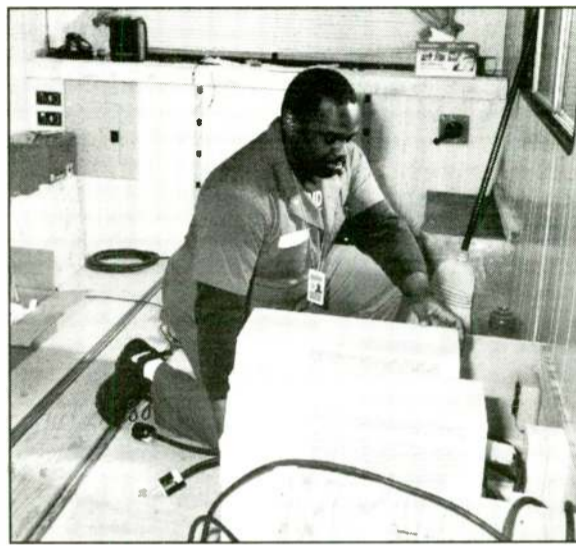
A source close to USADR said the proponent would attend the National Radio Systems Committee and Field Test Task Force meetings in July even though they were not participating.

The source added USADR is studying its options but did not say whether or not the company would try to get back in the field tests.

Since the announcement of the acquisition of Infinity, Westinghouse is taking a fresh look at USADR and doing some restructuring. Along with Gannett, Westinghouse has been one of the primary backers of USADR.

All of the DAB proponents' equipment is now out of the lab. While the other systems are in the test van, however, the USADR systems — two FM systems and one AM — are locked up in a room back home.

Said Fasold, "Right now, we would find it really hard to let them back in because there is no way to verify that the equipment they took out of the NASA Lewis Research Lab would be the same equipment they would be giving us for the field tests."



Outfitting the Test Van

DAB for Asia, Africa And Latin America

► continued from page 1

for the underdeveloped areas of the Third World to a mix of services designed for the fast-growing and high-tech affluent population centers.

Final details are in place to launch the three satellites. Agreements for the chip technology needed to affordably produce millions of StarMan radio sets were finalized with semiconductor giants SGS Thomson and ITT Internatell.

Throughout the six-year history of WorldSpace, doubts were cast on the project and on the ability of Samara's organization to carry it all out. But the continued leading role of the France-based space and telecommunications corporation Alcatel, the confirmed launch schedule and the finalization of arrangements for chip manufacture appear to put the whole project on the brink of realization. WorldSpace also announced an additional agreement with Alcatel Espace to operate the satellite orbit system.

The system was designed to provide a range of services, with audio from low-cost speech quality information channels delivering local radio, health and educational information, to high-quality stereo music, all utilizing ISO/MPEG Layer III coding that was developed in collaboration with the German Fraunhofer Institute.

There will be great flexibility with each of the three beams, which can provide up to 96 of the speech-quality channels at 16 kbps or be configured for high-quality audio by grouping many 16 kbps streams together. Commercial and international broadcasters will be sought for the leasing of these channels.

On technical grounds, the proposed system is not compatible with reception of terrestrial DAB, and though WorldSpace has examined the possibility of introducing features of Eureka-147, that has not materialized. In particular, the strength of Eureka-147 for reception in moving vehicles is not present in the WorldSpace system.

The WorldSpace satellites require a good deal of on-board signal processing and experts feel this introduces a risk of equipment failure and it would be wiser for such processing to take place on the ground.

The likely quality of reception also has been a hot topic of debate, as has the question of whether the power of the satellite is adequate.

One significant regulatory problem concerns the system's use of L-band frequencies that are not available for satellite use in all countries. It is anticipated that the U.S. will lodge an objection to the level

of interference from WorldSpace transmissions intended for the Caribbean, and some southern European countries are not happy with spillage from Africa on frequencies they do not plan to release until the year 2007.

The concept of a system built primarily for the developing world is novel and something with which some major broadcasters do not feel comfortable.

Also, because WorldSpace is a small, private corporation whose structure, ownership and finances are not known, broadcasting organizations that are accountable to the public due to public funding are somewhat reticent to get involved. However, Voice of America and Radio Netherlands registered early for options of first refusal on capacity.

WorldSpace is now opening its African headquarters in the Accra, Ghana, and the Ghanaian government obtained the Africa satellite's orbital slot from the ITU.

SGS Thomson and ITT Internatell were contracted to produce 1 million circuits, which are the heart of the StarMan receivers. Sales of sets to the public will be crucial to the project's early success.

According to WorldSpace, a minimum of 2 million receivers will be produced for the first year of service to meet current contracts with chip manufacturers.

WorldSpace maintained that in 10 years, 183 million people, "subject to several assumptions," would have paid \$100 extra for consumer products with WorldSpace reception.

Construction of the satellites will be carried out by a new joint France-U.K. company, Matra-Marconi Space. Launch dates are June 16, 1998, for AfriStar; December 16, 1998, for AsiaStar; and June 16, 1999, for CarribStar.

One of the final pieces to put in place, the On-station Operations Service (OSOS) that will permanently function as control center for the entire system, is under construction by Alcatel Espace under a contract valued at \$60 million. It will be based in Toulouse, France, and employ 45 people.

At the site in Toulouse, the first simulation of the entire system was recently tried out using a test-bench version of the satellite processor and prototype portable receiver. The organization said the result was completely successful.

But many of WorldSpace's important potential customers want to wait and see how the actual system performs.

□ □ □

Radio World International Editor in Chief Alan Carter contributed to this report. ☺

Industries Association and USADR.

In May, a down-to-the-minute showdown had the EIA lawyers on 24-hour call ready to talk. In the end, Bernice Strom with USADR said the EIA violated an agreement when it released lab test data

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SIGNAL-TO-NOISE

Non-PC Internet Radio Coming Soon to TV

by Frank Beacham

NEW YORK A dramatic race is now under way to extend the Internet beyond the personal computer platform. One of the most ambitious new projects — called WebTV and slated for a fall launch — is targeted at bringing cheap and easy Internet access to any standard TV set.

What has been overlooked in all the hoopla about WebTV is that the new technology will offer the first non-PC appliance that can be called an "Internet Radio." Actually, the device is a cable-style TV set-top box that allows any TV to become an Internet web browser. Built

inside, however, is a powerhouse audio system that also makes this device the first truly hi-fi digital Internet audio receiver.

To be sold by Sony and Philips at a retail price of only a few hundred dollars, the new WebTV boxes come with internal software that can play RealAudio, MIDI music or MPEG 1 and 2 audio programming. The box even includes real-time synthesis of 128 tonal musical instruments, 84 percussion instruments and audio special effects.

Out of the box the device's internal 33.6 kbps V.34bis modem is designed to connect to the Internet over a standard dial-

up phone line. This, of course, will limit the fidelity of audio streamed over the Internet. But, anticipating the near-term arrival of high bandwidth Internet services, the WebTV box has a 1.8 Gbps data port that allows hook-up to cable modems and other high bandwidth peripherals.

Although WebTV complies with today's Internet standards (HTML 3.0 and virtually all Netscape Navigator 3.0 and Microsoft Explorer 3.0 extensions), it is also designed to scale with the Internet through its evolution. Every time a set-top box connects to the WebTV network, it checks for software updates. When new

software and HTML extensions are released, the box automatically updates itself by storing the data in Flash ROM.

Planning for an expected rapid improvement in Internet audio, WebTV's engineers gave their new box 44.1 kHz, 16-bit digital stereo outputs and powerful digital signal processing capabilities. There's also MIDI Jukebox software that supports customized background music for each user. And, there's an ISO Smart Card slot that supports ISO-compliant Visa, Mastercard, ATM and cash cards for on-line purchases. (It becomes easy to use your imagination as to what can be done with such features.)

In addition to partnering with Progressive Networks, maker of RealAudio streaming software, WebTV is working with Headspace, a company co-founded by musician/composer Thomas Dolby Robertson, that specializes in music and sound technology for the Internet and interactive entertainment. Headspace is providing the music

Built inside is a powerhouse audio system.

and audio effects technology for WebTV.

Headspace will be launching its RMF (Rich Music Format) technology with WebTV. RMF is a platform-independent open standard created to provide intelligent musical interactions in the multimedia and on-line arenas. It allows the streaming of high-quality MIDI music integrated with digital audio. RMF files are designed to be compact and respond intelligently to a user's interaction with a web site or CD-ROM. Audio quality is much higher than with most multimedia or Internet technologies.

If you think WebTV just came out of the blue, you are about right. Founded in 1995 by three Apple Computer veterans now in their early 30s, the start-up has been secretly developing its Internet capabilities under the fictitious business name Artemis Research in the garage of a former automobile dealership in Palo Alto, Calif.

There is some serious talent and money behind the new company. CEO Steve Perlman designed much of the underlying video, graphics and multimedia technology in the Macintosh computer. COO Bruce Leak is responsible for creating Apple 32-bit Color Quickdraw and industry-standard Quicktime multimedia software. Senior engineering vice president Phil Goldman created Multifinder, the heart of the Macintosh operating system. Their financial backers include Paul Allen of Microsoft fame and former movie mogul Marvin Davis.

For more information on WebTV technologies, products or services, call (415) 614-5566; or e-mail: pr@webtv.net. WebTV home page is at <http://webtv.net>

□□□

Frank Beacham is a New York-based writer and producer. Visit his Web site at: <http://www.beacham.com>. Mail: 163 Amsterdam Ave. #361, New York, NY 10023. E-mail: frank@beacham.com

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COLE'S LAW

Redefining Radio 'Markets'

FCC Definition of Radio Market Could Contribute to Increased Local Concentration

by Harry Cole

WASHINGTON That sound that you may have been hearing at all hours of the day and night since last February is probably nothing more than the sound of the radio industry consolidating itself into a nice little club of four or five licensees who will control all the radio stations in the country, probably in the next week or two. (Okay, so I exaggerate — maybe there will be as many as 10 or

12 different licensees ...)

While anybody with half a brain expected consolidation to flow from the enactment of the Telecommunications Act of 1996, it is probably safe to assume that the speed with which that consolidation has been occurring has surprised many.

One factor likely contributing to the speed of that process is the ability of group owners to acquire not just a lot of stations, but a lot of stations in particular markets — notwithstanding the fact that

Congress retained local (albeit relaxed) ownership caps.

The particular question of how those local ownership caps are being applied provides interesting insight into the thinking, or lack of thinking, that went into the deregulation of ownership limits.

Old limits

Before the enactment of the Telecommunications Act of 1996, there were limits on the overall number of radio stations you could own nationally, and also limits on the number of radio stations you could own in any particular market. With respect to the local limits,

the commission's rules prohibited any one entity from owning more than two stations in a given service in a given market. Life was pretty darned simple.

But then along came Congress, which eliminated entirely the national ownership cap and which increased the number of stations that could be owned locally. According to Congress, local ownership limits would depend on how many stations already serve the relevant local "market." As a result, one licensee could control as many as eight stations (no more than five in the same service) in a given market, as long as the market had 45 or more commercial radio stations.

While Congress' specific rationale is not stated in the legislation, it is apparent from the numbers that Congress did intend that, even in the smallest markets, there would be at least three competing radio licensees. And in the biggest markets (with 45 or more commercial stations), there would be at least six different competitors.

So far that seems to make sense. But the problem is that Congress, apparently without thinking about it too much, decided to use the FCC definition of market, even though that definition had been developed in the context of a far different set of ownership rules. Congress' decision has created, shall we say, opportunities that Congress may not have anticipated.

City-grade signals

The FCC definition of a market depends on the city-grade signals of the stations to be commonly owned. When the rule provided that, no matter how many other stations might be around, you could own only two stations in a given service with overlapping city-grade signals, that definition may have been appropriate. But when the possibility exists that you can own up to eight stations in any particular market, how you define the term market suddenly takes on added significance.

Take Trenton, N.J. A swell town, the capital of the state of New Jersey, a substantial community with a significant suburban outgrowth. It's got a metro population of more than 300,000. It's treated by local folks, and by at least one national audience ratings service, as a market unto itself. While Philadelphia is 30-40 miles down the road, Philadelphia is its own market, independent of Trenton, and vice versa.

At least, that's what folks in Trenton used to think.

There are eight radio stations licensed to Trenton or its suburbs. If Trenton were viewed as a stand-alone market (as common sense dictates) under the new local ownership limits, the most stations any one entity could own in the Trenton market would be four. So the most ownership concentration you might normally expect would be to have all the stations in the market owned by two different licensees, each holding four of the eight local licenses.

But wait. According to the FCC's definition of market for multiple ownership purposes, you look at the total number of stations — irrespective of their communities of license — which have city-grade contours that overlap the city-grade contours of the stations to be commonly owned. So if you start off with a Class B FM station (or a reasonably high-powered AM station) in Trenton, you immediately expand the relevant market to include most, if not all, Philadelphia stations: because most Philadelphia stations are higher powered, their city-grades extend

continued on page 18 ►

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FCC Should Redefine 'Markets'

► continued from page 16

out toward Trenton, so much so that they easily overlap city-grades from Trenton.

Counting stations

So when you define the Trenton market to include the majority of stations in Philadelphia (and other communities in the vicinity), suddenly you find that the Trenton market doesn't just have eight little old local stations; rather, it has as many as 30 stations! Under the new local limits, that means that a single licensee could legally own seven of the eight radio stations licensed to Trenton or its immediate suburbs.

In other words, despite the fact that

local ownership is supposed to be limited in some meaningful sense, the way that limitation is being implemented by the commission effectively eliminates most meaningful restrictions. The result is that, even as you read this, local concentrations of ownership are flourishing well beyond the constraints which Congress seems to have believed it was enacting.

Trenton is not the only place where this phenomenon could occur. For another example, an entity seeking to own seven stations in Rochester, N.Y., advised the commission — accurately, as far as I know — that there were 30 stations in the relevant Rochester market, i.e., enough stations to support common ownership of

seven stations in the market. But to get the total number of market stations up to 30, the applicant included among those 30: a station in Buffalo; a 3.8 kW FM station more than 20 miles from Rochester; and a 0.9 kW AM station some 40 miles from Rochester.

All of these stations do appear to satisfy the FCC's definition of being "in the market" because their city-grades overlap, to one degree or another, the city-grade of at least one of the stations to be acquired. But you still have to wonder how the commission or Congress could ever seriously contend that a station in Buffalo, or a 900 W AM station 40 miles outside of Rochester, constitutes a competitive

voice in the Rochester market.

There are, presumably, many other such examples across the nation. Again, I note these particular examples not to suggest any wrong-doing on the part of the applicants in question — they are, after all, merely taking advantage of the law as written.

Limited sense

I do mean to suggest that the law, as written, makes only limited sense.

From what I can see, the problem arises from laziness or carelessness on Congress' part. Congress, enthralled by the hypnotic notion that "deregulation invariably leads to greater competition," chose to deregulate local ownership limits somewhat. That's fine. But in doing so, Congress seems to have neglected to think through the details of how that deregulation was to be implemented. In particular, Congress appears not to have given any attention at all to the definition of market. Instead, Congress simply bucked that question over to the commission.

The result is that Congress' deregulation is likely to diminish local competition, rather than enhance it. If one entity can own seven of the eight radio stations local to a market like Trenton, it seems that competition has suffered. The same is true if increased concentration of control in a market like Rochester can be justified on the basis of a 900 W station nowhere near Rochester.

Of course, the commission itself could correct this problem by adjusting the definition of market in light of the new local limits. The FCC has taken no steps at all in that direction, however, and with the breakneck speed of consolidation, both national and local, it is doubtful that the FCC will ever take such steps. And, with the current speed of consolidation, if the commission waits much longer, the issue may become moot.

If you have any questions about this, you should be sure to discuss it with your communications counsel.

□ □ □

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

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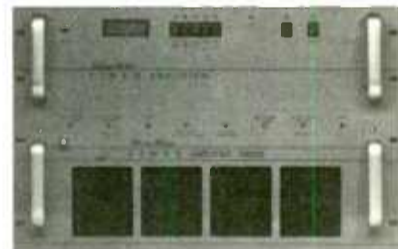
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Painting Towers Takes Time, Diligence

Painting a Tower Can Be Time-consuming Work, And Sometimes You Get More than You Bargain for

by Troy Conner

BRASSTOWN, N.C. Think quick now. When was the last time the tower was painted? If you have a hard time remembering exactly when, then it's probably been too long.

Generally speaking, after three to five years the paint is probably no longer in compliance with FAA specifications. The paint on most towers I have reason to climb is not even close to required reflectivity.

Anyone who owns or is otherwise responsible for the care and feeding of a tower should call their regional FAA office and request a copy of FAA Advisory Circular 70/7460-1H "Obstruction Marking and Lighting." This free publication is the FAA rule book regarding tower marking (painting) and lighting.

Valuable tool

An aviation-orange color tolerance chart, purchased from a paint manufacturer, is

also a valuable tool in determining the condition of the paint. Sampling should be done on the upper half of the structure, as weathering is greater there. This is a task that can easily be performed during an annual inspection, relamping or any other task that requires personnel to climb the tower.

Tower painting is a notoriously expensive, less-than-glamorous purchase. It's like buying tires, you know you have to do it, but it's just not fun or very satisfying, so it is often put off as long as possible. As a painter of towers, trust me when I say that tower painting is not, and I repeat not, fun. It is extremely messy, monotonous and just generally

takes much longer than I would like it to.

Modern advances have helped. Latex paints and the airless paint sprayer are indeed godsend, as are the pressure washer and, in severe cases, a sand-blaster. I do not mourn the demise of the old traditional paint mitt. I have returned to the ground sunburned, wind-burned and red-eyed after a long day of painting, and then faced the indignity of having to soak my hands in gasoline to remove my shirt sleeves from my wrists once too many times to miss the paint mitt and non-water soluble paints.

Unforeseen disasters

Along with the technological advances come the unforeseen disasters. Take for example a friend and competitor of mine. A nice guy and a tower painter extraordinaire. I can literally identify his work, he is that good. Starting as a teenager, he has done nothing but paint big towers for more than 20 years. He truly understands paints and the painting

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Expect a good contractor to spend one or more work days for each hundred feet.

process. He takes his time doing the prep and primer work. Lastly, he sprays a nice heavy coat of paint on every bit of exposed steel.

Paint is pretty heavy stuff, and to generate sufficient head to pump it straight up — up to 2,000 feet — takes one heck of a paint sprayer. We're not talking about something you pick up at the local hardware store to paint the house. It takes roughly five to 10 horsepower to push paint that high in the air. We're talking about a sprayer that can suck up a five gallon bucket of paint just to fill the hose. Typically, a tower sprayer is a gasoline-powered, commercial paint pump capable of running half a dozen guns, of which only one port is used.

Hot towers

Back to my friend. He shared this horror story with me on a job we worked together in Southern Texas. Years ago, right after building his first airless paint sprayer, he was painting a small AM tower just outside of Washington. It was his first AM station using the sprayer. As was typical in those days, he was working the tower hot because the station would not or could not afford to be off the air for any length of time, much less the time it takes to paint a tower properly. The rubber paint hose was OK, it couldn't ground the tower out, so up the tower he headed towing the hose.

Meanwhile, on the ground the Briggs and Stratton five-horsepower sprayer was running wide open. At some magic point the radiated frequency equaled the length of the hose then suspended vertically right next to the tower, and it burned the hose in two.

Pandemonium then ensued. The sprayer, pumping its little heart out, proceeded to shower a nearby Volvo dealer-

continued on next page ►

ship with five gallons of aviation-orange paint, leaving more than 50 new cars speckled in orange. Call the insurance agent. There goes the profit on this job. The culprit: the metal braided reinforcement between the two layers of rubber in the hose.

than jobs done well. Most good paint contractors will query the station owner, manager or engineer extensively about the site, in addition to asking for details about the tower. A site visit prior to bidding is a good sign on any job of significant size. A good contractor will provide you with a list of references without being asked. The same goes for a certificate of liability insurance. Check the references and the insurance.

Watch a good tower paint contractor and you should see as much or more time spent on the prep and priming as on the actual painting. Spot primer should be applied immediately after scraping and brushing an area. A pressure washer often provides the best surface preparation on badly deteriorated or failed paint, which also usually necessitates the application of primer on the entire structure.

Prep time

Normally the top of the tower will be more weathered than the lower half, so it should receive more attention and take longer than the bottom half. In addition, you should see more time spent prepping the white color bands than the orange, as the white paint, having less pigment, normally

fails before the orange paint.

Expect a good contractor to spend one or more work days for each hundred feet of all but the smallest guyed structures. Self-supporting structures are considerably more time consuming due to the additional rigging and contortions required to properly paint all surfaces: inside, outside, top and bottom.

Old socks

A good contractor will also mask the beacon(s) with garbage bags (removed nightly) and probably use old socks to mask the smaller obstruction fixtures. All exposed steel should be thoroughly painted, and that includes the ladder, any platforms, antenna mounting hardware, etc.

Keep in mind that the paint on the

tower has two distinct functions: to comply with FAA regulations and to slow inevitable corrosion. It is also wise to request that the guy termination hardware be painted with cold-galvanizing compound. Areas that should not be painted include any rigid transmission lines and the insulators at the base of AM towers.

Finally, any good contractor should not object to having their work inspected by an independent tower firm. Close-up photographs of the paint at a dozen or more points on the tower should provide a sufficient sample to determine the quality of the work.

□ □ □

Troy Conner is the owner of Tower Maintenance Specialists, and can be reached by phone at (704) 837-3526; or by fax at (704) 837-1015.



The task of finding a reputable, knowledgeable painting contractor to paint a tower can be a challenge. In the process of inspecting towers across the country, I have seen more botched paint jobs

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WORKBENCH

Troubleshoot Wandering Patterns

by John Bisset

SPRINGFIELD, Va. That 14-month deadline for NRSC and harmonic measurements for AM stations is near — depending on when you made measurements last year. Remember that in addition to checking the close-in “NRSC” emission requirement, stations still must measure their harmonic frequencies and record the result, along with a description of the measurement procedure. Refer to 73.44 and 73.1590 for more information.

Speaking of AM, we encountered a client with what appeared to be a wandering pattern — the phase and ratios of the four-tower array were changing as he watched the parameters on his PI AM-19 antenna monitor. The phases were drifting up to 20 degrees from the norm, and the loop ratios were at least 10 percent out. It sounded like a capacitor was going bad somewhere. The big storms we’d just had the night before could have caused the problem, we surmised.

Our first step was to pull the J-plug for each tower, one at a time, to see if the

problem would settle down. The problem persisted. Thinking the problem was in the phasor, one of my associates suggested we check the monitor points. They were rock stable.

Now we were getting somewhere. Because nothing looked amiss in the phasor and the common point impedance was normal, our attention turned to the antenna monitor. Yes, sometimes Potomac Instruments gear breaks — especially if it was helped along by lightning. In this case, the +15 V DC supply was no longer regulated, and was reading 22 V.

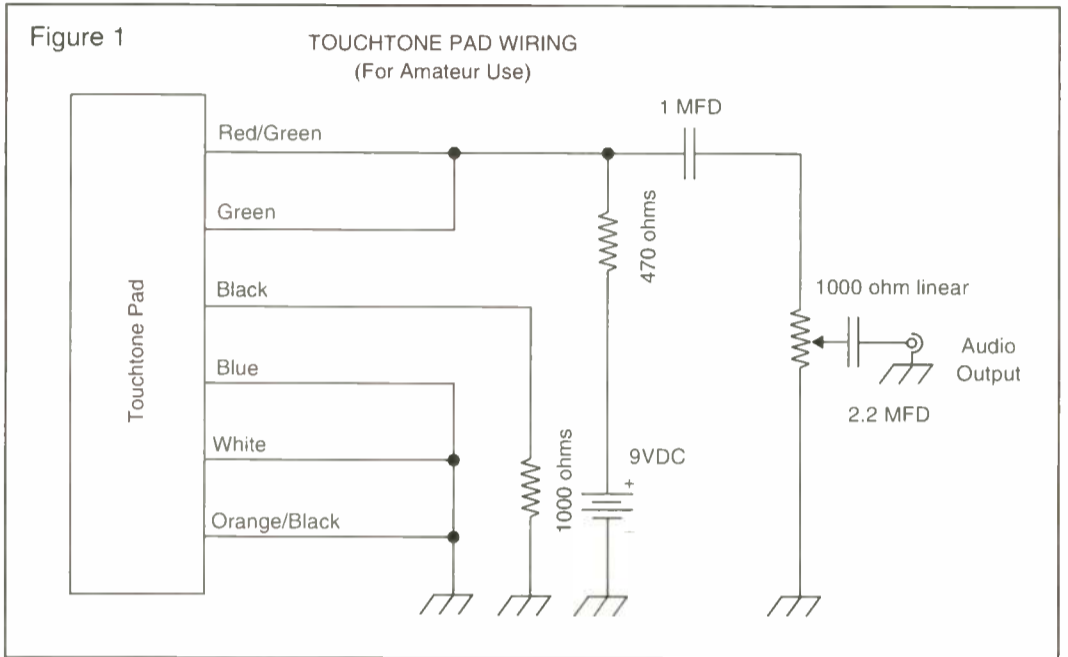
If you suspect your antenna monitor, check all the DC power supply voltages first, and particularly the filter capacitors. Because the monitor bases its calibration and operation on reference voltages, they have to be right to give you good readings.

I got a call the other day from an engineer who was looking to set up a touchtone

pad to feed down an equalized line to start a cart recorder at the other end. Seems he had a number of keypads in his parts box, and didn’t want to spend the money for the Radio Shack equivalent. After finding the schematic, which I think I got from a ham publication years ago, I thought it might

which will vary according to voltage and relays used, but the circuit is ideal for walk-away jocks who only have to insure that a fresh cart is in the machine, and the record button has been pushed.

The circuit is also helpful in preventing the airing of an old traffic report. If the record button is still lit, you know the traffic person has not yet recorded the report.

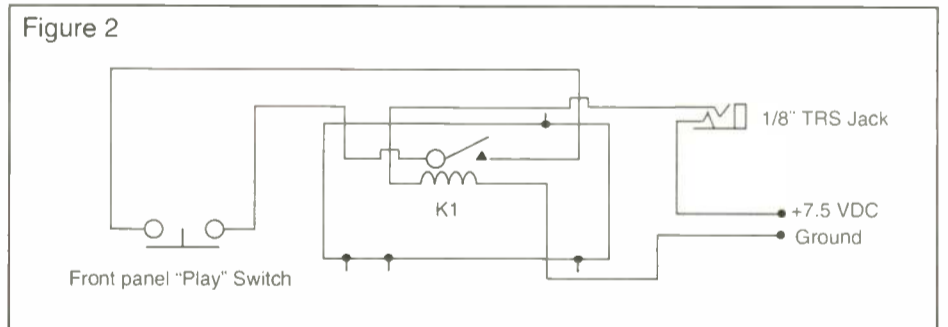


be useful to others.

Figure 1 shows the hookup, which we ran into one of the mic mixer inputs. On the receive end, the touchtone decoder hung across the line. The record procedure, which came from the folks at Metro Traffic, is unique. The talent presses digit 1 for example, holding it in for about two seconds. The touchtone

A number of stations are racking up old VHS recorders with a three or six-hour audio tape of programming — just in case. With the “smart” remote control systems or even the cheaper “dial-up” systems, engineers have a means of staying on the air if an STL is lost.

Figure 2 shows a simple modification that was originally used for Technics



decoder senses the digit, and is wired to pull in a relay when it sees the tone.

The wiper of the relay is connected to an electrolytic capacitor. The N.O. relay contact is tied to +12 V (or whatever voltage you are using). When the decoder senses the correct tone, the relay contacts move to permit the capacitor to charge from the +12 V supply.

When the traffic reporter releases the touchtone digit, the decoder drops out, as does the relay. The N.C. relay contact is then tied to the coil of a second relay, and then to ground.

As the capacitor discharges through the second relay coil, that relay briefly closes. The normally open contacts of this second relay are connected across the start circuit for the cart machine.

The traffic reporter was instructed to hold the button down for three seconds, release, wait half a second, and begin the traffic report. You’ll have to experiment on capacitor sizes and timing.

“consumer grade” CD players to give them remote start capability. Because it’s not wise to extend logic-level signals over long remote start wires, an internal relay powered off the player supply takes care of turning the unit on. On the SLPG-300 and -400 model CD players, the DC voltage to power the relay is found on the main PCB of the headphone power supply. K-1 is a 5 V reed relay. The normally open contacts parallel across the PLAY switch, using wirewrap wire tack soldered to the switch contacts.

□ □ □

John Bisset is a principal in Multiphase, an engineering services company based in Washington. He can be reached at (703) 323-7180.

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STATION SKETCHES

Stop Incidental Phase Modulation

by Tom Vernon

HARRISBURG, Pa. When interest in AM stereo was at a high point a few years back, there was some attention paid to IPM, or incidental phase modulation, as it related to tuning and adjusting AM transmitters. Even if your station isn't planning a conversion to AM stereo, you should still care about IPM adjustments, for reasons this article will explain.

Incidental phase modulation, as the name implies, is an unwanted frequency modulation of the AM carrier when audio is applied. You might think of it as the complement to the problem of synchronous AM in an FM transmitter. It usually occurs somewhere in transmitter circuits associated with the modulation process.

Figure 1 shows a textbook representation of the AM carrier and its upper and

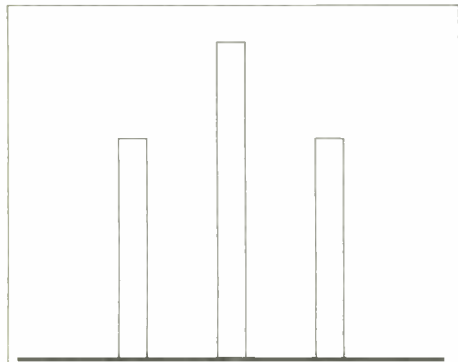


Figure 1 This is a textbook representation of the spectrum of an AM signal, just the carrier and two sidebands.

lower sidebands. If the transmitter is modulated at 5 kHz, then the sidebands appear 5 kHz above and below the carrier. Two-thirds of the energy is in the carrier, while the remaining third is in the sidebands. This idealized representation of the AM spectrum assumes a distortionless audio input through a perfectly linear system.

Figure 2 shows what happens when phase modulation is added to the mix. Our 5 kHz audio signal now produces an infinite number of sidebands, each 5 kHz apart. It's easy to see that the legal bandwidth will be quickly exceeded.

If this isn't enough to startle you, consider the affect IPM will have on your listener's radios. Again, in the ideal world, envelope detectors in AM radios will ignore frequency or phase

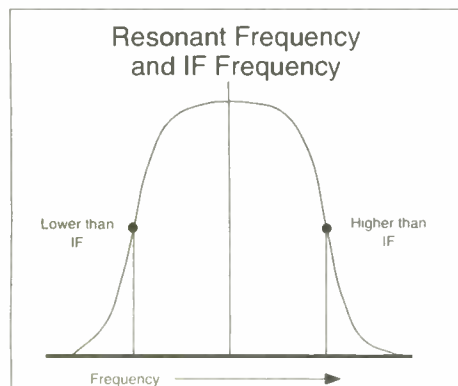


Figure 1a If a tuned circuit is tuned to the incoming IF frequency, frequencies above and below the IF receive less amplification than the IF itself.

modulation in a properly tuned signal. But in the real world, receivers aren't always tuned dead on, or the radio could have an asymmetrical IF pass-band.

When either of these happens, a phenomenon known as slope detection occurs. Figure 3 illustrates how this can take place. The end result is a drastic level of distortion, which will probably inspire your listeners to find another station.

But wait, there's more. IPM products can become AM as a result of phase rotation when the signal bounces off the ionosphere. In areas where the

groundwave and skywave meet, high levels of distortion can result, meaning your station's coverage area is greatly diminished. In short, a nonlinearity in any part of the transmitting or receiving system can have a negative impact on the station's effective coverage area.

The first step in investigating and eliminating the problem is assembling the necessary test equipment. This includes an audio oscillator, distortion meter and spectrum analyzer. While there are ways to cure IPM without the spectrum analyzer, they are more tedious and difficult.

The first step is to minimize harmonic distortion. Excessive THD will mask

IPM distortion products on the spectrum analyzer display, so they must be dealt with first. Modulate the transmitter at 100 percent with a 1 kHz tone. Verify that the distortion is below 1 percent. Even older tube transmitters should be able to do this with ease. If not, find out why or reduce modulation slightly so you're below the 1 percent THD threshold.

As long as harmonic distortion is below 1 percent, the additional sidebands will be about 40 dB below the 1 kHz sidebands. This being the case, whatever else you see on the spectrum analyzer display will be easily identified as IPM.

Eliminating IPM follows the standard procedure of starting with the most likely suspects and working backwards. Remember that there can be multiple

continued on page 26 ►

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IPM Adjustment Vital to Signal

► continued from page 25

causes of IPM, so don't quit after the first adjustment yields an improvement.

Experience shows that the PA stage of plate- and pulse-modulated transmitters is the most common offender, and improper neutralization is the most frequent cause. Many older 1 and 5 kW transmitters used triodes in the final, and adjusting neutralization is standard procedure whenever tubes are changed. In fact, adjusting for minimum IPM is also the best way to ensure proper neutralization.

Even PA stages with tetrodes can cause problems. While they don't need neutralization, they can still create

undesirable IPM products. The solution here is to add just enough capacitance to cancel out IPM. This can be a tricky chore, with disastrous results awaiting experimenters. It's a job best left to a consultant.

Working backwards, modulation changes on the PA affect the grid, which in turn, can affect the RF driver stage. An adjustment for optimal IPM may be different than that for peak grid current. Going the other way, the load on the PA can also be a source of problems. If the ATU or phasor is narrowband and presenting an asymmetrical load to the sidebands, this can cause IPM as well.

AM transmitters that were built within

the last 10 years were designed after IPM became widely known and should not pose any problems by themselves. If a check reveals objectionable levels of IPM in a newer transmitter, compare readings on the dummy load and antenna. IPM products that only show up when the transmitter is connected to the antenna suggest antenna/ATU problems.

To properly adjust the neutralization, tweak the control while observing the spectrum analyzer display. Careful adjustment should yield sidebands that are at least 50 dB below the first-order sidebands. In some instances, there may not be enough range in the neutralizing circuit to perform a complete

neutralization. This can be the result of either a design oversight in the transmitter or the use of tubes with extremes of interelectrode capacitance. This is a fairly common occurrence with rebuilt tubes or new tubes manufactured overseas. In either case, experimenting with the right value of padder capacitor should take care of the problem.

Experimenting with all the adjustments related to driver tuning can result in

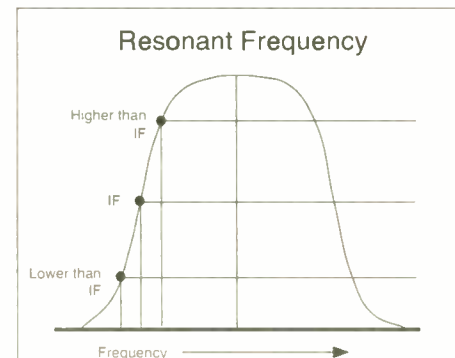


Figure 1b On the other hand, in a mistuned circuit, frequencies above the RF receive more amplification, while those below receive less.

further improvements to the IPM numbers. Sometimes even slight adjustments can have dramatic effects. The optimal position for the IPM null may not be the point of peak grid current. This is OK, as long as your final adjustment provides enough grid drive to maintain positive peak capability. To finish off, expand the

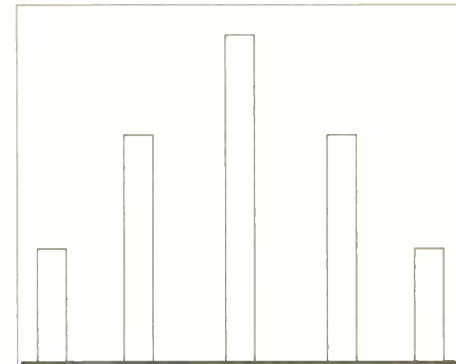


Figure 2 Phase modulation of the AM signal will create an infinite number of sidebands.

display on the spectrum analyzer and go back to fine tune all these adjustments for symmetry of second- and third-order sidebands.

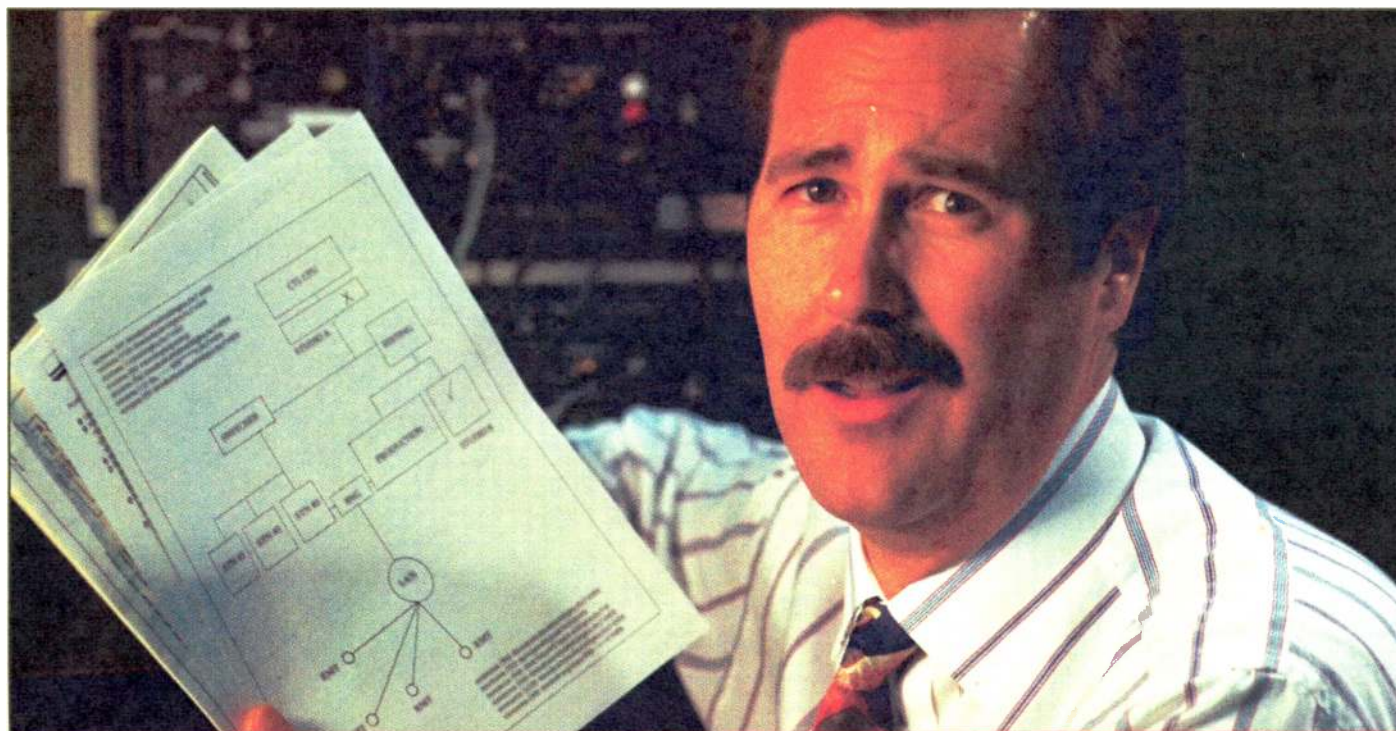
Unfortunately, tweaking for minimum incidental phase modulation isn't a one-shot deal. When you replace tubes in the final, the procedure needs to be repeated, as new tubes will have different interelectrode capacitance.

It's worth noting that adjusting for minimum IPM is an acceptable way to neutralize the final, but proper neutralization does not ensure minimal IPM. This is because the IPM null is much more precise than the dip observed with traditional neutralization procedures.

Taking the time to do regular IPM adjustments can enhance the signal in your primary coverage area, as well as make you a good neighbor in the crowded AM spectrum.

□ □ □

Tom Vernon is completing his Ph.D. at the University of Pennsylvania in Philadelphia. You can reach Tom via e-mail at tvernon@aol.com; or by calling (717) 367-5595.



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Keep Up with Current Distribution

by W.C. Alexander

Part II

DALLAS In the first of this series of articles on AM antenna systems, we looked at some basics and learned some of the buzzwords of the trade.

In this installment, we'll pick up where we left off and continue with the fundamentals. Some of this may be familiar material to you and if so, take this opportunity to brush up. For those for whom we are breaking new ground, pay close attention because this material lays the foundation for more complex topics to follow later.

An insulated, non-top loaded tower will typically have a current loop (or maximum) 90 electrical degrees down from the top of the tower. If the tower is shorter than 90 degrees long, the current loop will occur at the tower base.

Current distribution on a single, insulated, uniform cross-section radiator will be more or less sinusoidal in nature and is approximately defined as follows:

$$i_a = I_a \sin(G - \gamma)$$

where:

i_a = current in amperes at height γ

I_a = Maximum current in amperes

G = Tower height in degrees

γ = height in degrees of current element

There is always a current node (or minimum) and voltage loop at the top of any tower that does not employ top loading. As we move down the tower, the voltage will decrease and the current will increase in an approximately sinusoidal fashion until a current loop and voltage node occur at the point 90 degrees below the top of the tower, if the tower is greater than 90 degrees tall, or at the tower base if it is shorter than 90 degrees.

At the point where the voltage or current nodes occur, the voltage or current does not pass through zero but rather reaches minimum values and shifts approximately 180 degrees in phase in traversing the node region. On a tall tower (greater than 180 degrees), more than one node will occur along the tower's length.

Many things influence current distribution on a tower. Cross-section, uniformity, and nearby conductors are a few examples. In some cases (which we will explore in detail in the future), there are actually two currents flowing on a particular frequency on a tower — the current that contributes to radiation and the current that is induced from another nearby radiator.

This is the norm in directional arrays, where a tower will have current flow from its own excitation and current flow from radiation arriving from other elements in the array. The current distribution on towers such as these is sometimes hard to predict using conventional methods.

For most purposes, we assume sinusoidal current distribution on a radiator, and it usually works fairly well. Modern computer modeling using moment method analysis can, however, do an excellent job of predicting the current flow and distribution on a radiator, and this gives the designer a much better picture of what is happening. Knowing the current distribution is important to the

vertical radiation characteristics of an antenna. Knowing where the current loop is on an antenna is essential when detuning a radiator for the purpose of eliminating reradiation.

Occasionally, it is beneficial to measure the current distribution on a tower. To do this, a small sample loop is constructed out of copper tubing or aluminum angle and fitted with some sort of insulated bracket/handle so that all measurements can be made with the loop the same distance from the tower leg.

Vertical radiation

Generally speaking, groundwave radiation (and apparent efficiency) from a vertical radiator will increase as the current loop moves up from the base. The optimum electrical length of a vertical radiator is 225 degrees or five-eighths wavelength. At this electrical length, current loops occur at 45 and 135 degrees above the base. Radiation on the horizon is maximized and radiation above the horizon is minimized.

Shorter towers have more radiation above the horizon and thus produce more skywave radiation and less groundwave radiation. Towers considerably shorter than 90 degrees produce so much radiation above the horizon that much of the power is wasted into space. Nighttime power is usually much more limited when using an electrically short radiator, although considerably more daytime power may be allowed as a result of the reduced groundwave efficiency.

The vertical radiation characteristic of a vertical radiator that is not top loaded or sectionalized, or the function of theta, is defined as follows:

$$f(\theta) = \frac{\cos(G \sin \theta) - \cos G}{(1 - \cos G) \cos \theta}$$

where:

$f(\theta)$ = function of theta

G = height of the antenna in degrees

θ = vertical angle

This equation returns a multiplier by
continued on page 31 ▶

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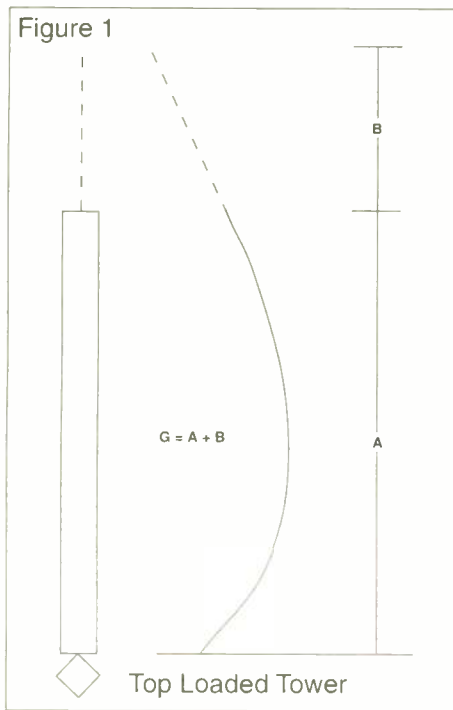
Measuring Current Distribution

► continued from page 28

which the inverse distance field of an antenna is multiplied to find the radiation at a particular vertical angle (θ). For example, if a tower is 90 electrical degrees tall, has an inverse distance field of 300 mV/m at one km and you wish to find the radiation from the antenna at a vertical angle of 20 degrees above the horizon, the above formula gives us a function of theta or multiplier of 0.914. Multiplying this by the antenna's groundwave inverse distance field of 300 mV/m, we find that the radiation at 20 degrees above the horizon is 274.3 mV/m at one km.

This information would be used in engineering a nighttime allocation to determine how much skywave field a particular station would produce at a given location. The design engineer would find the appropriate vertical angle for the distance to the receiver, find the function of theta using this formula, find the skywave multiplier from the FCC formula and multiply that by $E(\theta, \theta)$ or the radiation at the pertinent azimuth and vertical angle from the station. I mention all this now only to show the need to know the function of theta in some circumstances.

In Part 1 of this series, we touched on one way an electrically short tower can be electrically lengthened using top loading (see Figure 1). If a tower employs top loading, the function of theta is computed as follows:



By way of example, if we have a sectionalized tower that has a lower section that is 120 electrical degrees tall (A) and the current distribution makes the lower section seem as if it is 20 degrees taller than that (B), the overall height is 220 electrical degrees tall (C) and top loading of the upper section results in current distribution that makes the tower seem as if it is 15 degrees taller (D) and we want to find the function of theta for a vertical angle of 30 degrees, the above formula yields 0.593.

This formula is, obviously, quite cumbersome and difficult to solve using a pocket calculator and paper. However, it lends itself easily to codifying into computer language or a programmable calculator.

Insulated and grounded towers

By and large, the vast majority of AM antennas consist of insulated base towers. Almost all directional arrays use insulated base towers. There are several advantages to using an insulated base tower, chief of which is control of the current distribution on the tower. Insulated base towers are fed across the base insulator. This type of tower is said to be series fed, because the excitation is, in essence, fed in series with the tower base.

Occasionally, it is advantageous to use a grounded base tower as an AM radiator. Such circumstances may include mounting of an FM or other antenna on the tower, use of an existing grounded base tower for AM or, from time to time, proximity of the tower base to a populated building or structure. In these cases, it is possible to use a grounded base tower with good results as an AM radiator if the guy wires are all insulated.

The base impedance of a grounded base

tower is essentially zero, but that impedance rises with height above the base. At some location up the tower (assuming it is of adequate height), a point will exist that will provide an acceptable feed impedance. The easiest way to feed a grounded base tower is with a slant wire, which is attached at the aforementioned point and returns to the transmitter building at an angle approaching 45 degrees. This forms what is essentially half of a "delta" match.

The location of the best attachment point for the slant wire is usually determined by a cut-and-try method, although experience on the part of the field engineer and modern computer modeling techniques can point to a starting point that should be

close to the desired impedance. In most situations, if the feedpoint is properly selected, the only matching needed will be a series capacitor to cancel out the inductive reactance of the slant wire.

Because the excitation in a slant wire fed grounded base tower is shunted across the grounded tower base, this type of antenna is said to be shunt fed. The current flow is up the slant wire and then on up the tower to the top, where a current node and voltage loop will exist. Some current, however, also flows down the tower from the slant wire feed point and contributes to radiation. Because there are two radiated fields below the feedpoint (one from the slant wire and the other from the tower below the feedpoint), some suppression of radiation occurs, usually on the side of the tower

continued on page 33 ►

$$f(\theta) = \frac{\cos B \cos(A \sin \theta) - \sin \theta \sin B \sin(A \sin \theta) - \cos(A+B)}{\cos \theta [\cos B - \cos(A+B)]}$$

where: $f(\theta)$ = function of theta
 A = the physical height of the tower in degrees
 B = the difference, in degrees, between the apparent electrical height (based upon current distribution) and the actual physical height
 θ = vertical angle

If, for example, a particular tower is only 60 degrees tall (A) but employs top loading that makes it seem 30 degrees taller (B) based upon current distribution, and we wanted to find the function of theta for a vertical angle of 20 degrees, the above formula yields 0.923. Note that for the same electrical height based on current distribution achieved through top loading, the function of theta is higher than the same electrical height achieved without top loading.

Sectionalized tower

Another type of antenna we briefly discussed in Part 1 was the sectionalized tower. Sectionalization is used to increase the groundwave efficiency (and reduce skywave radiation) by placing an insulator near the center of an electrically long radiator and controlling the current flow on each section with a network between the sections (see Figure 2). For sectionalized towers, there is yet another formula to determine the function of theta:

$$f(\theta) = \frac{\sin A [\cos B \cos(A \sin \theta) - \cos G] + \sin B [\cos D \cos(C \sin \theta) - \sin \theta \sin D \sin(C \sin \theta) - \cos A \cos(A \sin \theta)]}{\cos \theta [\sin A (\cos B - \cos G) + \sin B (\cos D - \cos A)]}$$

where: A = the physical height, in degrees, of the lower section of the tower
 B = the difference between the apparent electrical height (based on current distribution) of the lower section of the tower and the physical height of the lower section of the tower
 C = the physical height of the entire tower, in electrical degrees
 D = the difference between the apparent electrical height of the tower (based on current distribution of the upper section) and the physical height of the entire tower. D will be zero if the sectionalized tower is not top loaded
 G = the sum of A and B (A+B)
 H = the sum of C and D (C+D)
 A = the difference between H and A (H-A)

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Circle (37) On Reader Service Card

World Radio History

Following Antenna Current Flow

► continued from page 31

where the slant wire is located. Seldom is this a problem, however, and the antenna is still considered to be a nondirectional radiator.

Feed option

Another way to feed a grounded base tower is to mount an insulated skirt on it consisting of six or so wires suspended off the tower on insulators and parallel to the length of the tower. The skirt wires are bonded together at the top of the tower and then bonded to the tower itself at a point that produces a desired driving point impedance, usually somewhere below the 90 degree point (0.15 wavelengths is a common location for this bond). The skirt wires are also bonded together near the tower base, and this is where the excitation is applied. This type of grounded base antenna is called a folded monopole.

The skirt wire conductors form the outer conductor of a transmission line. Were the short located at the quarter-wave point, it would transform the short at that end to an open at the other end, creating a virtual base insulator at the bottom of the tower. By adjusting the location of the short between the skirt wires and the tower, the impedance at the feed point can be adjusted to a favorable value. This arrangement forms what is essentially a "gamma" match.

Current flow in a folded monopole is up on the skirt wires and down on the tower structure. Such antennas perform much like base insulated towers. Radiation current flows up the skirt wires to the tower

part, is the reason that short towers are less efficient than tall towers.

Taller towers have higher base

resistance, and at some point (usually around 80 electrical degrees), the reactance crosses over and becomes inductive. There is some benefit to selecting a radiator with close to a zero reactive component in its base impedance when

designing an antenna system. Empirical tower base impedance data is available and published in many places, both in

By and large, the vast majority of AM antennas consist of insulated base towers.

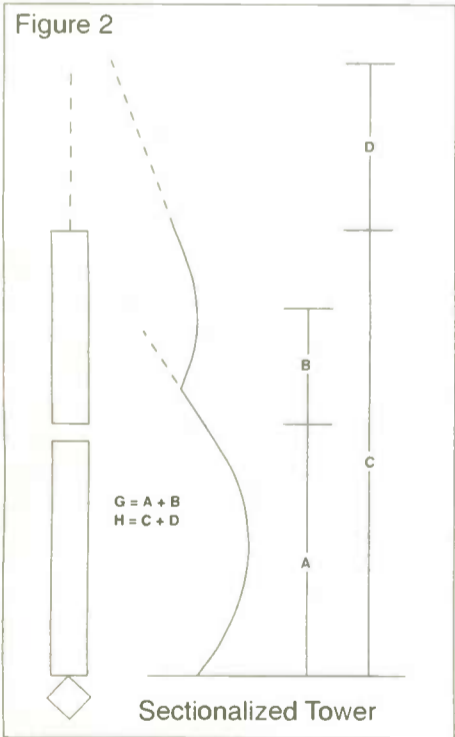
tabular and graph format. Through the use of moment method computer modeling, the base impedance of many different tower configurations can be accurately predicted. This is particularly useful with tapered

or free-standing towers, where the cross-section is great and the parallel capacitance of multiple base insulators is significant.

In grounded base, shunt-fed towers, the feed point impedance is more dependent on feed point location. Because this is usually at least to a degree within the control of the user, a desirable base impedance can often be obtained. This impedance often has a relatively large reactive component: the resulting Q is usually higher and bandwidth lower than that of an insulated tower of the same height.

□ □ □

Cris Alexander is director of engineering for Crawford Broadcasting in Dallas. He can be reached at (214) 445-1713; or by e-mail at 76440.1670@compuserve.com



and then on up to the top of the tower, where a current node and voltage loop will exist.

Base impedance

The base impedance of an insulated base tower is determined primarily by the electrical length of the antenna, cross-section, the extent of the ground system and the elevation of the feed point above ground. Short towers have much lower base resistance, and the reactance becomes quite capacitive.

When base resistance is quite low, the fixed ground loss of one to three ohms becomes a significant part of the radiation resistance of the antenna. This, in

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Studio Sessions

Which Mic to Use?
Bruce Bartlett
Tells You.
See page 38.

Equipment and Applications for Radio Production and Recording

Getting Tubed for Less with PAiA

by Alan R. Peterson

WASHINGTON The whole world and his brother are making vacuum tube processors. Preamplifiers, compressors, limiters and audio mixers are available

and bottom of a waveform. A trimmer pot adjusts the symmetry of the output waveform. An IC output stage converts the 12AX7 hi-Z output to levels consistent with modern audio equipment. Two such circuits make up the TubeHead.

code paint during manufacture, leaving a number of "mystery" components that required checking.

Do you despise wallwarts? PAiA includes a generic OEM one and tells you to cut and discard the connector so

the tube into clipping. The Pre/Post control balances the tube and op-amp mix; dial in a little or go full-bore. The Output dial adjusts levels going into the next device. The trimmer pots alter the amount of clipping done to the wave's top and bottom. The clipping also adds some amplitude limiting to a signal.

TubeHead sounds really tubey without sounding like a cheap fuzz effect. Don't expect sophisticated, pedigreed, silver-plated sound. Properly tweaked, this box can be as surly as a Philadelphia cabbie.

Undesirable for production? Not at all, especially for alternative-leaning radio production. In-your-face promo work takes well to a dose of clipping and the edgy sound a TubeHead preamp can dial up pulls this effect off nicely.

Picture 1



everywhere, promising salvation from "sterile" digital audio.

Tube gear can be pricey. The high-voltage variety requires heavy multi-wound transformers and nasty voltages. Low-voltage, starved-plate hybrid circuits are reasonably priced, but still cost more than a simple solid state device. For stereo, double the price.

If you want to get tubed without getting hosed, meet the two-channel, bare-bones, hybrid TubeHead for only about \$100. The unit comes from PAiA Electronics: quite possibly the most interesting company you never heard of.

Those fabulous '70s

PAiA (sounds like *papaya*) came along in the 1970s with a line of inexpensive D-I-Y electronic music and audio kits, including the Gnome Microsynthesizer, a novel handheld oscillator/filter device.

Today, the company, headed up by John Simonton, boasts studio EQs and compressors, guitar effects, a mixer, a vocoder and Theremin, all in kit form.

Musicians, experimenters and hackers form the core of PAiA clientele, but the TubeHead is quite appropriate for the serious production rat.

Circuitry

The TubeHead hybrid circuit uses a twin-triode 12AX7 and a pocketful of 5532 op-amp ICs. See Figure 1.

An op-amp stage is coupled to the grid. Low supply voltages and plate

There are three pots per channel. An input "Drive" control, a "Pre/Post" blend control to mix tube and solid-state sound and an "Output" level adjust. Do not expect a pair of ruby-jewelled d'Arsonval meters. The \$100 TubeHead only has clip LEDs.

Power comes from a 12 volt wallwart supply. A 4049 chip running at 60 kHz and a voltage multiplier circuit pump out 45 VDC for the plates. Two channels of tube processing are available in one rackspace.

The TubeHead is for recording and processing purposes. Similar TubeHead products include a mic preamp, guitar amp simulator and a hi-fi version with RCA jacks.

But first ...

Before you send any audio "through the bottle," you have to solder the thing together. It is after all a kit, leaving the quality of construction and function mostly up to you. If you have a problem, you fix it yourself.

For many, this is an equitable tradeoff: a low initial price in exchange for a couple of evenings spent building the device.

The quarter-inch aluminum front panel is pre-drilled and screened. The metal chassis is lightweight aluminum. The PC board is of good quality and components are carefully counted and supplied.

Instructions are clear and concise. All steps are checked off as they are completed. Tips like "don't wear nylon"

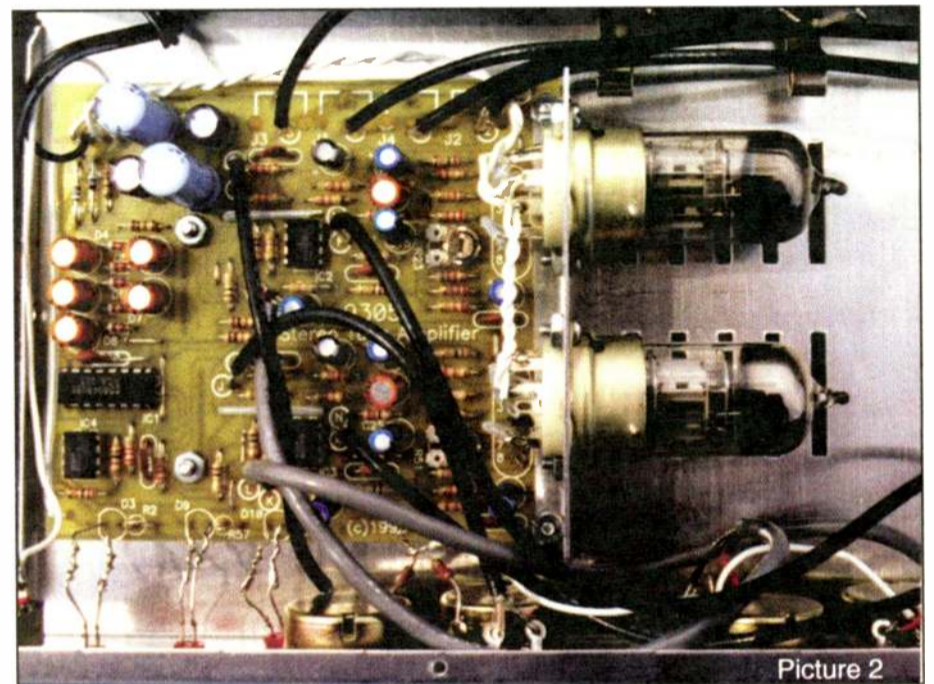
it may be soldered to the PC board. Trust me, there is a perverse pleasure derived from being told to deliberately mutilate a wallwart.

Rather than a prebuilt wire harness, PAiA sends wire for you to clip and strip yourself. This results in a rat's nest of shielded cable and hookup wire inside (see Picture 2), but saves money. A harness assembly would only add to the price of the kit. Similarly, the jack

Conclusions

How one reacts to tube sound is purely subjective, so its use is discretionary. Some audio projects "warm up" very well while some are better off staying "digital." It is your choice.

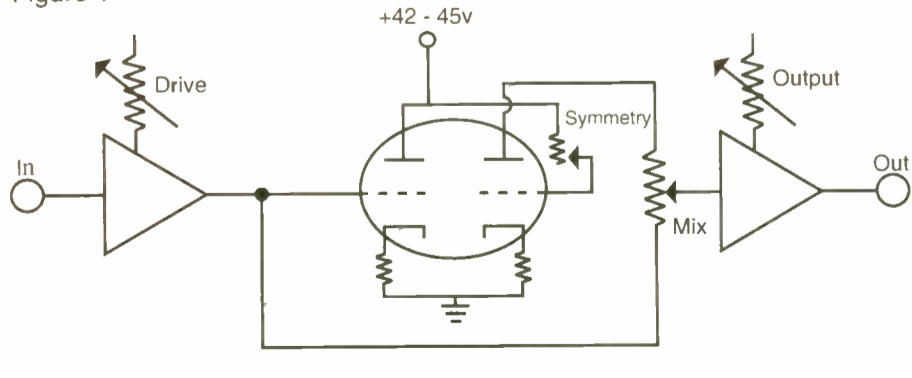
Because radio stations have been trying to eliminate tube equipment for many years, a TubeHead would be out of place in an airchain. However, it is



Picture 2

No harness means wild wiring.

Figure 1



currents make the tube operate in its nonlinear range.

The plate of one triode is coupled to the grid of the second, clipping both the top

(preventing potential static damage on the 4049 IC) pepper the instructions.

Keep a VOM nearby to check the tiny resistors. Many missed getting color

legend on the back panel consists simply of printed peel-and-press labels.

Before you think "cheese," remind yourself *you just scored your own stereo vacuum tube preamp for only \$100*. Put the money where the sound is — nobody but you will be looking inside anyway.

After the TubeHead is built, apply power and standby for the "smoke test." If nothing explodes, you built it correctly. Patch it into your board and go.

Sound

Attention skeptics: "tube sound" really exists. Whether it is due to a different order of harmonics, more roundness in the bottom or the effects of heat on insulation, folks agree it is there.

A moderate amount of Drive will send

very appropriate in the production room or a personal production studio as a patchable rack module.

Well-moneyed studios will likely aim for high-end units with meters and other doodads. But maybe cash flow is snug and you don't mind skipping TV for two or three evenings to build a kit. Maybe you feel you have to get inside your own gear to really know it.

Or maybe you just like the smell of melting rosin-core solder. No matter, check out the TubeHead line from PAiA Electronics. You will get tube sound and still have lots of cash left over.

□ □ □

For information and a catalog, contact PAiA Electronics at (405) 340-6300 or circle Reader Service 22.

DIGITAL DOMAIN

A Multichannel Future for Radio?

Multiplexed Audio Technology Could Mean Alternate Language Broadcasts and Multiformat Delivery

by Mel Lambert

LOS ANGELES Normally I would not suggest we take more than a fleeting backward glance at the Quadraphonic debacle of the '70s. But in retrospect I wonder if there is anything radio has learned from the experience?

Few record company executives appear to have spent more than a couple of nanoseconds with the technical types. Still, we cannot ignore this fact: According to recent estimates, a significant percentage of our rec rooms now boast home-theater playback systems

channel, in addition to the familiar matrixed-encoded Dolby Surround L-R information.

By using a suitably equipped decoder unit, this AC-3-encoded data can be used to reconstruct the Dolby Digital soundtrack into its constituent channels; these are the Left, Center, Right, Surround-Left, Surround-Right plus 200 Hz subwoofer channels.

DTS/Coherent also plans to offer laserdisc releases with apt-X100-encoded 5.1-channel soundtracks.

While we are on the subject, DTS Entertainment — the firm's new software

per second because of the lower compression ratio used.

All in all, there are a number of possibilities to be gained from these new multichannel delivery formats. Something tells me that there is a lot of life left in the surround-sound debate. And the potential for the use of multiplexed

digital audio to provide alternate-language and/or multi-format delivery methods for the radio community is going to be hard to ignore.

□□□

Mel Lambert has been involved with production and broadcast on both sides of the Atlantic for 20 years and is now principal of Media&Marketing, a Los Angeles-based consulting service for the professional audio industry. Reach him via mediapr@earthlink.net or at (818) 753-9510.

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A 2.0GB drive may sound like a lot of storage space for your DAW right now, but just wait three months. Seagate Technology has upped the ante by a factor of 10.

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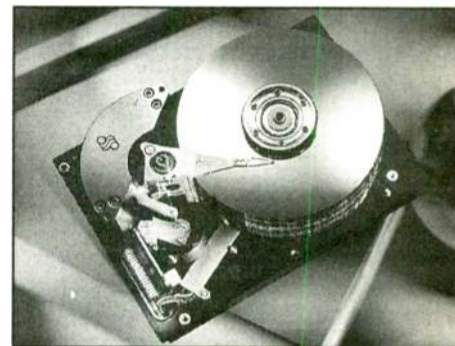
In audio terms, this is roughly equivalent to 37 hours of uncompressed (linear) 44.1 kHz stereo audio on a single drive.

The drive is being engineered for mainframe, server and digital audio/video applications. It utilizes the Seagate Advanced SCSI Architecture II code and is fully compatible with existing Fast SCSI-2 and Fast Wide SCSI-2 peripherals.

As is, the drive provides a sustained data transfer range of 8.2 to 12.1 Mbps. At a 44.1 kHz sample rate, this means simultaneous playback of

anywhere from 93 to 135 mono tracks is possible.

With the addition of the 8- or 16-bit UltraSCSI interface, peak data transfers of up to 40 Mbps are possible. Production quantities of the Elite 23



(ST423451) will be available late in the third quarter of 1996.

For information, contact Seagate Technology at (408) 439-2838 or circle Reader Service 94.

— Alan R. Peterson

A single break can contain several messages, allowing you to derive the desired one.

capable of providing some form of surround-sound playback.

This is true even though they may not currently include rear-channel loudspeakers.

This large installed base is readily compatible with Dolby Surround ProLogic movie soundtracks. That is why it is attracting the attention of various advocates of multichannel formats for the upcoming, much-anticipated Digital Video Disc (DVD) that will herald the death knell for consumer VCR formats.

So what about radio?

But is there an application here for the radio community? Yes. Stations with a heavy emphasis on classical music can already take advantage of various performances that were recorded and/or mixed in the matrix-encoded 4:2:4 Dolby Surround format.

It has not escaped the attention of the more visionary commercial producers that various out-of-phase and processed information can be included in voice-over, ambiance or sound-effects tracks, which will then replay from the surround channels after ProLogic decoding.

Incidentally, if this is done correctly, it can also sound rather interesting via conventional two-channel stereo playback.

Wait, there's more

Of course, matrix encoding surround sound is only half the story. There are now a variety of interesting techniques capable of delivering multiple, discrete playback channels.

These include a variety of formats being utilized by the movie industry. Variants of these basic concepts are finding their way into a number of consumer formats.

These variants are derived from data-compressed systems used to carry multichannel soundtracks on the film print — including the Dolby Digital/SRo D and Sony SDDS formats — or on a companion CD-ROM, as is done for the DTS/Digital Theater Systems.

You may have heard about "5.1 channel." A number of laserdisc releases now available contain a multiplexed 5.1-channel soundtrack on the FM-encoded data

division — also intends to produce a series of DTS-encoded CDs. Watch for collections from jazz pioneer Tim Weisberg, blues legend Joe Houston, East Coast rock band Shoeless Joe, Barbara Weathers, Alan Parsons, and award-winning producer Robert Margouleff.

Radio's role

While 5.1 channels may be overkill for the majority of current radio output, there are additional uses to which these multichannel sources could be put.

Consider alternate-language commercials and station IDs that could be extracted with a suitable consumer playback system. A single break during a broadcast can contain several messages, allowing you to derive the desired one.

This is very possible. It is anticipated that movies released on DVD will feature not only English soundtracks, but also several other different versions in, for example, French, Spanish and other languages.

Now, how about a central, city-based station that is serving various rural communities? Simultaneous, area-specific commercials and IDs could be carried via the additional channels, keyed to replay in only the appropriate markets.

Look at facts. The costs of operating stations are forever rising and audiences are looking for alternate ways to spend their time and/or consumer dollars. There may be a marketing advantage in formatting a basic music or talk-radio station to operate live within a miniature satellite-delivery network with different liners and stop sets.

Amazingly, these multiplexed 5.1 channels can be broadcast with a remarkably small amount of data bits. A consumer-format Dolby Digital/AC-3 laserdisc requires only 384 kbps to carry full bandwidth, data-reduced information.

Certainly this digital bandwidth might exceed what is readily available to some of the currently proposed digital broadcasting formats. However, there is no reason why specialist outlets could not offer alternatives to current, narrowly defined niche formats. DTS-encoded media requires up to 1.411 GB

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FIELD IMPRESSIONS

'Capitol Steps' Step Up to CD-R

by Jim Smith

WASHINGTON I have been recording "Politics Takes A Holiday" live-to-tape in a Washington nightclub for the last eight years or so. This is a quarterly public radio comedy special performed by the Capitol Steps comedy troupe.

Because of the political nature of the show, fast turnaround is required. DAT masters must be sent simultaneously to producing station KCRW-FM in Santa Monica, the NPR uplink facility in Washington and to the Capitol Steps themselves, all on the very night of the recording. From these three sources, the show finds its way to as many as 180 public radio stations every three months.

Although mistakes in the performance are rare, I have begun bringing an MTU MicroSound DAW along in the remote truck. I use it to provide a backup recording as well as streamline fixes when they are required.

On-site CD production

Having installed the MTU MicroCD software and a Yamaha CDR-102 2X CD recording deck in my workstation the month before, this year's 4th of July edition of the Capitol Steps show offered some interesting possibilities.

CD-Rs — while not rerecordable — seem to be a more robust and durable medium than DATs. They are easier and

faster to cue and fall firmly within playback requirements of nearly all stations and NPR uplinks.

Creating dubs or cloned masters is also faster: 2X or 4X speed, depending on the recorder. They are also more foolproof with the computer overseeing the process.

With the cost of CD-R blanks being about the same as DATs, there did not seem to be any negative aspects to making the switch to CD-R masters. KCRW-FM producer Sarah Spitz and the Capitol Steps agreed that the format upgrade made sense.

On the level

One issue that arose which bears further discussion was optimizing levels for the digital format.

There are equally valid arguments for providing "commercial" CD level of 0 digital or the preferred NPR level of a nominal -18 or -20 digital.

To allow for human board ops as well as automated playback situations, I chose to maintain the -18 level and a heads-out sequence of tones and silences I had previously provided.

Hopefully, as CD-R and short-run CDs continue to proliferate as means of mastering and distribution for radio programming, some standards will be agreed upon that make sense for both commercial and public radio.

The actual recording and mastering required little new effort on-site. After making sure my three redundant digital recording formats (DAW, DAT and Tascam DA-88 digital multitrack) were all receiving identical input level from

With the image file complete, CDs are pumped out at whatever rate the CD recorder allows, using the same image file repeatedly.

Almost no time

My own 2x recorder gave me two half-hour CD masters 28 minutes later. A 4x recorder, readily available from MTU, would obviously cut the time in half.

It is worth mentioning the creation and



The MTU Microsound Workstation



Screenshot of MTU MicroCD

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the console. I opened a MicroSound project file I keep on the hard drive with 30 seconds of pure digitally generated 1 kHz tone. I renamed this project and recorded the live show into it.

Snap to it

The process of setting up a CD at show's end was handled within the normal editing environment. The speedy Instant Zoom and Snap To functions made things easy.

In less than two minutes, I was able to clean up the front and back of the program, place program material 15 seconds after the tone, drop in a pair of track IDs and a 15-second countdown cue.

After saving this project file, I opened the MicroCD software. With a single mouse click, a CD image file was created, taking about half real-time on my rig; in this case, about 14 minutes.

cloning process described here was largely unattended and had virtually no impact on the normal show process. Wrapup and teardown proceeded while the computer did its thing.

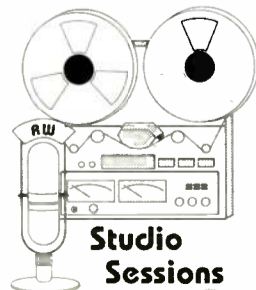
Masters were being labeled a full half-hour before pulling power on the truck and driving off.

Overall, the transition from DAT to CD-R masters was seamless and transparent for me on the MicroSound DAW. Even better, my own sense of confidence and my client's security are increased with a CD in hand.

I am sure CD-R will be my format of choice for the future. It really is just too easy.

□ □ □

Jim Smith is the former supervisor of technical production at NPR and now owns and operates Muddy Hole Studios. His e-mail address is: mudsmith@intrepid.net



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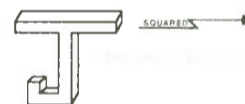
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LINE OUT

Pick the Right Mic for the Job

by Bruce Bartlett with Jenny Bartlett

ELKHART, Ind. Most radio engineers are familiar with directional mics. As if by magic, these mics can pick up what they are aimed at, but reject sounds to the side and rear.

For example, talk into a cardioid microphone from all sides while listening to its output. Your reproduced voice will be loudest when you talk into the front of the mic and softest when you talk into the rear.

Because they discriminate against

sounds to the sides and rear, cardioids help reject unwanted sounds such as room acoustics (reverberation), feedback, or leakage. Cardioids are the most popular choice for this reason.

How do they work? In other words, how do you make a mic directional?

Mic in the can

Start by making an omnidirectional mic. Take a mic transducer, made of a diaphragm and some hardware that changes diaphragm motion into a signal. Then put this transducer in the end of a sealed can, so that incoming sound

contacts the diaphragm only on its front surface.

Sound from the front presses on the front of the diaphragm, and makes a signal. Sound from the side or rear bends around to the front of the mic. This sound also presses on the front of the diaphragm and makes a signal.

So the mic responds the same to sounds from all directions. In other words, it has an omnidirectional ("all-directional") polar pattern.

Note that the omni mic becomes directional at high frequencies.

That is because the mic housing blocks high frequencies that arrive off-axis.

Get the drill

Now suppose we put some holes in the can behind the diaphragm. We carefully size these holes, and add acoustic damping such as felt or foam to create an acoustic phase-shift network. It is much like an RLC electrical circuit which delays the signal passing through it.

These holes, or "rear ports," let sound

and is delayed. If the delay inside the mic is set the same as the delay outside the mic, sounds arrive at the front and rear of the diaphragm at the same time in phase.

Sounds push on opposite sides of the diaphragm, in phase. The diaphragm cannot move, so sounds from the rear make a very weak signal. Rear sounds cancel out. You have created a cardioid polar pattern.

Sounds coming from the front do not cancel out. Why not? Frontal sound waves travel to the rear ports during time T . Inside the mic, the phase-shift network further delays the sound by time T . The total delay is $2T$. Because there is a big delay or phase shift between the signals at the diaphragm's front and rear, a frontal sound makes a strong signal.

High frequencies do not reach the rear of the diaphragm because they are filtered out by the rear port's RLC filter. The cardioid mic is directional at high frequencies because its housing blocks high frequencies off-axis.

Ribbon mics

How about a bidirectional ribbon mic? The ribbon is fully open to sound on its front and rear. Sounds from the front or

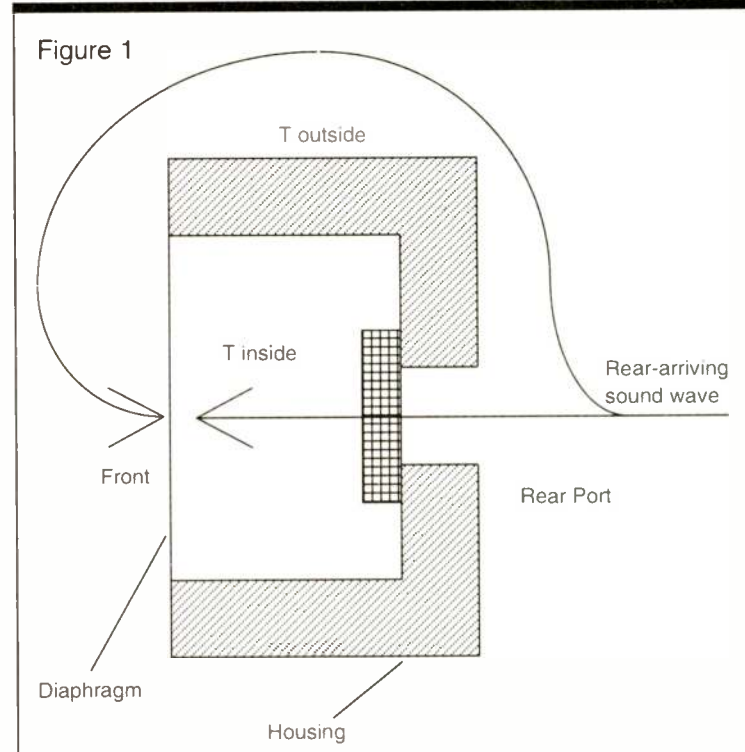
rear experience a phase shift as they travel around the ribbon, so you get an output signal. But sounds from the side press equally on the front and rear of the ribbon, in phase.

The ribbon cannot move, so you get a weak output from side sounds.

By changing the delay of the rear ports, you can get almost any pattern between bidirectional and

cardioid, such as supercardioid or hypercardioid.

Each of these two patterns has a rear lobe that is in opposite polarity with the front lobe.

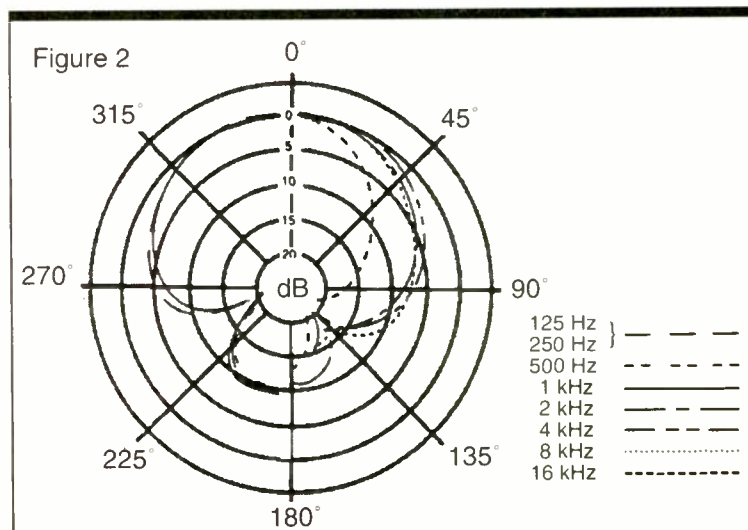


into the back of the diaphragm. Also, the ports delay the sound reaching the back of the diaphragm.

How does this arrangement cancel sound from the rear? Suppose a sound wave approaches the mic from the rear. It travels to the diaphragm by two paths: outside the mic, and inside the mic through the ports. See Figure 1.

Some of the sound wave travels to the front of the diaphragm, outside the mic. The sound travel time from the rear port location to the front we will call T .

Some sound also enters the rear ports,




What is the exact shape of each polar pattern? A mic with a cardioid pattern is sensitive to sounds arriving from a

continued on page 40

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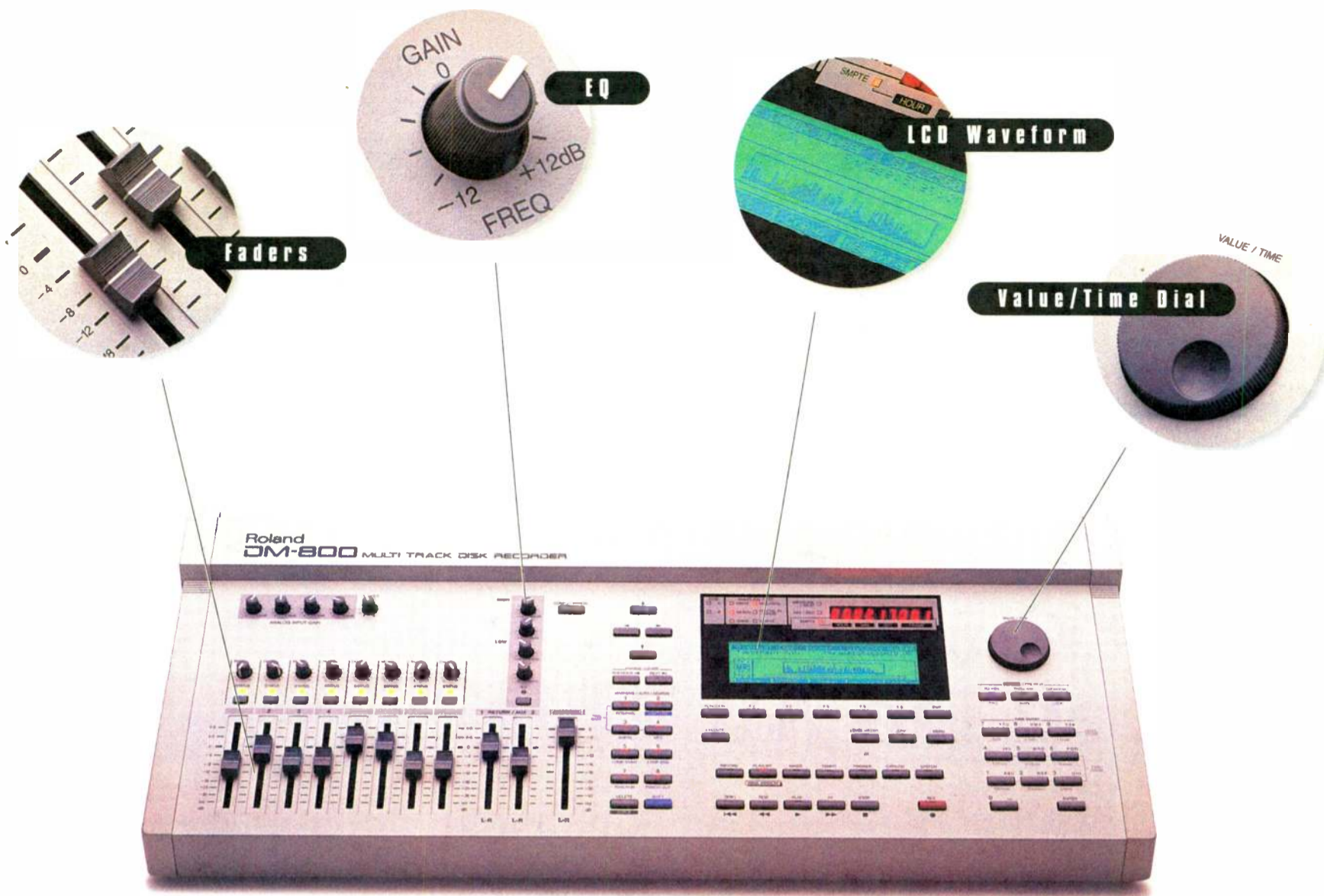
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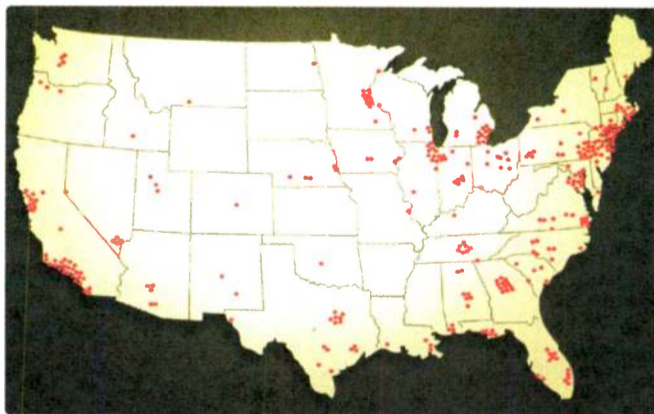


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Selecting Mic Can Make You Hyper

► continued from page 38

broad angle in front of the microphone. It is about 6 dB less sensitive at the sides, and about 15 to 25 dB less sensitive at the rear.

The supercardioid pattern is 8.7 dB down at the sides and has two nulls of least pickup at 125 degrees off axis.

The hypercardioid pattern is 12 dB down at the sides and has two nulls of least pickup at 110 degrees off axis.

Polar patterns can be plotted on polar graph paper. In an anechoic chamber, the mic is exposed to a tone of a single frequency, and is rotated around its diaphragm as its output voltage is measured. Figure 2 shows such a pattern.

charted at several frequencies.

The voltage at 0 degrees (on-axis) is called "0 dB," and the voltages at other angles are referenced to that.

In other words, the polar-response graph plots relative sensitivity vs. angle of sound incidence at various frequencies.

A polar plot is not a geographical map of the "reach" of a mic. A mic does not suddenly become dead outside its polar pattern: for that matter, there really is not an "outside." The graph plots sensitivity as distance from the graph origin. This is not the spatial spread of the pattern.

In good mics, the polar pattern stays

pretty consistent at all frequencies. If not, you will hear off-axis coloration which means the mic will sound tonally different on and off axis.

If the polar patterns are about the same at different frequencies, the response is about the same for sound coming in at any angle — at least in the front half of the pattern.

Applications

Omni mics have characteristics that make them useful for certain applications. Use omnis when you need:

- All-around pickup.
- Pickup of room reverberation.

- Low sensitivity to pop (explosive breath sounds).
- Low handling noise.
- No proximity effect, or up-close bass boost. A multiple-D directional mic with slotted handle also handles this.
- Extended low-frequency response (in condenser mics).
- Lower cost in general.

Use directional mics when you need:

- Selective pickup.
- Rejection of room acoustics, background noise, and leakage.
- Up-close bass boost.
- Better gain-before-feedback in a PA system.
- Coincident or near-coincident stereo miking.

Use a cardioid microphone when you need:

- A broad-angle pickup of sources in front of the mic.
- Maximum rejection of sound approaching the rear of the mic.

Use a supercardioid mic when you need:

- Maximum difference between front-hemisphere and rear-hemisphere pickup.
- More isolation than a cardioid.

The cardioid mic is directional because its housing blocks high frequencies off-axis.

Use a hypercardioid mic when you need:

- Maximum side rejection in a unidirectional mic.
- Maximum isolation — maximum rejection of reverberation, leakage, feedback, and background noise. This is because the hypercardioid pattern has the greatest random energy efficiency, or the greatest rejection of random-incidence sounds that arrive from all directions.

Use a bidirectional mic when you need:

- Front and rear pickup with side sounds rejected. Across-table interviews are an example.
- Maximum isolation of an orchestral section miked overhead, aiming down.
- Blumlein stereo miking (two bidirectional mics crossed at 90 degrees).

Some condenser mics come with switchable polar patterns. An omni boundary mic (such as a PZM) has a half-omni or hemispherical polar pattern.

A unidirectional boundary mic has a half-supercardioid or half-cardioid polar pattern.

The boundary mounting makes the mic more directional, so the mic picks up less room reverb and sounds clearer.

□ □ □

Bruce Bartlett is a mic engineer, writer and recording engineer, and the author of "Practical Recording Techniques" published by Howard Sams. Jenny Bartlett is a technical writer. Bruce can be reached at (219) 294-8388.

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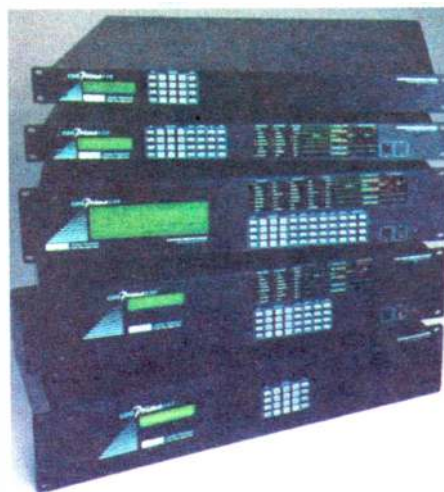
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PRODUCT EVALUATION

Pocket-size Sampler from Yamaha

by Ed LaComb

SYRACUSE, N.Y. A sampler is one of those handy little items that should be in every production director's studio.

For those of you who have put off getting one in your studio because you didn't have the room, the budget or the knowledge of how to use a sampler, here is a great solution for you.

The Yamaha SU10 digital sampler, a storage and playback device about the size of a VHS cassette. It is small, simple, fun and it sounds good.

A quick look at the face of the unit shows a set of transport buttons similar to a tape deck (Record, Play, Stop, FWD, BWD, etc.). There are also 12 pads for instant access to your sampled sounds.

To the left are six function keys that work in conjunction with the pad keys to direct the sampler to do what you want it to do. A small liquid-crystal display (LCD) gives you all the information you need.

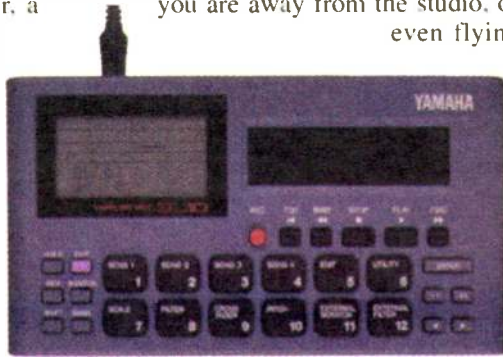
Ribbon controller

I enjoyed the very cool ribbon pad on the SU10. This is great for positioning the playback cursor and getting that "scratch" sampled sound for some hot mixes. Punch a couple of keys and it becomes a mini wah-wah filter.

The back side of the box gives you

MIDI in/out capability, which is great. Audio in/out capability is, unfortunately, on eighth-inch mini jacks. I really would like to see RCA jacks at a minimum, and quarter-inchers would be best.

The right side of the SU10 has a volume control and headphone jack. This is where the real beauty of this toy comes into play. You can actually do quite a bit of work on the thing even while you are away from the studio, or even flying



to another town.

Just pop in six AA batteries or an AC adapter, plug in a set of headphones and you are ready to work. When your work is completed, plug the unit into your studio board and ba-da-bing: you have 44.1 kHz stereo sound.

Don't let the physical size of the Yamaha SU10 fool you. This is a real sampler with CD-quality sound. The user interface is clear and easy to understand.

You have a total of four banks' worth of

storage, with 12 samples per bank and up to 53 seconds' sample memory.

You can also play back more than one sample simultaneously as four mono or two stereo sounds. Yamaha calls this "polyphony," which is the fancy word for "how much can you do with this thing?"

For example, you can create a beat loop, then add in some key samples of vocals, effects or whatever to create a "Song." You can create and store up to four songs for playback from the keypads.

An external playthrough mode lets you send realtime audio into the SU10. You can then grab it and scratch it as if you were a club DJ. The unit monitors the input and keeps the most recent few seconds of audio ready to scratch.

With the MIDI jacks, you can dump all data to or from any other MIDI device. And if you are stuck for a sample to record, the SU10 comes with two CDs filled with loops, beats and sound effects you can load right in.

As far as I can tell, there do not seem to be any RAM expansion possibilities, which is too bad. The comparable Roland MS-1 pocket sampler uses PCMCIA flashcards for additional sample storage. And the Yamaha's 53 seconds can be used up in a hurry.

Editing

When it comes to the editing functions, you can do everything. You can deter-

mine which portion of a sample plays out, change sample playback direction forward or reverse (for doing those devil messages), select single play or loop mode and whether playback continues when you release the pad. You see the waveform on the LCD just as you would on any digital workstation to determine the start and end points of a sample.

A handy lock feature prevents you from accidentally deleting samples or songs from the SU10. The memory of the unit is nonvolatile, so your samples are stored and ready to roll at any time.

The Yamaha SU10 is recommended to any beginner just getting his/her toes wet in sampling. The \$399 list price is certainly an enticement.

It is possible you may outgrow it in a matter of weeks, but I am also sure you will find yourself returning to your old pal very often when you need quick, simple results.

□ □ □

Ed LaComb is director of NewCity Production Services in Syracuse, N.Y. He can be reached at edlacomb@aol.com

Product Capsule:**Yamaha SU10 Sampler****Thumbs Up**

- ✓ 44.1 kHz audio
- ✓ Waveform display
- ✓ Editing, scratch control

**Thumbs Down**

- ✓ Memory not expandable
- ✓ Mini jacks

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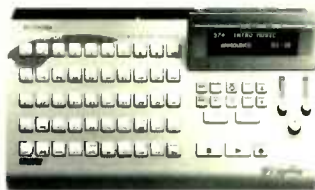
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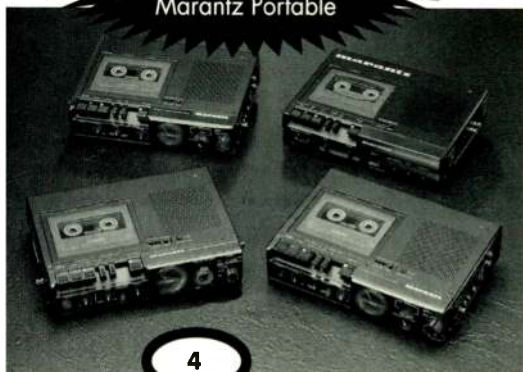
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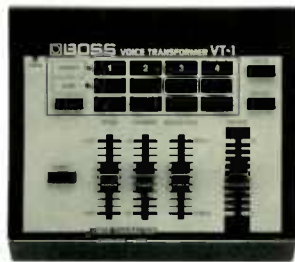


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1	Radio Sys	RS6	6 channel stereo console - NEW	\$4,799.00	\$4,165.00
Audio Processors					
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1	Aphex	320A	Compellor	\$1,350.00	\$929.00
1	Aphex	107	Tube Mic Preamplifier	\$595.00	\$375.00
Analog Recorders/Players					
1	Tascam	102MKII	professional cass. deck	\$369.00	\$257.00
1	Audicord	DLPS	stereo playback cart mach.	\$1,150.00	\$925.00
1	Sony	ALIII	auto locator for multitrack	\$1,895.00	\$499.00
2	Tascam	ATR602HS	1/2" 2 track reel-to-reel - NEW	\$4,500.00	\$1,499.00
Digital Recorders/Players					
1	Tascam	DA30	pro DAT machine	\$1,499.00	\$999.00
1	Denon	DN980F	MD player	\$2,400.00	\$1,788.00
1	Denon	DN970FA	pro cd player for production	\$2,800.00	\$1,699.00
1	Sony	MDSB2P	MD player	\$2,200.00	\$1,495.00
1	Sony	MDSB4P	MD player	\$2,500.00	\$1,595.00
2	Ramsa	SV3700	pro dat machine	\$1,695.00	\$1,125.00
1	NSM	CD3101ACD	100 CD changer	\$3,800.00	\$1,495.00
1	Tascam	CD401MKII	pro cd player	\$1,049.00	\$719.00
Digital Workstations					
1	Digidesign	Session-8	digital audio workstation for PC	\$3,995.00	\$1,995.00
2	Roland	DM80-8	8 trk hard disk recorder	\$6,595.00	\$4,995.00
2	Roland	DM80F	fader unit for DM80	\$1,195.00	\$799.00
1	Roland	DM80R	remote control for DM80	\$1,895.00	\$1,299.00
Telco/Remote Equipment					
1	Telos	150	twin digital telephone hybrid	\$2,180.00	\$1,895.00
2	Cylink	Airlink64D	wireless modem 64K	\$2,895.00	\$1,499.00
1	CCS	CDQ2001	digital audio codec - NEW	\$7,400.00	\$4,999.00
1	Henry	DigistorXMHF	digital message recorder	\$620.00	\$429.00
2	Comrex	DXP21	digital codec w/X.21 inter.	\$2,395.00	\$1,895.00
1	Comrex	DXR	digital codec	\$1,500.00	\$1,225.00
1	Comrex	TCB2A	telephone coupler	\$250.00	\$219.00
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1	Ramsa	WSA70K	loudspeaker	\$330.00	\$148.00
1	Sabine	FBX901	feedback controller	\$649.00	\$449.00
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See page 48.

PIONEER PROFILE

Power Built Improved Receiver

by Barry Mishkind

TUCSON, Ariz. Back when radio was in its infancy, stations were few and far between. The challenge was not just a matter of turning the dial on your radio to find a station playing your favorite music. It was more like finding a station at all.

The earliest stations were operated by a series of enthusiastic, even zealous, young people. They were scientists or amateurs, seeking to develop the new technology. What they lacked in funds, they made up for in dedication, ingenuity and versatility.

Commercial exploitation followed slowly, because few could imagine how to make a profit from broadcasting. Starting around the time of WWI, some receiver manufacturers and retailers put stations up to demonstrate their receivers. However, there were not enough listeners to interest most other businesses.

In order to sustain a successful radio station, operators soon discovered they needed more than a product. There was a need for financing and a solid plan for production and sales. Clearly it was a "mine field" for anyone who was not a good businessman. And thereupon hangs a tale ...

Powerful idea

As a young man early in the century, Harold Power was fascinated by radio; he had built his own receiver at age 10 in 1903, and his own amateur transmitter only two years later. He eventually attended Tufts University in Massachusetts, supporting himself by teaching wireless to high school students.

Power graduated with an engineering degree from Tufts and with several other Tufts graduates formed the American Radio and Research Corporation (AMRAD). The plan was to utilize what they had learned and build an improved receiver.

Power and associates went to work in a building provided by a couple of Tufts' professors, and soon began to broadcast from a 306-foot tower he had constructed on site. By 1917, IXE "The AMRAD Station" was broadcasting pretty much on a daily basis. Sometimes it was talk or music, sometimes just code transmission. The 100 W transmitter was the only "local" station in the Boston area.

So far, so good. The company was actually faring reasonably well, having picked up both a backer and a contract to build receivers for the Navy. The noted

millionaire banker J.P. Morgan had been impressed with Power's progress and bankrolled AMRAD. Additionally, many Tufts students, sensing the opportunity to be on the cutting edge of a new medium, volunteered their efforts both in the lab and on the air.



Harold Power was fascinated by radio.

One of the more popular announcers, who went on to become a Boston mainstay for many years was "Big Brother" Bob Emery. Another of Power's key employees was a woman: Eunice Randall. Like Power, Randall had an early interest in radio, building her own amateur station (WICDP and ER). She was a draftsman, engineer and even served as an announcer for IXE. Like for most early broadcasters, the job might change from day to day, and Randall would do whatever was required: sing when a guest artist failed to show or read bedtime stories to children (The Story Lady) — whatever it took.

Problems

WWI proved to be an opportunity for Power to sell his receivers to the military. But when the war came to its end, problems started to surface: a lot of unsold inventory. Power belatedly started advertising AMRAD receivers in magazines such as QST, and opened a sales office in New York. The AMRAD receivers were indeed of high quality, but getting them built and shipped out seems to have been difficult for the company to accomplish. In today's terminology, it appears that many of AMRAD's designs were no more than "vaporware."

Predictably, money began to become a problem. The station itself was not providing any real revenue. Although J.P. Morgan was more of a businessman than Power, he was said to have dropped as much as \$800,000 into the company, and he was rapidly losing interest due to

the lack of any return.

Over the next few years, IXE evolved into WGI radio, yet devolved into an economic basket case. At the same time, WGI began to offer college courses by radio, lectures by famous people, opera singers, daily newscasts, speeches by local politicians, even a morning show (unusual in those days when most broadcasting was done in the evening). But the financial damage was done. AMRAD's reputation had become one of missed opportunities, failed shipments, financial disaster. The result was an inability to repair the transmitter when it failed, and programming became somewhat sporadic.

The end

By late 1923, the station experienced more and more equipment problems which took it off the air just as other stations were coming on to compete for the audience. Several of the original air staff left for other stations. And things got worse.

Perhaps it was an attempt to avoid confusion with WGY Schenectady, or maybe it was preparation to sell a station without the WGI reputation. In any event, WGI became WARC in early 1925. But it was too late. Tufts wanted its building back; creditors wanted money. The station even lost its

full-time status and had to share time with a religious station.

Power did try to sell the station. Even though merchant John Shepard was actively seeking to buy another station, neither he nor anyone else wanted any part of AMRAD's reputation nor its founder, Power. Eventually, with a total lack of funds, the station went dark.

Late in 1925, Powel Crosley acquired AMRAD's manufacturing equipment. The radio station itself was finally sold to the Boston Evening Transcript. However, they had little more success with the transmitter than Power, and eventually even printed a front page apology for their poor transmissions.

The staff was gone. The factory was gone. The dream was gone. But in just a few short years Power and his associates had accomplished a lot. They had shown they could develop better receivers, produce a wide variety of programming and bring radio to the point of acceptance by the community.

I'd like to share credit for this look at The AMRAD Station with Donna Halper, a radio consultant and broadcast historian at Emerson College in Boston. She provided a good deal of assistance in researching and illuminating Harold Power and his station.

□ □ □

If you have suggestions for future Pioneer Profiles or would be willing to share any materials, please help share and save broadcasting's history. My address is 2033 S. Augusta Place, Tucson, AZ 85710. Thanks!

Barry Mishkind, can be reached at (520) 296-3797, and invites e-mail to barry@broadcast.net

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MANAGER'S NOTEBOOK

Assertive Actions Solve Crises

by Sue Jones

BURKE, Va. In the previous *Manager's Notebook* I outlined the first steps in effectively handling a management crisis at your station: preventing the crisis and having a plan to deal with one. Continuing, the next steps in effectively handling a crisis involve recognizing the scope of the problem, containing it, resolving it and profiting from it.

Recognizing the scope

It is easy to misclassify a problem, to focus on the individual, technical or internal aspects and ignore the issues of

perception. But it is often public perception that causes the crisis.

An example of underrating a problem might involve a religious station DJ that is arrested for cocaine possession. It is not just a personal problem for the DJ, it is also a credibility and public relations problem for the station. Fraudulent use of funds for religious and public radio stations are other examples of public trust problems.

Perception is reality. Ironic as it may be, this age of sound bites, often created by radio, can contribute to a station's undoing. Precious little information is conveyed in sound bites. While convenient

and quick, they often do not cover the full perspectives of all the players in a story. Often times the story seems one-sided. Your station's perspective may be shortened or presented in such a way that you become the villain. You may find yourself on the defensive after you have offended public sensibilities.

The first positive step is to immediately offer a public apology for a lack of sensitivity and explain the steps that you will take in the future to prevent the problem.

Be willing to accept the problem and work through a resolution. Crossing your fingers, holding your breath and hoping the problem will resolve itself is a fool's

game. Problems do not go away by themselves, they get bigger. It may be far more important over the long term to take tough decisive action that could be costly in the short term. But it could be far more costly if no action is taken.

Start by placing the interests of the listeners and clients and open communication above all other station needs. It will make your station a long-time winner.

Containing the crisis

The next step is containment and damage control. Decisiveness is critical at this point. Some reasonable decisive action is almost always better than no action. The general manager must clarify a confusing situation to the public and staff. Be careful of conflicting advice. Legal advisers often warn against telling too much in order to protect the station's legal position. Most experienced leaders will agree that it is preferable to overdisclose to protect credibility and long-term objectives, even at the risk of harming the station's legal position. Credibility is far more important over the long term than legal positioning for the station.

Quickly gather as many facts and professional opinions of appropriate responses as possible. State clearly that you do not know all of the facts but state the facts that you do know. The objective is to get it right, get it quick, get it out and get it over. Evaluate the human issues and real messages that you want to convey to the listeners before you make a public response.

Founding principles often aid decision-making in a crisis. Stations that have thought through what they stand for well in advance of a crisis are those that manage crises best. When all seems to be crashing down around them, they have principles to fall back on.

There is also value in dispatching the senior responsible person to talk with clients and listeners — usually the general manager. The general manager's presence sends two important messages: I care and I am accountable. This concept cements public trust much faster than a general manager who hides in his or her office with "no comment." As the leader and spokesperson for the station, you cannot remain silent even in the face of contradictory information.

A word of caution. Shooting from the hip without the benefit of counsel from staff, owners and other appropriate professionals can be just as damaging as the crisis. A swift, measured response is usually best. In situations that truly threaten the station's reputation or existence, the general manager belongs on the front lines.

Another important step is to identify a single individual to be the station spokesperson to make all the public comments. This will most likely be the general manager. Make sure the entire station staff is aware of the policy and the importance of speaking with one solid voice when you are ready to make a statement. Leaks of information by well-meaning staff could magnify your problem.

Keep the station's constituencies — its clients, owners, employees, suppliers and listeners — informed as appropriate. They should not be informed about the problem and its resolution solely through the media.

Put a devil's advocate on the resolution team. This should be someone who can tell the emperor in no uncertain terms

continued on page 47 ►



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OFFBEAT RADIO

'When Radio Was' Still a Favorite

The Man Who Brought Us the Lake Michigan Sundae Still Thrills Listeners with Syndicated Radio Show

by **Dee McVicker**

PHOENIX Long-time radio satirist and Radio of Hall Famer Stan Freberg still maintains there are some things you can do on radio that you can't do on television.

Drain Lake Michigan

Like, drain Lake Michigan, fill it up with hot chocolate, and then top the whole sundae-like thing off with a giant maraschino cherry — transported, of course, by the thunderous roar of the Royal Canadian Air Force, which releases its cargo with a megawatt kerrplunk-k-k.

"Now, you want to try that on television?" Freberg asked a nation of listeners in the early '60s, after a torrent of sound effects that literally plucked the event right out of thin air.

"I've always felt that radio is dedicated to man and woman's imagination ... the theater of the mind," stated Freberg emphatically, who was commissioned to do the commercial by the Radio Advertising Bureau 30 years ago to help position radio against the encroaching threat of TV.

Today, Freberg is still at it as the host of the radio show "When Radio Was," a compilation of old-time radio programs produced by Radio Spirits Inc. of Buffalo Grove, Ill. And, he has every bit as much zeal for the imagination-producing characteristics of radio today as he did way back when.

Apparently thousands of listeners in 38 states do too, tuning into "When Radio Was" to hear Freberg and greats like George Burns and Gracie Allen, Jack Benny, Fibber McGee and Molly, and such shows as "The Shadow," "Abbott & Costello" and "The Lone Ranger."

Insightful

During the hour-long shows, aired by affiliates typically in the 8 to 11 p.m. week-day timeslots, Freberg offers his insightful commentary about radio luminaries, many of whom he knew personally as a young radio network actor and as Jack Benny's replacement on the CBS Radio Network.

The show is offered to radio broadcasters on a barter arrangement that apparently is as good for the syndicator and production company as it is for the stations. "Almost everywhere in the country where they carry our show, our block of time is usually number one or number two," said vintage radio lover and Radio Spirits founder Carl Amari.

WMAQ(AM), Chicago, for example, picked up the five hour-long weekly shows for its 11 p.m. timeslot, to fill a programming void left by Chicago's WBBM(AM) when it quit running vintage radio show "Old Time Radio Classics." The show ran for 10 years and ranked number one with listeners in its time period.

So great was the market potential for old-time favorites that the programmers of WMAQ decided to trim an hour from the station's nightly sports talk show to make room for "When Radio Was," an

almost unheard-of occurrence in sports-crazy Chicago.

The reason for this return to classics, according to Amari, "is because old-time radio is so much fun to listen to. The dramas still work — and the mysteries and the comedies."

Young listeners

Amazingly, it's not just the older demographics that listen to old-time radio. "Young people are into it because you have to remember that when old-time radio was on, it was not just for old peo-

I've always felt that radio is dedicated to man and woman's imagination . . . the theater of the mind.

—Stan Freberg

ple. Back then they didn't grow up with it, it was new to them then."

Amari ought to know. As a boy of 12 he became interested in old-time radio when he heard his first radio mystery, the '40s thriller "Suspense." He soon began collecting his favorites, and while in college, launched what would eventually become Radio Spirits Inc.

Currently, Radio Spirits is the largest rights holder distributing Golden Age shows from the '30s, '40s and '50s. Amari has amassed the rights to 50,000 shows from the heirs or estates of the show creators, who receive royalties.

There is a lot that goes on behind the scenes at Radio Spirits to bring the old-time

shows up to CD quality. Three studios run 24 hours a day, two shifts, to clean up material from days gone by.

All material is processed through what Amari calls the Cadillac of restoration systems, the Sonic Solutions NoNoise system. The original 16-inch transcription tape is loaded onto an Apple computer, where clicks and pops and other audio imperfections are removed so that mysteries such as "Suspense" and "Inner Sanctum" are just as tension-filled as they were 50 years ago, only without the distortion.

The company provides audiocassettes and CDs packaged with the Smithsonian imprimatur in addition to the programming service, and it is growing more than 50 percent a year — from \$1 million in 1994 to about \$3.5 million in 1995.

Amari built up the business by purchasing time on small market stations, eventually landing a nighttime show on WJJD(AM) in Chicago, and then supplying vintage radio shows to Eastern Airlines for inflight entertainment of passengers.

Syndication

As luck would have it, a passenger on one of those Eastern Airlines flights, Dick Brescia, who had just retired after 22 years as president of CBS Radio, liked what he heard and later started syndicating the show under his syndication company, Dick Brescia Associates (DBA).

DBA now distributes the shows to more than 300 stations from a satellite uplink in New York, providing five one-hour shows with six minutes available for

local advertisement insertion and six minutes of national advertising by corporations like Johnson & Johnson, Sears and Visa — traditional television advertisers all.

When asked why the old-time shows are popular advertising vehicles and appear to be gaining listener support, Stan Freberg said: "Maybe people are tired of checking in their imaginations and staring at the tube."

Stan Freberg recently released his latest album, "Stan Freberg Presents the United States of America, Volume II - The Middle Years," now available in record stores or direct from Rhino Records at (800) 432-0020.

□ □ □

Dee McVicker is a free-lance writer and regular contributor to Radio World. She can be reached at (602) 545-7363, or via roots@primenet.com

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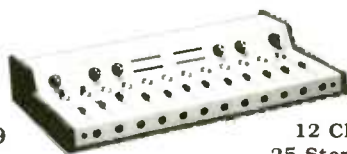
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the Month! Very well done, said the hamburger to the gas grill! (Hey, that reminds me — when is lunch getting here?)

Checking in

I recently set my cyber-tootsies down at the KSLU(FM) Web site (<http://www.i-55.com/kslu/>), and liked what I saw. "We're really cookin' ... a gumbo of entertainment, mixed with news and spicy music." it says right at the tippy-top of the homepage. And, darned if my taste buds weren't a-buzzin' at the hint of spicy music!

The home page serves some pretty pertinent information up front, continuing the food-tinged theme: "We invite you to dine regularly at any of our many restaurants: 90.9 on your FM dial, cable TV systems in four parishes and here on the Internet."

KSLU hangs its hat on Southeastern Louisiana University's campus in Hammond, La., — a link to the university's Web site is provided.

Visitors can choose to read about the station's history (it's 21 years young and 3,000 glorious watts/24 hours-a-day strong), read about the "chef's specials" — the hot programming on the station — or take a gander at the "complete menu" — a click of the mouse brings visitors to each day's roster of shows.

What's here is informative, well-presented and useful for the station's listeners. Gumbo on, KSLU!

Mailbag's open

... and spilling out all over the place, so let's get crackin' and take a look at some of the e-mails we've been receiving here at the global Haberspace headquarters (more next month).

I heard from Mark Holland at Communications Data Services Inc., who wrote to urge me to "keep the Haber-craft cruising." I never take my toes off the pedal, Mark, so that won't be a problem!

Anyway, CDS, which is in the business of providing RF engineering software and services to the telecommunications industry, has a nice page on its site (<http://www.commdata.com>) with a gorgeous green clay-like clickable map of the United States.

Clicking on the map (hey, it's clickable!) brings visitors a menu of links to radio stations in different states. Very nice and very useful, Mark.

I also heard from Tom Speicher at WWAS(FM) at the Pennsylvania College of Technology (WWAS was mentioned in this Space in June).

Tom tells me that the station has just gone into "phase two" with its site (<http://www.pct.edu/wwas>) — the WWAS folks are giving away a \$400 mountain bike exclusively on the Web.

The contest began on June 19; by the next day, 40 Web surfers had entered. Nice going!

Every once in awhile, it's kinda nice to hit upon a site that doesn't take itself too

seriously.

At KRUD Radio's site (<http://www.krud.com>), the medium you and I know and love is put under the funny microscope, and whaddayaknow ...

there's plenty of funny here! Well, not plenty exactly ... some, but some funny

page, stations can contribute their funniest bits to show other radio pros how to make yuks happen. Anyone with a RealAudio player can listen in and smile.

There's more KRUD to be had here, and it's probably worth your while to check KRUD out. I mean, any site that starts out on its home page by asking, "You don't like the songs we play?" and answers, "That's your problem" deserves a look ... and your funny bone's attention.

Hey, lunch is here!

Yu-uuuuuum!!! The eats have finally made it through to our desks, so I think

we'll quit surfin' for awhile and chow down! Next month, we'll chew the cud at KMOO-FM, get prepped and check out some more cool radio station Web sites.

Keep e-mailin' me at zoogang@earthlink.net — no information is too informative, remember. And, not coincidentally, no lunch is too yummy.



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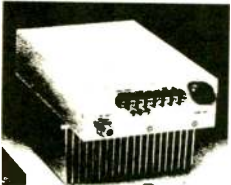
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Lynk 5250 emulation cards (2), ISA compatible w/DOS Windows software, use w/IBM System 36, S 38 or AS 400 twinax networks, new, never used. \$150 ea; IBM 5364 Baby 36 system w/4224 printer, 5160 PC/XT console, assorted lengths twinax cable, used w/JDS 1000 traffic system, gd cond, BO +shpg. M Humphrey, WPLY, 1003 Baltimore Pike, Media PA 19063. 610-565-9000. mark@y100.com

Want To Buy

Tandy 6000 HD with at least one floppy drive. Mel Crosby, 408-363-1646.

CONSOLES

Want To Sell

Ampex AM10 6x2 mixer, \$495. J Price, Price's Recdg Std, 2651 Globe Ave, Dallas TX 75228. 214-321-6580.

Autogram AC-8 8 chnl stereo workhorse in gd cond (2), \$2200 ea/\$4200 both. T McGinley, WPGC, 6301 Ivy Ln, #800, Greenbelt MD 20770. 301-441-3411.

Tascam 208 studio mixer, 8 in, 4 out, slide pots, separate 4 band EQ, XLR, RCA & 1/4" inputs & outputs, pro quality & quiet. \$550 +shpg. RK Hatcher, Rainbow Prod, POB 147, Yorktown IN 47396. 1-800-371-3548.

BE 8BEM-100 8 chnl mono, \$750. u pick up. Dave or Harold, KUVR, Box 465, Holdrege NE 68949. 308-995-4020.

Harns 80 stereo console, \$1000: LPB 8 chnl stereo, \$1200; Sparta 8 chnl stereo, \$500. D Rose, KDUC, POB 432, Barstow CA 92312. 619-256-2068.

Radio Systems ESA-10 stereo console, 10 pots, gd cond. \$1800. G Arroyo, 407-830-0800.

Soundcraft Spirit Folio 10 chnl portable w/slide faders, \$295. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-817-1030.

Spotmaster 5 chnl mono, several, \$300. J Parsons, Parsons Sound, 2781 Fayson Circle, Deltona FL 32738. 904-532-0192.

Mackie 1604, \$725; Tascam 512, \$950; Tascam 520, \$1750; Allen & Heath SYNCON 28x24, \$8000; Ramsa 820, \$2200. W Gunn, 619-320-0728.

Want To Buy

Autogram RTV-20, 20 chnl console ASAP in gd cond, T McGinley, WPGC, 6301 Ivy Ln, #800, Greenbelt MD 20770. 301-441-3411.

DISCO-PRO SOUND EQUIPMENT

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Want To Buy

UREI or Teletronix LA2A, LA3A, LA4A, 1176, Gates, RCA, Collins, Altec, dbx 160/165, all types, working or not. T Coffman, Rolltop Music Studio, POB 17203, San Diego CA 92177. 619-571-1645.

LIMITERS...WTS

Teletronix LA-2A's, UREI LA-3A's & LA-4's, Fairchild 660's & 670's, any Pultec EQ's & any other old tube compressor/limiters, call after 3PM CST, 214-271-7625.

Ampex style table top tape eraser, vgc, \$100; Taber table top tape eraser, works OK, auto switching needs work, \$200. M Crosby, 408-363-1646.

Catel FM modulator w/pwr supply, rack mount, for CATV on 105.1 MHz, \$250. B Campbell, KRIG, Bartlesville OK, 918-333-7943.

MICROPHONES

Want To Sell

HME-WM 252 wireless w/SM58 mic xmtr, \$195; Telex WT-200, \$300; Telex WT-50, \$250. J Price, Price's Recdg Std, 2651 Globe Ave, Dallas TX 75228, 214-321-6580.

Neuman U-87, Sennheiser 421, AKG 451-E, Shure SM-7. T Coffman, Rolltop Music Studio, POB 17203, San Diego CA 92177, 619-571-1645.

Shure 561's, several, new & used, \$10-50. A Wodel, ILCC Telecom, 1209 N 7th St, Esterville IA 51334, 712-362-4119 (eves).

Want To Buy

16B K06B EV RE 20 in good condition. Lino Bugatty, Dance Mix USA Prod, POB 1802, Pacifica CA 94044, 415-755-8370.

Any prof mics, any cond, for parts. J Price, Price's Recdg Std, 2651 Globe Ave, Dallas TX 75228, 214-321-6580.

RCA 77 & 44, Neuman, Sennheiser, EV, Altec, Coles, T Coffman, Rolltop Music Studio, POB 17203, San Diego CA 92177, 619-571-1645.

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MISCELLANEOUS

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

Symetrix T1-101 telephone interface, gd cond, \$175. G Gibbs, KMNS, 901 Steuben St, Sioux City IA 51102, 712-258-0628.

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300 best country songs 1975-76 on reel, \$150; servo motor for Ampex AG440-C, has little click in motor but works, \$250. H Sewell, Oakridge Music Recdg Svcs, 2001 Elton Rd, Haltom City TX 76117, 817-838-8001.

Blonder-Tongue audio/video TV modulator. VHF chnl's, \$99. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003, 602-817-1030.

dbx 166A comp & limiters, \$400; M85 MK 2 cassette deck for parts, \$100; mic 64225 hand held needs rcvr, \$100; Telex WT200 (3) no mics, \$35 ea; KC 100 voice control key change, \$150; dbx 1BX 111 range expander, \$50; Rec-O-Kut record lathe, \$350; tubes of all kinds; UREI 1176 LN limiters (2), \$1500 ea; Sony CD player, nearly new, no rack mount, \$250, H Sewell, Oakridge Music Recdg Svcs, 2001 Elton Rd, Haltom City TX 76117, 817-838-8001.

Electron tube test set TV 7.U, \$35; Gates time pulse gen, \$35; SKL variable electr filter, \$35; Sorenson AC voltage regulator, \$50. J Wilsbach, WMSS, 214 Race St, Middletown PA 17057, 717-948-9136.

Henry Match Box IHF-Pro audio box, like new. A Wodel, ILCC Telecom, 1209 N 7th St, Esterville IA 51334, 712-362-4119 (eves).

Lyrec tape timers (3), \$300 ea; (7) Seike/Spotmaster tape timers, \$175 ea; (5) Spotmaster TP1B cart winders w/timer, \$225 ea; (5) Spotmaster TP1B cart winders, no timer, \$50 ea. Mel Crosby, 408-363-1646.

Want To Buy

Issues of Audio Engineering & Audio magazine from 1940's, 50's & 60's. P Chance, Imperial Analog, 925 Clinton St, Philadelphia PA 19107, 215-574-8147.

SCA generator card for Collins 310-A exciter. B Campbell, KRIG, Bartlesville OK, 918-333-7943.

Jazz record collections, 10" LP/12" LP be-bop, swing, dixie, highest prices paid. B Rose, Program Recdgs, 228 East 10th, NNY 10003, 212-674-3060.

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Scientific Atlanta Encore DSR-3610 sat rcvr, setup for sportsbabe. Sedat/DATS, 7 mos old, \$3000; Universal Electronics XE-1000 sat rcvr, 7 mos old, \$1000. G Arroyo, 407-830-0800.

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Alignment tape: B346-1, 7.5 ips FT 0 VU 1/4", \$20; 4690005-01 15 ips NAB 1" FT, \$200/BO; 4690007-01 15 ips NAB 2" 8 trk, \$200/BO; 4690048-01 30 ips AES 1", \$220/BO; C0005 1/2" 7.5 ips NAB 185nW, \$125/BO; C0006 1/2" 15 ips NAB 185nW, \$125/BO; C0007 1.0" 30 ips AES 185nW, \$140/BO; C0023 1 2" 3.75 ips NAB 185nW, \$130/BO; X1353 3150 Hz flutter, 1/2" 15 ips FT, \$95/BO; X1252 3150 Hz flutter, 1/4" 30 ips, \$60/BO; X1352 3150 Hz flutter, 1/2" 7.5 ips FT, \$85/BO. M Crosby, 408-363-1646.

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Ampex 300-4 4 chnl rcdr w/tube electr, \$750; Ampex 2, 1-1/4" & Sony 630 w/lid speakers, \$75 ea, no shpg, come w/truck & S. T Houston, Custom Audio Recdg Svcs, 929 California Ave, Bakersfield CA 93304, 805-324-0736.



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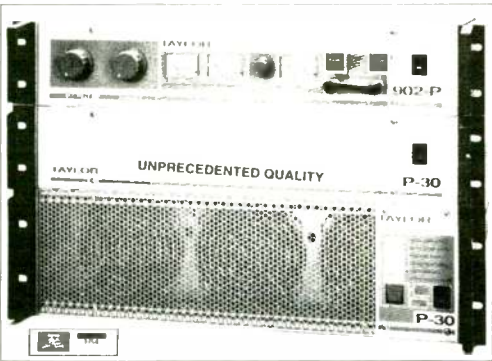
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