Radio World®

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Studio Sessions
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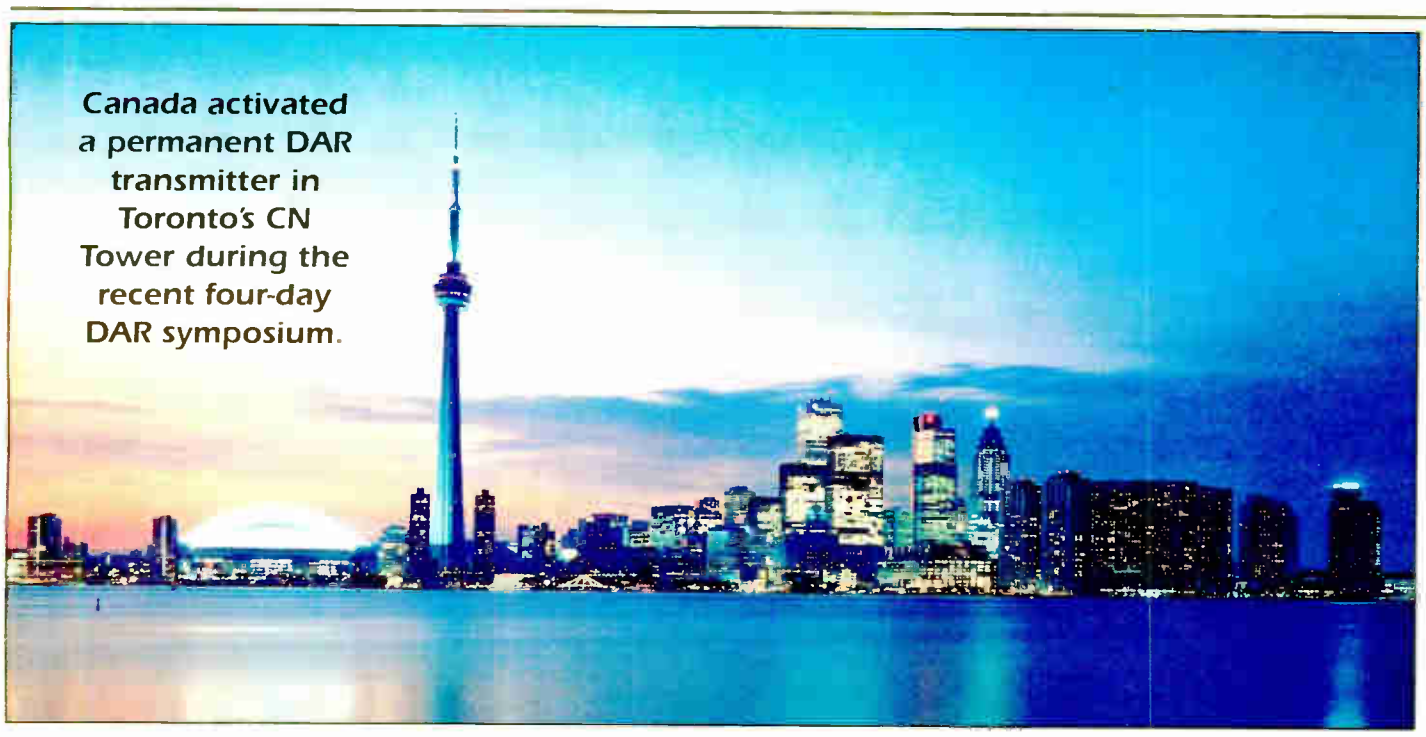

Canada activated a permanent DAR transmitter in Toronto's CN Tower during the recent four-day DAR symposium.

DAR Symposium Faces the Future

by Charles Taylor

TORONTO The Second International Symposium on DAB, "The Sound of 2000," offered an optimistic but upfront analysis on the challenges of tomorrow's radio technology around the world.

The four-day gathering at the Sheraton Centre here focused on technical accomplishments in DAB thus far and the realm of economic, regulatory and manufacturing issues now facing the broadcasting industry.

More than 400 delegates from 25 nations attended the conference, which featured some 85 speakers and panelists. It was organized by the Canadian Broadcasting Corp. (CBC), the Canadian Association of Broadcasters (CAB), Industry Canada and the European Broadcasting Union (EBU).

Continued cooperation

While it was acknowledged that the reality of digital radio is at least several years away in most nations, a call for continued cooperation among standards-setting nations was a strong theme of the symposium, amid warnings that broadcasters must boldly confront the future to remain viable in a quickly advancing world media marketplace.

In the opening address, Michael McEwen, co-chair/co-president of the event and senior vice president of the CBC, remarked, "If we do not embrace the potential afforded us by digital audio technology, we will simply not be competitive, either in market terms or in public service terms. Our listeners will simply tune us out.

"I am suggesting that (radio's) relevance will decline to the point where it becomes only a mild curiosity and a haven for a rather aged population," McEwen stressed.

The next step

More than anything, delegates voiced their eagerness for the next step for digital radio, acknowledging the general widespread acceptance of Eureka-147 as the preferred vehicle for digital radio transmission, and utilization of L-band or VHF spectrum in a majority of nations.

"Until now, DAB has mainly been technology-driven. What I'm hearing, however, is, let's now turn to business applications," said Michel Tremblay, co-chair/co-president of the event and executive vice president of the CAB. "It's

continued on page 12 ▶

Industry Has Role In NII

by Randy Sukow

LAS VEGAS The key phrase of NAB 1994 was "spectrum flexibility."

Broadcasters could justifiably leave the 1994 National Association of Broadcasters Convention in Las Vegas last month with a renewed sense of confidence in their future on the telecommunications superhighway.

A few days before the convention opened, broadcasters won House Energy and Commerce Committee approval of an amendment to its National Information Infrastructure (NII) bill (H.R. 3636), to give TV broadcasters the right to use their future high definition television spectrum assignments "ancillary and supplementary" digital services beyond HDTV.

NAB94 NEWS COVERAGE

Although the amendment was aimed at aiding TV broadcasters, the bill could eventually have implications for radio broadcasters before a final version is sent to the president (see RW editorial, April 6).

Both the House and Senate versions of the NII bill face several legislative hurdles, but Capitol Hill staff seemed confident that a bill would be passed this year and that some form of spectrum flexibility would be in it.

"Even though there was considerable opposition by your competitors to the spectrum flexibility amendment in this bill, it went in and it went in overwhelmingly," said Cathy Reid, minority counsel, House Telecommunications Subcommittee.

Perhaps confirming broadcasting's emergence in the shaping of the NII was the sight of Ray Smith, chairman and CEO of Bell Atlantic, talking about telephone industry convergence with broadcasters as seriously as its already-started (but of late more complicated) convergence with cable TV.

"We won't be able to meet our customers needs without (broadcast

continued on page 18 ▶

NEWSWATCH

NAB Crystal Awards Announced at Convention

LAS VEGAS Ten radio stations received the NAB's 1994 Crystal Radio Awards at the NAB Convention in Las Vegas with four Minnesota stations taking home the annual award

The winners were: KBHP-FM, Bemidji, Minn.; KLBJ, Austin, Texas.; KPSN, Phoenix; KSJN-FM, St. Paul, Minn.; WWTC(AM), Minneapolis; KCBS(AM), San Francisco; KOJM-AM, Havre, Mont.; KRMG(AM), Tulsa; WCCO, Minneapolis; and WXYV-FM, Baltimore.

The winners were chosen from 43 finalists nationwide. "These stations have shown tremendous commitment to their communities," said Bob Fox, chairman of the NAB Radio Board. "They set the radio industry standard in local service."

The Crystal Awards were created in 1987. The award winners were presented during the convention luncheon, March 22, that inducted Chicago Cubs sportscaster Harey Carey into the NAB Broadcasting Hall of Fame.

SBE Offers Radio Operator Course/Exam

INDIANAPOLIS The Society of Broadcast Engineers has introduced the organization's Radio Operators Certification Course, designed for entry level operators.

The new course was implemented to replace the FCC's Radio Telephone Third Class Operation License that was discontinued by the FCC in 1977.

According to the SBE, the new course was developed after radio station personnel "indicated a need for training and certification program to cover FCC training requirements, as well as provide an indication of competence of duty level operators."

The course consists of the SBE Radio Operators Certification Handbook and a customized 50-questions exam, drawn from 150 questions. To successfully pass the test, an applicant must score 90 percent or higher, which must be taken within a year of buying the handbook.

The course cost is $35 including exam fee. For more information, contact the SBE at 317-253-1640 (phone) or 317-253-0418 (fax).

Harris Schedules Technology Expo

RICHMOND, Ind. Harris Allied will conduct a one-day broadcast technology expo on Thursday, May 1, "Technology Solutions for Your Bottom Line." The expo will be held at the Leland Hotel in Richmond.

Products from 32 radio, audio, TV, video and satellite equipment companies will be displayed, and courses offered on RF and maintenance of CD players.

There is no charge for exhibit admission, training, meals, refreshments or parking, but Harris Allied recommends registering by April 29. For more information or to register, call 800-622-0022 or fax 317-966-0623.

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Freeze Impact Slight on Today's Engineering Firms

by Dee McVicker

WASHINGTON The FCC's recent comparative hearings applications freeze is having very little effect on broadcast engineering firms, according to several engineering firms who responded to **RW** queries into the potential effects of the freeze.

Robert Culver of engineering firm Lohnes & Culver, Washington, D.C. said: "I'm not concerned. I'm aware that it might have some impact, but right now I'm pretty busy. We're doing quite a bit of fix-up work rather than new filings."

Bill Suffa of Suffa & Cavell, Fairfax, Va., had similar comments. "My business strategy for a long time has been to provide real broad-based consulting and management services," he said.

And Jim Hatfield of Hatfield & Dawson, Seattle, summed up his firm's attitude: "I hate to think anybody is still making a living off of doing just applications."

Negligible effect

The firms' perception of the effects of the freeze announcement points to what many have suspected for some time: Broadcast engineering firms are shifting away from application filings toward maintenance type engineering services and even other industries. "The era of the 80/90 docket is passed," said Stan Salek of San Francisco's Hammett & Edison.

In recent years, all four engineering firms have expanded their service base in response to a changing broadcast market. Suffa & Cavell, for example, hired an electrical engineer expert in building construction to help the firm focus more on studio design and new construction. Lohnes & Culver made similar investments in studio as well as RF maintenance services.

The firms also have oriented their service in related industries, such as satellite communications and cellular telephone. "We do what one would think of as consulting engineering work in the traditional sense. But that is by no means the entire practice. We do a fair amount of business outside the broadcast area," Bill Suffa said.

Hatfield & Dawson also diversified into related industries, partly because of the maturation of broadcasting and partially because of the advancement of technology, according to Jim Hatfield, whose father founded Hatfield & Dawson in 1945 as a consultant engineer for the broadcast industry.

Not the same

"When we started out we had pencil and paper, an adding machine and slide rule, and sometimes a university computer" he said. "It's not the same game it used to be. Technology has changed. How we do things has changed."

Less than 10 percent of Hatfield & Dawson's business today is new application filings and some of Hatfield's time these days is dedicated to doing electromagnetic field measurements for related industries. "Applications are just a piece of the business," Hatfield said. "There just aren't that many new station applications because the service is a mature service."

The engineers interviewed did express concern that the February 25 freeze could slow up some projects already in the works. Dave Senzel with the FCC's General Counsel Office estimates that some 70 applications are being held up because of the freeze, and other applications will likely be affected.

During the freeze, all FCC applications requiring consideration of applicants' comparative qualifications will be "held in abeyance," according to FCC Public Notice 94-41. The freeze is the result of a federal court case, Bechtel vs. FCC, which called into question the FCC's policy on giving preference in comparative situations to those applicants who will be involved in the daily operation of the station.

The United States Court of Appeals for the District of Columbia accepted the arguments of Susan M. Bechtel, which were in essence that the Commission's policy of granting comparative credit to applicants whose owners will participate in the day-to-day management of the station is unlawful. The ruling, according to FCC Public Notice 94-41, "held that the integration of ownership into management, one of the principal criteria used in evaluating applicants for new broadcast facilities, is arbitrary and capricious and therefore unlawful."

Court mandated

The court ordered that the Commission consider Bechtel's application and any other application properly before it, under standards free of the integration policy. As a result of the ruling, said Larry Eads, of the FCC Mass Media Bureau's Audio Division: "The Commission felt it necessary to stop the proceedings and the processing of any comparative groups of mutually exclusive applications, so this affects not only FM, but it affects AM and television."

Broadcast engineering firms are shifting away from application filings toward maintenance type services.

All applications involving comparative analysis are put on ice, including at least three FM windows and AM applications for upgrades that might be contested under a comparative hearing. According to the FCC's Senzel, if an applicant is the only one proposing a viable facility that's buildable from a technical standpoint, then the Commission will likely grant the license. But if there is more than one applicant that meets the technical requirements, then the application is likely to go into comparative hearing order and wait for the freeze to thaw.

Applications for the AM expanded band will likely not be affected by the freeze, since worthiness of licensing on this band will be more of a technical consideration than an ownership or management consideration, according to Eads.

The freeze could be lifted "within a short time," according to Senzel, although it's probable the Commission's entire criteria for comparative analysis will be reexamined. The FCC is likely to take a look at a rulemaking initiated in 1992 regarding the criteria. "The Commission put out a notice of proposed rulemaking in 1992 that basically asked the question whether the criteria that are now being used to decide comparative hearing cases should be retained, modified, or eliminated," Senzel said.

Re-examination of the criteria could drag on, although the likelihood of this is very slim. "There's an urgency because the Commission cannot resolve cases," Senzel added.

Fun Times and Winners in Vegas

WASHINGTON Elsewhere on this page you will find the list of winners of **Radio World**'s first annual Cool Stuff Awards for NAB 1994. For those of you who were unable to attend the Vegas show, we scouted out the new and exciting stuff on the floor for you. As I mentioned in the preview issue, we put together a panel of experts whose mission at the NAB was to find the *Cool Stuff*.

The **RW** panel of experts walked the floor the entire week of the show and made note of any product (small or large, simple or complex) that stopped them in their tracks and made them exclaim, "Cool stuff!"

On the last day of the show, Buyer's Guide Editor T. Carter Ross and I stopped by the winning booths and presented each with a plaque and took pictures. All winners will be pictured in the May 4 **RW**, in our NAB product wrap-up.

★ ★ ★

News/Studio Sessions Editor John Gatski and I had our personal favorites,

in addition to the list from our judges. Editor's pick goes to the Harris Allied's DIGIT Digital FM Exciter, introduced last year but now sporting a Direct Digital Synthesis (DDS) technology to generate a signal with true 16-bit digital audio quality. The DDS device has a direct interface to all standard AES/EBU data rates.

John's pick is not a brand new product, but the Neumann TLM 193 microphone gives the user nearly all of the classic Neumann U87 sound at a very affordable $1,295. John also is impressed by the Spectral Synthesis PRISMA digital audio workstation and the Akai DR4d budget multitrack hard disk recorder (reviewed in this issue), a big hit with radio broadcasters at the show.

★ ★ ★

Other fun stuff happening at the show included a raffle by Broadcast Supply Worldwide. Alan Karben of Dow Jones & Co. (pictured with BSW's Bernice McCullough) won a Card D SAW software pack, and Shirley J. Updyke of WRGN(FM) in Sweet Valley, Pa., won the Digidesign Session 8 the company gave away on the last day of the show. Congratulations to both.

★ ★ ★

People news coming out of the show included an announcement from Bradley Broadcast Sales. Paul J. McLane, former U.S. sales manager for Radio Systems Inc. joined the company as marketing manager. McLane will be responsible for Bradley's annual catalog, direct mail marketing, sales training and convention planning.

CBS Radio President Nancy Widmann announced the promotion of Helene Blieberg, director, communications, to vice president, communications, for the CBS Radio division. Blieberg has been with CBS since 1982 when she joined the company as manager, press information, for the company's radio networks.

The Associated Press (AP) named Bob Keyes to the newly created position of director of broadcast planning. Keyes joins AP from NBC News in New York.

★ ★ ★

Another NAB has come and gone. Another **RW** Dream Team basketball game has been played. Scheduling conflicts did not allow me to make the spring match but I hear from Sean Bowers at Computer Concepts that this convention's game had a great turnout. The regulars were there, including: Cutting Edge's Frank Foti, 360 Systems's Don Bird, Harris Allied's Scott Beeler and Sean.

Making a second game appearance was Harris Allied's Jamey Miller, plus fellow co-worker Steve Poindexter. Sean reports that a mystery player showed up from the TV side of the business, but no one caught his name. He did, however, make the game very competitive. Another first for the Dream Team occurred when Chris Scherer of WZAK in Cleveland (a customer) joined the fun.

As announced, the game was held at 6 a.m. on Thursday and, from Sean's report, was hard-fought and contained only one tripping incident. The next Dream Team match-up will occur in Los Angeles in October, so keep your calendars open.

Winners

- Digital Broadcast Associates and AIR Corp. for the compression-less magneto-optical technology in their digital cart machines
- Aphex Systems for its four-channel processor, Model 106
- Audion for its VoxPro on-air digital audio editor
- QEI for its Quick-Link digital radio system for stereo remote broadcast
- Crown Broadcast for its FM-100 combination solid state transmitter/processor/stereo generator
- Gentner Communications for its Direct Connect Technology product line of telephone interface products
- DK Audio for its Master Display
- Radio Design Labs for its ST-RG1 ramp generator, ST-SX4 audio switch and ST-OSC2 oscillator
- Moseley Associates for its Starlink 9000 digital transmitter
- Videoquip Research for its DAVE digital audio workstation
- Telos Systems for its Zephyr digital transceiver
- Andrew Corp. for its HRL bullet-less transmission line
- Neutrik for its Combo XLR-Jack connector
- Potomac Instruments for its AA-51A audio analyzer
- Chris Payne for the Assistant Chief DTMF Audio Generator

Honorable Mentions

- Radio Systems for its Digital Delivery System (DDS)
- Alesis for its Monitor One studio reference monitor
- Modulation Sciences for its PRD-3000 RDS monitor, decoder and analyzer
- Corporate Computer Systems for its PACE workstation
- Sony, Denon and Otari for their MiniDisc cart machines

READERS FORUM

If you have comments for Radio World, call us at 800-336-3045 or send a letter to Readers Forum (Radio World, Box 1214, Falls Church, VA 22041 or MCI Mailbox #302-7776). All letters received become the property of Radio World, to be used at our discretion and as space permits.

Plenty of change

Dear **RW**,

I must beg to differ with the premise that the radio industry resists technological change (see front page and editorial, **RW**, March 23).

My companies market to radio stations and their vendors. The changes we have seen in eight years of operation have been radical. We used to sell sound effects on vinyl.

When vendors wanted to mail to radio stations, they'd come to us for peel-and-stick mailing labels. Now they often want the info on a computer disk (and it had better have the fax numbers too).

Many of today's radio stations are as modern as can be. Computers often handle everything from music scheduling to traffic and billing or maybe even the AP wire. An increasing number of stations use database marketing for both clients and listeners.

Some stations don't even own a turntable, and they ask their listeners to fax in their requests. Most program-preparation services now fax their materials, so the jokes are as fresh (or at least as silly) as today's headlines.

Auditorium testing, focus groups, RDS encoders, satellite dishes... the changes are so rapid that my spell-checker is choking on some of this stuff.

Perhaps the biggest obstacle to change isn't the inflexible mind of the broadcaster, but the money to pay for some of the high-tech gizmos. Not all of us have the financial resources of Michael Bloomberg. But one need only look through the pages of your publication to watch the technology emerging almost faster than we can keep track of it.

The big problem is that the rate of change is rapidly accelerating, and yes, radio must move with it or perish.

I write this as I am packing for the NAB show where radio and TV broadcasters will meet to see, touch, taste, feel and smell all the new toys. If anyone still thinks radio has a problem, walk into one of those fully digital production studios where the only time you will see a razor blade is if someone's feeling suicidal because they believe it when they're told they aren't changing quite fast enough.

Dave Dworkin, President
Ghostwriters and The Radio Mall
Minneapolis

Fellow sufferer

Dear **RW**,

The guest commentary by Jim Wojciechowski, "Radio Engineers: Leading a Thankless Life" (**RW**, March 9), certainly rang true with me, particularly when he said, "Never in working life...did I ever feel so completely unappreciated and used."

In November 1993, I left a job as a chief operator/announcer at a 5 kW DA AM station where I had worked for nine and a half years. Old equipment, almost no test gear and a transmitter with no available manufacturer technical assistance were a challenge. Other working conditions and attitudes, however, made the words "thankless" and "unappreciated" understatements.

They were compounded by the fact that I received only one wage increase during that period—10 percent in 1986.

I came close to leaving many times, but age was not on my side. Upon reaching 62 last year, I didn't have to take it any longer. My current Social Security income is almost equal to my old salary.

Many thanks to Jim Wojciechowski for saying what many of us felt, but just kept to ourselves.

Ray L. Jenkins
Delmont, Pa.

'Maximize' is right

Dear **RW**,

This letter is in response to "Maximize Sales While the Answer Is Yes," by Bob Harris (**RW**, March 9).

The major thrust of the article seems to be that many (80 percent) of all salespeople forget to sell the french fries and soda, along with the hamburger. I believe Bob is right in saying that many salespeople forget the extras.

I try to include the extras with the proposal when I meet with clients. I give them a choice of bonuses, such as a special rate on extra spots if they agree to purchase a certain package, or a discount on remotes with a regular spot but—whatever fits the situation at the time.

When clients say "yes" to an original plan, they often realize the value of the additional options, and, more importantly, the schedule they will be able to run. To me, the extras are like the meat on the bun.

Clients are not stupid. They know when the account reps are working for them and not just trying to pad their own pockets. Including the extras is a great way to prove you are working hard for them and that your station is the right one for them.

Scott Ten Kley,
KWOA-AM-FM Worthington, Minn.

Bad form

Dear **RW**,

Something else Alan Peterson doesn't know? Jeez!

He says he doesn't know what FCC Form BW-150 (mentioned in "From the Trenches," March 23) is for, so I searched and found my instructions for that form and enclose a copy. Regretfully, I could not find the actual form. I don't recall ever using one.

This copy is pretty old and has the original coffee stains all over it. I think it came that way.

And another thing, as far as Peterson's abuse of Auld Lang Sine is concerned, it is a well established TRUE FACT that the original Old Lang Sign is in NBC's Studio 5 at 30 Rock.

It was invented by Charles Lang of the NBC props department in 1955 just in time for a Milton Berle New Years Eve TV show and lights up the word "LAUGH" when you push the button.

They use it now only during the monologue of "The Tonight Show," and Lang's name is never mentioned at the specific request of his therapist. The shop steward of the NABET local is the only one authorized to touch it and he does so with great dignity.

(By the way, Mr. Lang retired in 1969 and moved to Boise where he lives on the other side of a mountain, completely blocked from all TV and radio signals. He reads a lot and is known to mumble to himself at unusual times.)

As always, you guys have a great paper.

James L. Sorenson, Chief Engineer
WTPX(FM) Fort Lauderdale, Fla.

Editor's Note: The enclosed instructions for BW-150—coffee stained, as advertised—are in the form of a joke letter of the kind many of us have received from anonymous or known mirth-makers over our fax machines. It claims that BW-150's sole purpose is "for use by (TV) stations changing from color to black and white for longer than the Carter presidency," which suggests this letter was probably not originally distributed by fax.

"The Tonight Show" has not been produced at 30 Rock in decades, so it must be assumed that the "Lang sign" made the trip west with Johnny Carson. But judging from the amount of laughter heard on the show in recent years, the sign is no longer being used in Burbank either.

Rip-out World

Dear **RW**,

May I suggest something that would have tremendous value to broadcasters?

The Feb. 9, 1994, edition of **RW** included a tear-out response card on the front page for subscription renewals. My idea is that **RW** could include regular sections, which could be easily removed and placed in notebooks for future reference.

The "**Radio World** Reference Manual" would continue to increase in value as time progressed. The manual could be color-coded by subject, such as sales, production, FCC rules, engineering and others.

This idea would benefit not only Industrial Marketing Advisory Services (**RW**'s parent company), but all of its subscribers and advertising clients.

Mark L. Russ, General Manager
WEIF(FM) Utica, N.Y.

Do Not Forget Radio

The recent NAB convention was an extremely strong and successful event, far and away the best NAB in recent memory. But with much of the growth and momentum of this show clearly headed in the professional video direction, the question is, "What about radio?"

Granted, most radio equipment suppliers said they were pleased with the exhibition. Some companies said they even closed significant deals on the exhibit floor, a sharp contrast to the lean times of the last few years.

However, it's clear that fewer and fewer U.S. radio station managers and engineers are attending the spring NAB. Many opt instead for the fall show, which has been more attractive in that it's been an all-radio event.

But starting this fall, the character of the NAB Radio Show is sure to change, now that the exhibits of SMPTE, SBE and RTNDA will be thrown into the mix. NAB promises that this won't dilute the Radio Show, but many radio broadcasters are taking a wait-and-see approach.

At the spring exhibition, one trend is that more and more traditional "audio" companies are opting to locate their booths on the video side of the convention center. In fact, in 1995, the industry's largest radio equipment supplier, Harris Allied, will follow the same path. These companies are drawn by the bustling traffic in the video hall compared to the audio hall.

The trend suggests that all radio equipment booths may eventually be spread throughout the exhibit halls, even though some companies will always fear being in the shadows of behemoth 10,000-square-foot TV booths.

Should NAB continue to offer to segregate the radio exhibitors at the spring show? Undoubtedly the lines are blurred between what is truly for-radio-only and what is general purpose audio gear. But radio is a distinct and separate medium. Its interests and needs should be protected and well served by the association that represents it.

NAB needs to watch these trends. With the fall Radio Show now a mix of radio and TV, certain radio industry forces are getting nervous. If NAB does not continue to provide the radio industry with its own strong forum, someone else will.

—**RW**

Correction:

Matt Locker of ProVoice, letter writer in the March 23 "Readers Forum," should have been identified as being from Wanaque, N.J.

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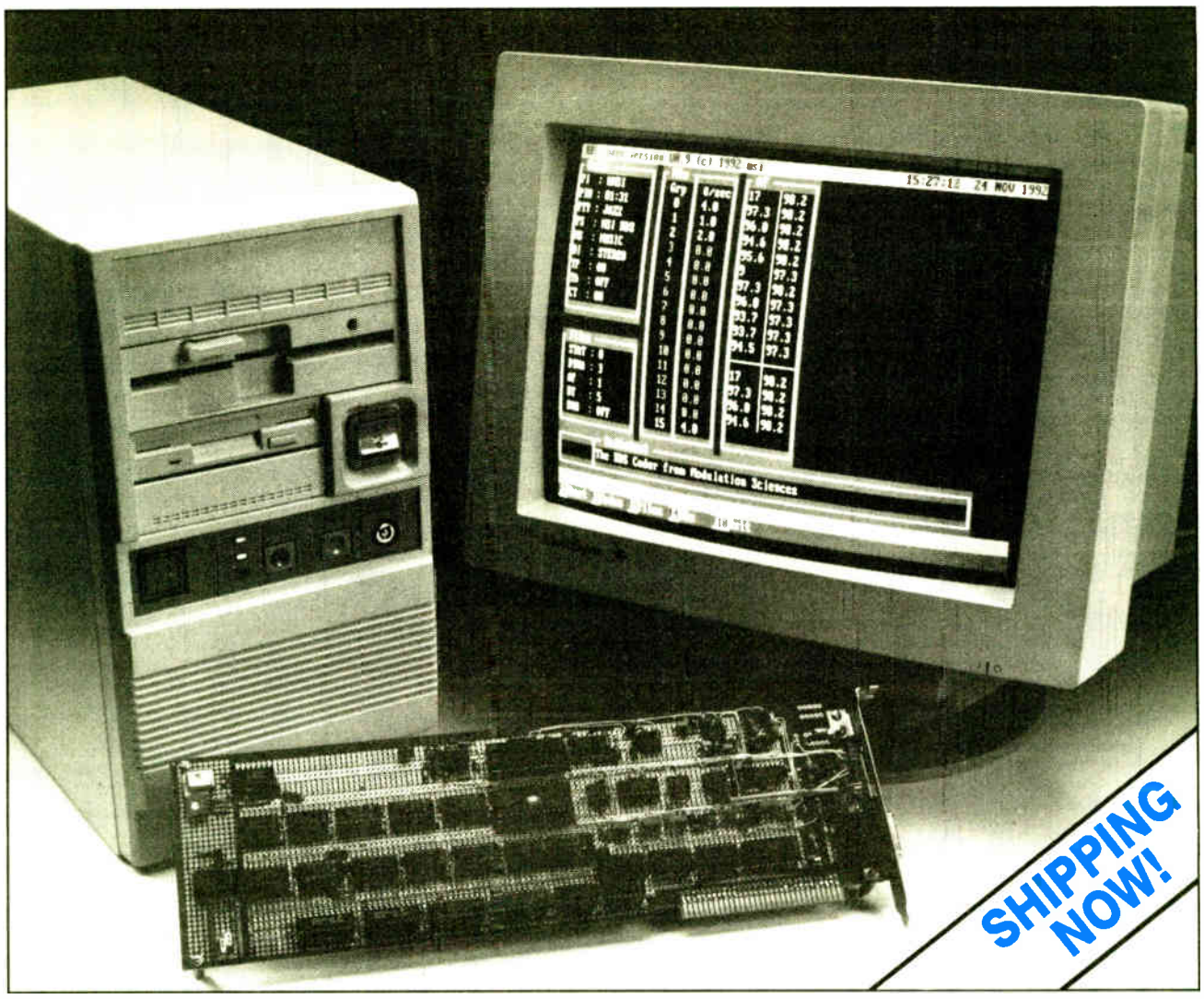

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Circle (115) On Reader Service Card

Hundt Addresses NAB Via Satellite

by T. Carter Ross

LAS VEGAS Addressing the NAB Engineering Awards Luncheon live via satellite from Argentina, FCC Chairman Reed Hundt stretched a hand out to broadcasters, asking for their help in repaving the telecommunications infrastructure of the United States.

Hundt was initially slated to deliver the opening address at NAB '94, but "patriotic duty," in his words, required Hundt to represent the U.S. and "our American business interests here in Buenos Aires" at the World Telecommunications Conference.

After expressing his regrets for being unable to attend NAB in person, Hundt outlined the themes by which he and the FCC regulate—access, reinventing government and economic growth—and how they are applied to broadcasting issues.

Access

In discussing access, Hundt pointed to the "important public services you [broadcasters] provide to the local community." He compared the access to local news that broadcasters provide to children's need for "quality education television."

"Congress is working on visionary legislation that will, among other things, ensure that we bring the information superhighway to every classroom, library and clinic by the year 2000....

"The 43 million school children who are in America's classrooms are a huge untapped audience for educational programming—and a great business opportunity for broadcasters."

FCC Chairman Reed Hundt addresses the NAB in Las Vegas.

Calling broadcasters "public trustees," Hundt stressed that he would seek to "balance the children's need for educational programming with practical economic considerations."

Hundt then moved on to his second goal: reinventing government. He urged broadcasters to call his office with suggestions as to how best revamp FCC operations.

At the same time, Hundt announced that he asked FCC Head of Mass Media Roy Stewart and FCC Chief Counsel Bill Kennard to report within 60 days on alternatives to the stiff fines broadcasters now face for failing to comply with FCC regulations.

"Broadcasters who make good faith efforts to comply with the commission's regulations," Hundt said, "should not have their licenses jeopardized by immaterial, unintentional violations of our rules."

Hundt then turned to his third objective: economic growth. Citing increases in ad revenues, he pointed to ways the FCC could help broadcasters continue their economic gains. He enumerated four points:

Growth potential

First, Hundt announced the ranking of 688 AM stations eligible to migrate to the expanded AM band.

Second, he assured that regulators "can examine our ownership rules to balance considerations of efficiency, competition and diversity."

Third, Hundt promised to analyze new technologies, including digital audio broadcasting (DAB), and to "pay studious attention to the competitive realities for terrestrial broadcasters."

Finally, Hundt pushed for broadcasters to join in developing "the information highway and ultimately the Global Information Infrastructure."

Hundt then moved on to an issue "intimately related" to the superhighway and to broadcasters—high definition television (HDTV). Stressing caution and his willingness to seek advice from the NAB, Grand Alliance (the corporate body lobbying in favor of HDTV) and others, Hundt tried to reassure broadcasters.

"With their guidance and the input of others, I believe the FCC will successfully balance the difficult and complex technological and economic considerations involved, questions of spectrum allocation and licensing related to HDTV."

Hundt ended by again asking for input from broadcasters on innovative ways of allocating spectrum space, promising to "examine your proposals with eagerness."

"My new friends, only miles separate you and me," Hundt said in closing. "And over those miles I hope you sense the sincerity of my belief that broadcasting has not even begun to reach the limits of the contribution it can make to America and the world."

FCC Seat For Ness

by Alan Haber

WASHINGTON President Bill Clinton announced last month his intention to nominate communications attorney Susan Ness as the fifth FCC commissioner. The nomination came less than two weeks after the nomination of Rachelle B. Chong to the fourth FCC commissioner post.

Ness, 45, is a communications attorney in Bethesda, Md. She spent nearly 10 years as senior lender and, later, as group head, in the Communications Industries Division of the American Security Bank, a regional financial institution based in Washington, D.C. Her portfolio included companies within a variety of communications industry sectors, including telecommunications, media (such as radio and television), and publishing.

After serving in the mid-1970s as Assistant Counsel to the U.S. House of Representatives Committee on Banking, Currency and Housing, Ness founded and directed the Judicial Appointments Project of the National Women's Political Caucus.

Born and raised in Northern New Jersey, Ness graduated with a Bachelor of Arts degree from Douglass College at Rutgers University, where she served on the board of directors of the university's radio station. In 1974, she received a Juris Doctor degree, cum laude, from Boston College Law School. In 1983, she earned a Masters in Business Administration from the graduate division of the Wharton School of the University of Pennsylvania.

A frequent speaker on broadcast finance at communications industry conferences, Ness is a member of the Federal Communications Bar Association and is admitted to the practice of law in both the District of Columbia and Maryland.

The President's nomination must be approved by the Senate Commerce Committee and the full Senate. If she is approved, Ness will succeed Ervin Duggan in the Democratic slot. Duggan left his post as an FCC commissioner earlier this year to become president of the Public Broadcasting System. Ness' term would expire in June 1994, at which point she would have to renominated.

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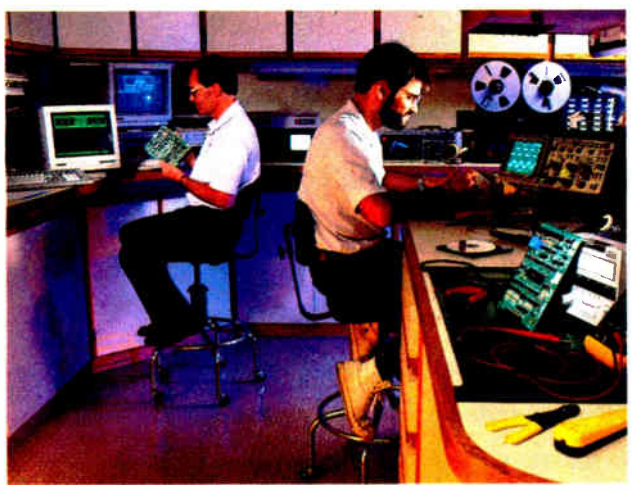

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NAB Draws Record Crowd

by John Gatski

LAS VEGAS The 1994 National Association of Broadcasters (NAB) set another attendance record at its spring convention, March 20-24, with a final attendance of 71,082—topping 1993's attendance by more than 10 percent.

The international attendance greatly contributed to the high numbers, increasing 27.3 percent over 1993. The actual international total was 14,669 or 20.6 percent of the total attendance, according to NAB.

"We were delighted with the attendance," NAB spokeswoman Lynn McReynolds said. "We knew the numbers were going to be up some."

As usual, the NAB offered numerous sessions covering industry topics such as digital audio work stations, EEO requirements, advertising issues, RFR standards, and digital audio broadcasting.

The FCC also revealed that a preliminary staff calculation of AM expanded band allotment shows slots for less than 100 stations. (**RW** will have complete coverage on the expanded band in an upcoming issue.)

Some NAB sessions experienced some logistical problems with certain ones bumping into the time slots of the next scheduled event; or speakers that switched their time, angering some audience members who were on a tight schedule. But McReynolds said such problems are part of the "growing pains" of the spring show.

From all indications, the exhibitors were happy with their floor space and the heavy traffic, McReynolds said.

The heavy traffic and number of vendors on the TV side of the convention hall, however, may be perceived as having a draining, effect on the radio side, according to some observers. This may continue to bolster the image that the spring Las Vegas convention floor is being dominated by video companies.

This year, there were a few more radio/professional audio companies on the TV side that had previously exhibited on the radio side, such as Modulation Sciences and Hafler. Other companies, such as Sonic Solutions, a major player in digital audio workstations, chose the Multimedia exhibit at the nearby Las Vegas Hilton.

And for the first time since the NAB has maintained separate audio and video exhibit areas, Harris Allied, the dominant U.S. radio equipment distributor, announced that it would move its booth to the TV side, starting in 1995.

Harris Allied spokeswoman Martha Rapp said that Harris sells a lot of video/TV products and that company has decided to put its booth on the TV side where there is heavy video traffic.

"It was a very, very difficult decision," Rapp said. "Harris is very involved in radio, but we are also heavily involved in TV/video industry."

Rapp said Harris Allied cannot have two booths, one in the radio side and another in the video area, because NAB does not allow it.

Rapp maintained that Harris "is in no shape or form abandoning radio" at the NAB spring convention.

Harman International, with its large number of pro audio companies such as Studer, and JBL Soundcraft may be able to fill in the void left by Harris' move. The corporate giant plans a large presence in the audio hall in 1995, according to company comments to **RW**.

NAB Vice President of Operations, John Abel said the radio/audio exhibit hall is in good shape with about 100 companies still on the waiting list.

In other technology related news, Radio Data Systems (RDS) equipment companies and service providers said that they believe they turned a corner at the NAB show with more interest shown by radio stations in datacasting. Currently, more than 100 are on the air or plan to be on the air shortly.

Companies showing product included RE America, CRL, Broadcast Electronics, Innovonics, Rohde and Schwarz and Modulation Sciences. Service providers included DCI, Coupon Radio and MusicBoard.

For the first time at a NAB convention, **RW** honored the cutting edge new products at NAB with the first annual Cool Stuff Awards. Fifteen of the awards were handed out as well as honorable mentions. (See *Page Four* for a complete list of the award winners.)

RBDS ROLL CALL

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

RBDS Equipment Manufacturers and Distributors

AEV
Via Saviolo I/E
40017 Le Budrie
Di S. G. Perisceto
Bologna, Italy
49-51-95-02-01/95-02-49

Bradley Broadcast
8101 Cessna Avenue
Gaithersburg, Maryland
20879
Contact: Art Reed
800-732-7665
Reader Service 33

Broadcast Electronics
4100 North 24th St.
P.O. Box 3606
Quincy, Illinois 62305
Contact: David White
217-224-9600
Reader Service 21

Broadcast Supply Worldwide
7012 27th St. West
Tacoma, Washington 98406
Contact: Tim Schweiger
800-426-8434

Harris Allied
3712 National Road West
Richmond, Indiana 47374
Contact: Scott Beeler
800-622-0022

Circuit Research Labs
2522 W. Geneva
Tempe, Arizona 85282
Contact: William Ammons
800-535-7648
Reader Service 44

Modulation Sciences
12A World's Fair Drive
Somerset, New Jersey
08873
Contact: Art Constantine
908-302-3090
Reader Service 161

RDS Diagnostix
74 Hanover Road
Mountain Lakes, N.J. 07046
Contact: Boyd Baker
201-334-7858

RE America, Inc.
31029 Center Ridge Rd
Westlake, Ohio 44145
Contact: John Casey
216-871-7617
Reader Service 201

Rohde and Schwarz
4425 Nicole Drive
Lanham, Md. 20706
Contact: Chris Porzky
301-459-8800
Reader Service 49

SCA Data Systems
Suite 350
225 Arizona Avenue
Santa Monica, Calif. 90401
Contact: Corinne Weber
310-576-0655

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

Tectan
Box 27157
Concord, Calif. 94527
Contact: Judy Pendleton
800-TECTAN-1
Reader Service 12

VG Electronics
Theaklen Drive Hastings
East Sussex TN34 1YQ
England
Contact: Bev Marks
+44-424-446888

RBDS Receiver Manufacturers

(with current U.S. models)

Axcess (Paging)
6620 Riverside Drive, Suite 200
Metairie, Louisiana 70003
Contact: Bobby Adams
504-889-9800

Denon (Car/Home)
222 New Road
Parisippany, New Jersey 07054
Contact: Stephen Baker
201-575-7810
Reader Service 69

DENON

Grundig (Portable)
3520 Haven Ave., Unit L
Redwood City, California 94063
415-361-1611

Onkyo (Home)
200 Williams Drive
Ramsey, New Jersey 07446
Contact; Fred Maxik
201-825-7950

RBDS Service Providers

Axcess (Paging)
6620 Riverside Drive
Suite 200
Metairie, Louisiana 70003
Contact: Bobby Adams
504-889-9800

Coupon Radio (Information Services)
10 Rockefeller Plaza
New York, New York 10020
Contact; David Alwadish
212-595-1313
Reader Service 28

CouponRadio

DCI (Global Positioning)
20045 Stevens Creek Boulevard
Suite 2A
Cupertino, California 95014
Contact: Ron Haley
408-446-8350
Reader Service 78

DCI

Sage Alerting (EBS)
700 Canal Street
Stamford, Connecticut
Contact: Gerry Lebow
203-357-1464

SATX (Computer Data)
Milestone Enterprises
2221 Mariner Circle
Raleigh, North Carolina 27603
Contact: Miles Beam
919-856-0063
Reader Service 157

SATX™

Specialized Communications (Music Billboard)
1638 153rd St. SE
Bellevue, Washington 98007
Contact: Allen Hartle
206-641-9043
Reader Service 140

Musicboard™

Terrapin (IVHS Services/Diff-GPS)
11958 Monarch Street
Garden Grove, California 92641
Contact: David Kelley
714-898-8200
Reader Service 66

TERRAPIN

If you would like to feature your company's logo and information on the RBDS Roll Call page, contact your Radio World sales rep.

RBDS Stations

Station	Frequency	City
CALIFORNIA		
KLON-FM	88.1	Long Beach
KTWV-FM	94.7	Los Angeles
KCRW-FM	89.9	Los Angeles
KNPR-FM*	88.1	Ridgecrest
KSFM-FM	102.5	Sacramento
KPBS-FM	89.5	San Diego
KEAR-FM	106.9	San Francisco
COLORADO		
KMJI-FM	100.3	Denver
DISTRICT OF COLUMBIA		
WGAY-FM	99.5	Washington
FLORIDA		
WTMI-FM	93.1	Miami
WUFT-FM	89.1	Gainesville
WFLZ-FM	93.3	Tampa
GEORGIA		
WSTR-FM	94.1	Smyrna
ILLINOIS		
WXRT-FM	93.1	Chicago
WLS-FM	94.7	Chicago
WFMT-FM	98.7	Chicago
WNUA-FM	95.5	Chicago
INDIANA		
WSHW-FM	99.7	Frankfort
WZPL-FM	99.5	Indianapolis
WZWZ-FM	92.7	Kokomo
WWKI-FM	100.5	Kokomo
LOUISIANA		
WGGZ-FM	98.1	Baton Rouge
KFXY-FM	96.7	Morgan City
WLMG-FM	101.9	New Orleans
WMYZ-FM	95.7	New Orleans
KCIL-FM	107.5	Houma
MASSACHUSETTS		
WGBH-FM	89.7	Boston
WBOQ-FM	104.9	Gloucester
WBCS-FM	96.9	Newton
MARYLAND		
WHFS-FM	99.1	Annapolis
WXYV	102.7	Baltimore
MICHIGAN		
WIOG-FM	102.5	Bay City
WLLZ-FM	98.7	Detroit
WKQI-FM	95.5	Detroit
WJLB-FM	97.9	Detroit
WQRS-FM	105.1	Detroit
WDBM-FM	88.9	East Lansing
MINNESOTA		
KBEM-FM	88.5	Minneapolis
MISSOURI		
KYYS-FM	102.1	Kansas City
NEW MEXICO		
KKOB-FM	93.3	Albuquerque
NEVADA		
KKLZ-FM	96.3	Las Vegas
KNPR-FM	89.5	Las Vegas
KNPR-FM*	88.7	Boulder City
KNPR-FM*	91.7	Beatty
KOMP-FM	99.3	Henderson
KNPR-FM*	88.7	Indian Springs
KNPR-FM*	89.5	Laughlin
KNPR-FM*	88.7	Moapa Valley
KNPR-FM*	88.7	Pahrump
KNEV-FM	95.5	Reno
KNPR-FM*	88.1	Scotty's Junction
KNPR-FM*	105.1	Searchlight
KLUC-FM*	98.5	Las Vegas
KFMS-FM	101.9	Las Vegas
KEYV-FM	93.1	Las Vegas
KRRI-FM	105.5	Las Vegas
KOMP-FM	92.3	Las Vegas
KEDG-FM	103.5	Las Vegas
KFBI-FM	107.5	Las Vegas
KYRK-FM	97.1	Las Vegas
KLNR-FM*	91.7	Panaca
KTPH-FM*	91.7	Tonopah
KEYV-FM*	103.5	Laughlin
NEW JERSEY		
WBGO-FM	88.3	Newark
NEW YORK		
WZRQ-FM	102.3	Albany
WHTZ-FM	100.1	New York
NEW MEXICO		
KKOB-FM	93.3	Albuquerque
OHIO		
WOUB-FM	91.3	Athens
WVXU-FM	91.7	Cincinnati
WWNK-FM	94.1	Cincinnati
WGAR-FM	99.5	Cleveland
WENZ-FM	107.9	Cleveland
WLTF-FM	106.5	Cleveland
WKKO-FM	99.9	Toledo
WGTE-FM	91.3	Toledo
WHIZ-FM	102.5	Zanesville
WOUZ-FM	90.1	Zanesville
WGLE-FM	90.7	Lima
PENNSYLVANIA		
WRTI-FM*	97.1	Allentown/Bethlehem
WNCE-FM	101.3	Lancaster
WFLN-FM	95.7	Philadelphia
WRTI-FM	90.1	Philadelphia
WPLY-FM	100.3	Philadelphia
WDUQ-FM	90.5	Pittsburgh
WRTI-FM*	97.7	Reading
TENNESEE		
WYPL-FM	89.3	Memphis
TEXAS		
KNLE-FM	88.1	Austin
KAYD-FM	97.5	Beaumont
KQXY-FM	94.1	Beaumont
KYKR-FM	95.1	Beaumont
KERA-FM	90.1	Dallas
KILT-FM	100.3	Houston
KOOI-FM	106.5	Jacksonville
KKMY-FM	104.5	Orange
UTAH		
KSOS-FM	106.9	Ogden
KSOS-FM*	92.1	Salt Lake City
KSOS-FM*	96.7	Salt Lake City
KSOS-FM*	98.3	Utah County
VIRGINIA		
WLTY-FM	95.7	Norfolk
WNVZ-FM	104.5	Norfolk
WKOC-FM	93.7	Virginia Beach
WCDX-FM	92.7	Richmond
WASHINGTON		
KUOW-FM	94.9	Seattle
KMPS-FM	94.1	Seattle
KRPM-FM	106.1	Tacoma

* Translators

DAR Symposium Faces the Future

▶ continued from page 1

time to focus on what's desirable and economically feasible."

Much commonality dominated the program as nations exchanged ideas on the numerous economic, consumer and regulatory issues now facing the introduction of DAR. Debate persists worldwide regarding such specifics as service areas, transition from FM and AM services, receiver technology (see accompanying article, page 14), cost and preparing consumers for acceptance. In any case, there was consensus that in time, DAR will represent replacement technology for FM and AM.

Outside of sessions, a dozen or so equipment manufacturers promoted their interest and involvement in the technology in a mini trade show. Companies included Rohde & Schwarz, Pioneer, Tennaplex Systems and ComLink Systems. Perhaps most prominent was Eureka-147, which held a dominant position not only on the show floor, but in session discussions.

U.S. a holdout

Among those not embracing Eureka-147 is the U.S., at this point intent on developing its own in-band, on-channel (IBOC) transmission system. The nation's failure to commit to L-band for DAR transmission—spectrum the Federal Communications Commission (FCC) is not willing to allot to broadcasters—drew harsh criticism from officials in other nations, and in particular from Canada, which shares not only its border with the U.S., but would benefit greatly in sharing mass proliferation of common DAR receivers with its North American neighbor.

In remarks at a meeting with the press, Minister of Canadian Heritage the Honourable Michael Dupuy, said it is not inconceivable that the two nations would sell different receivers to consumers. "We've taken a strong lead and are convinced we are offering Canada the best," he said. "I hope that America, in due course, will decide to join the rest of the world."

McEwen scoffed at public demonstrations of IBOC technology, referring to USA Digital Radio, a U.S. system under development that he suggested has, thus far, fallen short of expectations.

"If they get it to work, it will be a solution that will not fully address the needs of AM and FM broadcasters to meet the digital challenges of convergence and the multimedia environment," McEwen said.

"There seems to be a view by the U.S. broadcasters that whatever technology they develop, Canada and Mexico will pick up and follow," he added. "It is my personal view that Canada will opt for the best technology and the technology that best enables the broadcaster to serve our listeners and markets into the 21st Century."

In addition, Paul Ratliff of the BBC, a strong proponent of Eureka-147, chided the U.S. for investing so much time testing IBOC proponents. He said the nation should instead devote efforts to pressure the FCC to release L-band to broadcasters. The U.S. is "out of step with the rest of the world," Ratliff said.

The gathering focused on technical accomplishments in DAB thus far, and the realm of economic, regulatory and manufacturing issues facing the industry.

Permanent transmitter

Other significant events at the symposium included activation of a permanent digital radio transmitter in the CN Tower, the world's tallest freestanding structure and the signature of Toronto's skyline.

A similar transmitter was launched in Montreal on March 11. The installation was sponsored by Digital Radio Research Inc., a group consisting of the CBC, CAB and the federal government.

Symposium delegates also were offered the opportunity to hear digital audio broadcasting in a receiver-equipped van that cruised the city streets, utilizing the CN Tower antenna. The demonstration featured a third-generation Eureka receiver broadcasting six FM and AM channels at different bit rates.

A number of nations presented state-of-the-technology updates regarding digital radio during the symposium. Following are some highlights:

■ Canada remains among the leading catalysts for digital radio in the world. The technology is a priority not only for the nation's industry groups, but has support from the federal government. Recently, the CBC, CAB and government formed Digital Radio Research Inc. (DRRI), a research and development consortium.

Permanent antenna installations are in place in Toronto and Montreal as field tests are underway, and the nation has established a specific list of regulatory issues to tackle now: determine the shape and size of broadcast regions, how to group stations, ownership issues, staged implementation, transition period, and dealing with existing, ancillary and satellite services.

The CAB, which represents private and local broadcasters, regards the technology as a savior for the nation's struggling broadcast business environment, because it will allow development of new services and allow for shared equipment and operating expenses.

■ Germany: Field tests of Eureka-147 are in place in South Bavaria in Munich and to the North in Cologne/Bonn on television channel 12 and in Berlin on television band 1. The actual

continued on page 14 ▶

"The thing is just impossible to screw up! The DM-80's non-destructive editing is the only way to go, and revisions are extremely easy and very quick!"

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DAR Symposium Draws Global Crowd

▶ continued from page 12

launch is slated for 1997. Public and commercial stations likely will be assigned to channel 12. However, it is acknowledged that this spectrum—224-230 MHz—is not expansive enough to contain all the stations that will eventually broadcast digitally. The L-band, then, will be utilized for local broadcasters.

German officials now will tackle how to fit the technology into the nation's regulatory structure, as well as creating innovative programming that will provide incentive for DAR's consumer acceptance.

Cost estimates for planning and installation of a full-coverage DAR network: DM500 million.

■ The French DAB Club, a group of regulators, broadcasters and industry leaders brought together to nurture development of DAR, intends to launch service utilizing Eureka-147 by late 1995. In April, test transmissions were scheduled to begin with 10 stations around Paris.

"We'd like to go beyond the experimental phase into the commercial application of DAB," said Jean Ruff with TéléDiffusion de France. He acknowledged, however, that recession in France may make a launch challenging, not only for pioneer broadcasters, but in selling a new service to consumers. Innovative programming is key, he said.

■ U.K.: Following progress from its four working groups—which tackled frequency planning, field trials and evaluation, regulatory issues, and consumer equipment—the BBC intends to launch DAR services throughout London by late 1995, following favorably received Eureka-147 tests in the city earlier this year.

It hopes to implement the technology over the country's urban areas and main road infrastructure by 1988-99. This would cover 60 percent of the nation. Still, it will be "some years" before local services have a shot at DAR, said Mark Saunders of the BBC.

■ U.S.: While the U.S. actively pursues many questions surrounding DAR, it has yet to achieve success with the first step: technology. As a result, most nations regard it far behind in the race to digitize radio.

Other nations that are sold on Eureka-147 on L-band or VHF, have moved on to tackling economic and consumer issues, but U.S. officials thus far insist on developing their own system that would utilize IBOC spectrum allocation. This decision has been met with disdain from officials in Canada and across Europe, looking to agree on a worldwide standard.

Washington attorney Robert Mazer, however, told delegates that IBOC is efficient since existing frequencies are reused and it "preserves the economic integrity" of existing radio broadcasters.

■ Mexico is keeping an eye on DAR development—particularly in Canada and the U.S., its North American neighbors. While initially a supporter of Eureka-147, officials backed off in light of U.S. reluctance. Still, Mexico is eager for DAR inception, and is a member of the CAB and U.S. National Association of Broadcasters Task Forces. Even more telling, the nation's radio/TV association, the CIRT, has a 2.5 million pesos (US$800,000) commitment to fund the technology.

■ Australia is particularly interested in both terrestrial and satellite DAR, to bring service to remote areas not currently served by radio.

All sectors of broadcasting in Australia joined together to form a DAR Committee, which has committed to L-band. One issue still under consideration is just which technology to opt for: Eureka-147, an in-band system or satellite DAR. The organization also is exploring a number of policy issues, front transmitter ownership and access issues to transition.

■ The Netherlands hopes to introduce DAR service in 1997, backed by efforts of the Netherlands DAR Committee, made up of national, public and cable outlets and manufacturers. An experimental DAR network has been in operation by NOZEMA, the nation's broadcasting transmission company, since November 1993.

A priority in the region is development of creative and innovative programming to ensure success of the new medium.

■ In the Nordic countries—Sweden, Finland, Denmark and Norway—experimental transmissions already are in place, beginning in 1992 in the Stockholm area.

Nokia, a receiver manufacturer in Finland, is committed to developing a satellite/terrestrial unit utilizing Eureka-147, which will cover the frequency range 50-250 MHz and 1452-1492 MHz.

Still ahead for the countries are meetings to attempt unification of a frequency system. They are scheduled for 1995.

Receiver Makers Will Propel Consumer Acceptance of DAR

by Charles Taylor

TORONTO Participation in DAR by receiver manufacturers was acknowledged as a key step in consumer acceptance of the new technology, it was agreed at the Second International Symposium on Digital Audio Broadcasting here in mid-March.

"Technology alone will not sell DAR," said George Waters of the European Broadcasting Union (EBU). "The key to success will be in the receiver. If marketed at a reasonable cost, it will quickly penetrate the market."

Even more to the point, Michael Binder of Industry Canada commented, "Without receivers, this is a no go."

Already, eight manufacturers have met with officials in various nations regarding development of mobile and fixed DAR receivers: in Europe, Thomson, Telefunken, Philips and Grundig; in Japan, Pioneer, Sony and Kenwood; and in the U.S., Delco, which manufactures all radios for General Motors vehicles. Delco noted its receiver development would not be limited to in-band, on channel (IBOC) if the U.S. indeed adopts such a spectrum standard for DAR.

Officials noted confidence that all major receiver makers will come on board once it is better understood what features and functions are deemed desirable. "Datacasting" was strongly favored as one likely feature, and discussion was ripe about a variety of interactive, advertising-oriented services that might be possible with DAR.

Pioneer showed a prototype of the world's first DAR receiver, which it expects to have working in a year. The model will utilize Eureka-147 third-generation technology with MUSICAM source coding and COFDM channel coding.

In a session, Georg Lütteke with the European Association of Consumer Electronics Manufacturers (EACEM), described the first generation of digital radio receivers as relatively large and power consuming and not suited for small, hand-held battery-driven sets. He indicated that mobile applications would be optimum for initial applications.

As well, he said, first receivers will likely feature an interface to link them to future services, and include access to both the L-band and VHF bands—which most nations have allocated for DAR—along with FM and AM.

"To make DAR attractive to the customer, the full potential and flexibility of the DAR system in terms of services and products has to be exploited," Lütteke said. "Economy of scale must be achievable to keep receiver prices low."

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Mixers so good that they're regularly used to create major label compact discs, feature movie soundtracks, and more commercial production work than you can shake an RE20 at. For example, our CR-1604 16-channel mic/line mixers are used nightly on the Tonight Show, Arsenio Hall, Conan O'Brian and David Letterman Shows[1].

Our mixers have also covered hundreds of thousands of miles with acts like Peter Gabriel, Madonna, Whitney Houston, Paula Abdul, Bruce Springsteen, Reba McIntyre, Alabama and Michael Jackson[1]. Compared to the relative security of a station production room, a six-month world tour is about the most brutal test that any electronic component can go through. Our mixers have a reputation for being bullet-proof on the road — even when loading dock mishaps and power surges have taken out everything else in the same rack.

As for use at broadcast facilities, well, we're not total newcomers. A quick scan of our warranty database shows that over 70 U.S. radio stations already have Mackie mic/line mixers in place.

Does that mean you folks aren't as conservative as everybody says? If so, call your favorite broadcast supply house, or dial us toll-free for complete information on Mackie's line of mixers.

If you are conservative, keep an eye on us, anyway. We want your business even if we have to wait five years.

[1] Mention in this ad denotes documented useage only. Mention is not intended to infer endorsement by any of the television shows listed.

[2] Price is slightly higher in Canada.

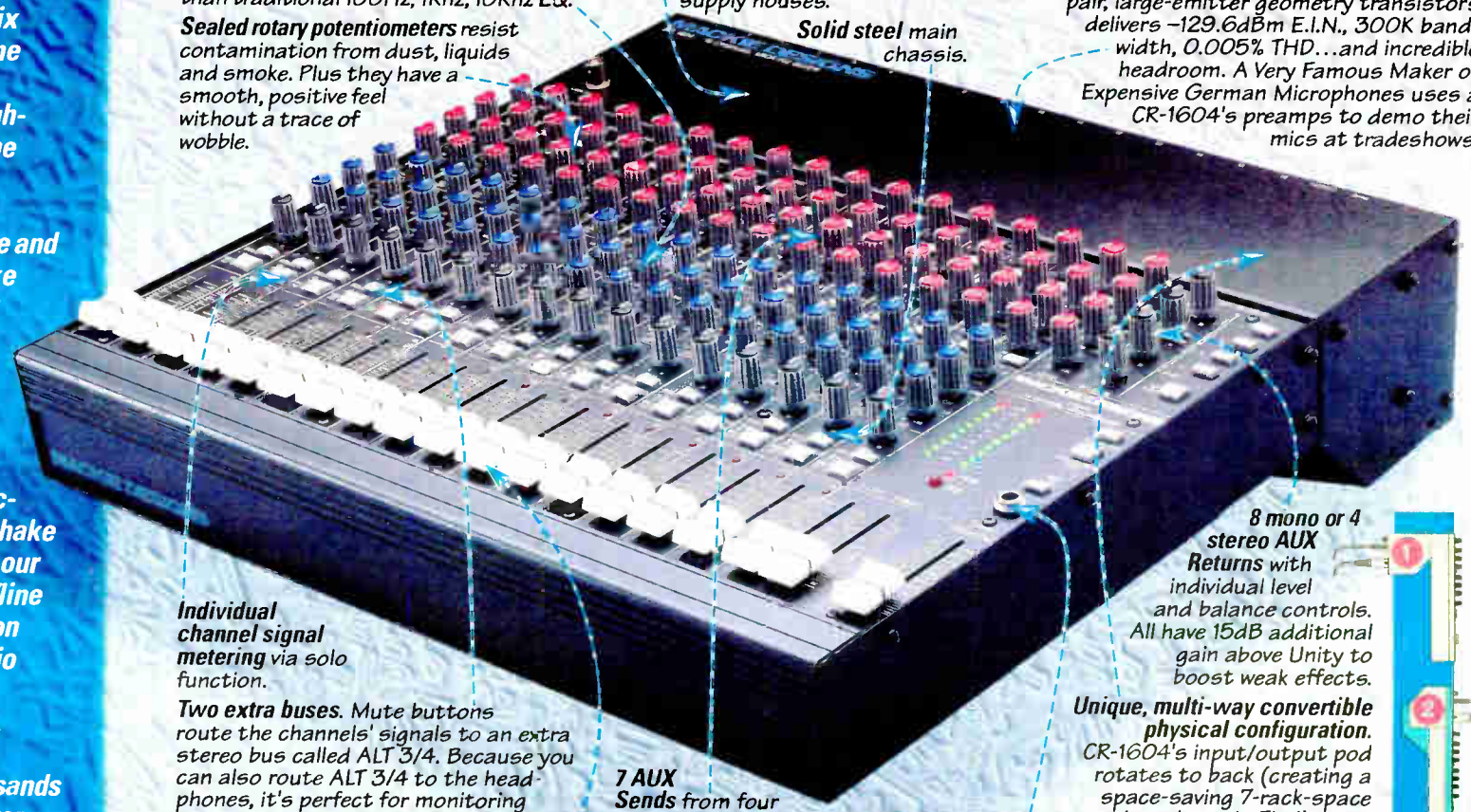
The Mackie Designs 16x2 **CR-1604 Mic/Line Mixer**. Suggested retail price, $1095[2]. Available at America's top broadcast supply houses.

3-band equalization done right: ±15dB at 80Hz, ±12dB at 2.5kHz (perfect for voices), ±15dB at 12kHz. Far more useful than traditional 100Hz, 1Khz, 10Khz EQ.

Sealed rotary potentiometers resist contamination from dust, liquids and smoke. Plus they have a smooth, positive feel without a trace of wobble.

Solid steel main chassis.

Six recording studio-grade microphone preamps with +48VDC phantom power. Discrete circuitry with four conjugate-pair, large-emitter geometry transistors delivers –129.6dBm E.I.N., 300K bandwidth, 0.005% THD...and incredible headroom. A Very Famous Maker of Expensive German Microphones uses a CR-1604's preamps to demo their mics at tradeshows.



Individual channel signal metering via solo function.

Two extra buses. Mute buttons route the channels' signals to an extra stereo bus called ALT 3/4. Because you can also route ALT 3/4 to the headphones, it's perfect for monitoring advance audio cues: Preview a signal that hasn't been brought up in the mix yet...then add it by unmuting the channel.

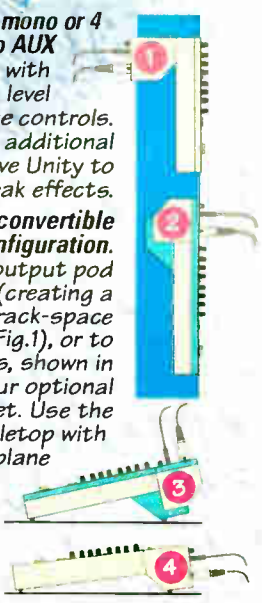
UnityPlus gain structure gives high headroom and low noise at the same time. Set the fader to center-detent Unity Gain, press channel solo to monitor the channel via the CR-1604's LED meters, adjust the input trim ONCE, and you're ready. Because there's 20dB MORE gain available on the fader, you won't need to constantly re-adjust the trim.

7 AUX Sends from four knobs. AUX 1 can be used as an effects send or headphone monitor cue via the MON. Sends 3 & 4 become AUXs 5 & 6 when the SHIFT button is pressed. All sends give you 15dB more gain above Unity so that you can get tons of effect even when the channel fader is pulled down.

Powerful headphone amp (with volume control) drives any phones to head-banging levels even an AOR production person will appreciate.

8 mono or 4 stereo AUX Returns with individual level and balance controls. All have 15dB additional gain above Unity to boost weak effects.

Unique, multi-way convertible physical configuration. CR-1604's input/output pod rotates to back (creating a space-saving 7-rack-space mixer shown in Fig.1), or to front (10 rack spaces, shown in Fig. 2) with our optional RotoPod bracket. Use the CR-1604 on a tabletop with jacks on the same plane as the controls via the RotoPod bracket (Fig. 3 below), or jacks to top (Fig. 4 below). Our XLR10 Mic Preamp Expander can also be added in any of these configurations.



Maximum RF protection. Most compact mixers use plastic jacks that transmit RF to the main circuit board where it's re-radiated and picked up by anything that rectifies (A). The CR-1604 uses **metal** jacks and washers plus a shunting capacitor to de-rail RF before it gets to any circuit traces (B). A **Radio World** reviewer tested a CR-1604 on a transmitter hill with 3 VHF TV and 1 FM sticks plus several microwave repeaters and shortwave transmitters. When he plugged in a notoriously RF-prone microphone, he detected NO RF.

Not shown: Inserts on Chs. 1 thru 8, main left/right bus inserts, phantom power switch, balanced/unbalanced main stereo outputs and separate mono output. XLR10 Mic Preamp Expander connects to the CR-1604 pod to provide 10 more preamps complete with trims and phantom power.

A chip off the old block: Perfect for remotes, our **MS1202** 12x2 Mic/Line Mixer has 4 of the same superb mic preamps that distinguish our larger CR-1604, plus phantom power, 2 AUX sends/ch., 2 stereo AUX returns, channel patching, 2-band EQ, 3-way 12-LED peak metering, headphone monitor amp with level control, built-in power supply. Suggested retail is just $399!

Rugged design and construction. Including mil-spec, double-sided, thru-hole-plated fiberglass circuit boards (horizontally-mounted on brass stand-offs for impact-resistance), double-parallel-wired faders for 2-times redundancy, and electronic protection against power surges, impedance mis-matches and static discharges.

Better-than-digital specs and headroom. The CR-1604 has a dynamic range of 108dB and an internal S/N ratio of –116dB (versus compact discs' 96dB dynamic range.) This means you're getting a mixer that can handle the output of digital workstations, CDs and DAT tapes without overload.

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GUEST COMMENTARY

RBDS Holds Information Services Potential

by Miles Beam

RALEIGH, N.C. Imagine this scenario: As the first rays of sunlight pierced the window of his study, Joe quickly scans the headlines of the morning news.

He glances at the weather map and listens to an audio clip of the forecast. A quick look at the traffic report shows delays on the interstate due to an accident that occurred just five minutes ago. His favorite stock is up five points.

Lastly, he retrieves a list of new real estate listings in Area 7, less than $125,000. The listing is only two hours old so maybe he could have the first shot.

Not bad for three minutes of work.

However, Joe is not reading any ordinary newspaper. Obviously, Joe is using his computer. But where and how did he get this up to the minute information? That's easy, he got it from the radio station.

Do not wait

While Joe is fictitious, the technology needed to create Joe's newspaper is not. It's here today. The radio world is rapidly becoming familiar with RDS and the potential it holds. The "Joe" scenario represents the next step beyond RDS. Radio stations have the potential to become important information distribution centers.

To become a successful commercial information distributor, radio stations may need to do much more than transfer lines of text to RDS receivers. The distribution of binary data files, not just text strings, may be the key that turns radio stations into tomorrow's information distribution centers.

Today's software applications use many types of information, including graphics and audio files, database and spreadsheet files, and even digital video files.

This is the kind of information that corporate America and you and I deal with every day. It is the kind of information that companies are paying to have distributed through satellites, telephone lines, and other means. There is no reason why radio stations can't carry some of that load and reap the rewards.

Radio's data advantage

Radio has certain advantages over other methods of data transmission. It is cheaper than satellites, can be tailored for local markets and it can reach mobile users. Generally speaking, the hardware required to receive data over radio is much less expensive than that used to receive data via satellite.

In some ways, radio stations can provide some of the same advantages as satellite delivered data services, though obviously on a much smaller scale. Radio stations will be able to target specific localized markets that would be economically unfeasible for satellite communications.

The potential applications for data over radio are numerous. Not only can radio stations deliver news, weather, sports, and classifieds, they also can serve as the information distribution medium for local chain stores. Advertisers could pay for "space" in radio-delivered newspapers. Radio can provide information to a company's local mobile sales force. It is even possible, through the use of addressable hardware and/or software, to provide e-mail services for local companies.

In order to implement a data broadcast system as described above, you will need the proper hardware, the proper software and a paying customer.

Equipment is ready

RDS and data subcarrier hardware is either available or becoming available from several vendors that support auxiliary RS-232 serial data inputs.

Find a serial communications product that runs on DOS-based IBM PCs and compatibles.

Now all you need is the paying customer. If all this capability is here now, why aren't companies knocking your door down asking you to provide this great service?

It's simple. As a general rule, they have absolutely no idea that such things are possible.

It's a chicken and egg situation. Companies are not asking for this service from radio stations because they do not know it can be done and radio stations are not implementing it because nobody's asking.

I'm willing to bet that in many markets, if you put together a data broadcasting system and announce it, they will come.

□□□

Miles Beam is the president of Milestone Technologies Inc., which specializes in the development of data broadcasting software and applications. He can be reached at 919-856-0700.

Broadcasters to Play Role in NII

▶ continued from page 1

news and information) product," Smith said during the keynote address to the convention. "It's pretty clear why we need you—we want to deliver your programming over our video distribution networks."

The next several months are likely to be hectic for communications lawmakers, many of whom will also be dealing with health care bills in the same committees. It may be difficult for them to reach compromises and agree to final versions of what are likely to be long, complicated and controversial pieces of legislation.

But Congressional staffers seemed confident that an NII bill could be done. "We don't give ourselves deadlines for when (H.R. 3636) will be on the floor, but I would expect it will be before Memorial Day," said David Leach, the lead staffer on telecommunications issues in John Dingell's (D-Mich.) House Energy and Commerce Committee.

John Windhausen, senior counsel to the Senate Commerce Committee, said he is "optimistic that we can get this done this year." The rules of the Senate make it more difficult to move a bill to the floor, but he said a vote on the Senate version (S. 1822) may come by this summer.

The drive to win spectrum flexibility picked up speed after the NAB Joint Board meeting last January. The board resolved to ask the government to remove barriers to broadcasting new digital services in order to stay competitive with other industries that are expected to deliver such services.

Soon after Congress returned from its winter recess, Senate Commerce Committee Chairman Ernest Hollings (D-S.C.) added both spectrum-flexibility and ownership-review provisions to his revised S. 1822. The flexibility provision, however, limits supplemental digital services to "program-related" data.

For example, if a station airs a baseball game over its HDTV channel, it may also transmit supplemental channels with additional camera angles, foreign-language play-by-play, expanded statistic sheets for each player and other information related to the game. It may not, however, transmit other data and services not related to the program being aired.

FCC Commissioner James Quello said he not only plans to serve the remaining two years of his term at the commission, but hopes to be renominated in 1996.

Pictured with Quello, center (as he accepted the NAB's 1994 "Distinguished Service Award," last month in Las Vegas) are NAB President and CEO Eddie Fritts (left) and NAB Joint Board Chairman Wayne Vriesman, vice president, radio group, Tribune Broadcasting Co., Chicago.

"You do serve an important social function that helps bring this country together," Windhausen said in explanation of the program-related provision. "It would be a shame if the desire to expand into new services were to lead to a desire to get out of or restrict the current services you provide."

The Commerce Committee held hearings on the spectrum flexibility provision just before the NAB convention opened last month, but due to schedule conflicts, only one senator was in attendance when testimony was given and there was no public round of questions and answers.

"Unfortunately it was a rather brief hearing, so we intend, on the staff level, to look at this more closely," Windhausen said.

The day before the Senate hearing, the House Energy and Commerce Committee passed its spectrum flexibility amendment to H.R. 3636. The amendment, introduced by Billy Tauzin (D-La.), instructs the FCC to "adopt regulations that allow (TV) licensees or permittees to offer such ancillary or supplementary services on designated frequencies as may be consistent with the public interest, convenience and necessity."

An earlier, shorter version of the amendment Tauzin introduced at the subcommittee level applied nearly identical language to all broadcasters. But that amendment was stalled after other digital services industries, especially those interested in investing in personal communications services (PCS) protested it.

The "clarified" version passed by the full committee limits the flexibility provisions to TV broadcasters. It also adds detail to a provision in the first Tauzin amendment requiring broadcasters pay fees to the FCC for any digital subscription services they may establish.

"Broadcasters have a terrific story to tell and I'm very grateful that a few weeks ago, (NAB staffers) Jim May and Steve Jacobs got to sit down with us and tell us about some of the new uses people were talking about with flexible use," Leach said. "It is astonishing when you think about the possibilities."

That was the general attitude of both political parties. "(Spectrum flexibility) gives the broadcasters a chance to compete effectively with telephone companies in the video business as well as with cable and satellite. It's time to do it," Reid said.

When and if an NII bill passes, the FCC

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Data Broadcasting Is Avenue for Expansion

by Randy Sukow

LAS VEGAS Whatever else may happen with spectrum flexibility and other NII-related reforms, radio broadcasters, especially FM licensees will be able to expand somewhat through data broadcasting. No further regulatory permission is needed to implement such systems—only money and patience.

"Broadcasters are part of the information highway in a big way," said David Kelley, vice president, marketing, Terrapin Corp., Garden Grove, Calif., and co-chairman of the National Radio Systems Committee's (NRSC) high-speed FM data broadcasting subcommittee. "SCA carriers are about to become very valuable."

Three subcarrier system developers have submitted their technologies for review by the subcommittee, which plans to write an industry high-speed data broadcasting standard. The systems operate at a range of 16 to 20 kilobits per second (kbps), many times the capacity of NRSC's Radio Broadcast Data System (RBDS) standard approved last year, which operates at 1.2 kbps.

In the DARC

Two of the three proposed systems—the DARC (DAta Radio Channel) system developed by NHK, the Japanese national broadcasting network, in cooperation with several Japanese electronics manufacturers, and HSDS (High Speed FM Subcarrier Data System) developed by Seiko Telecommunications Systems Inc., Beaverton, Ore.—were represented on the NAB panel.

NHK will be ready to begin broadcasting data with the DARC system "hopefully by next year," said NHK Engineer Tetsuro Miyazaki. NHK put the system through 100 days of tests last November, and was satisfied with the results, especially with DARC's level-controlled minimum shift keying (LMSK) modulation technology, which is designed to mask out multipath impairments.

The test signal broadcast at 10 kW produced 95 percent errorless DARC messages received well outside the Tokyo city limits, up to 30 miles away from the tower. About 80 million households were covered by the test signal.

VTCS (Vehicle Traffic Communication System) will be one of the first data services to be offered by NHK. Automobile owners with full-color liquid crystal displays on their DARC receivers will be able to receive maps of the Tokyo area with red spots to indicate where traffic is especially congested. VTCS, which has been tested in Japan since October 1991, is being developed with the cooperation of three offices of the Japanese government.

Another Japanese broadcaster, FM Tokyo, is not content to wait until next year to get into the data broadcasting business. It hopes to launch its DARC service over two Tokyo-area FM stations using its own proprietary software next October.

FM Tokyo is planning for eventual transmission of 256 pages of information over DARC, including traffic, weather, news, entertainment and other services. Each page represents about 60 characters of text.

Fourteen different receiver manufacturers, including Sony, Sanyo, Sharp and Toshiba, are planning to release DARC receivers in Japan concurrently with the launch of the NHK and FM Tokyo services.

Meanwhile, the U.S. agent for DARC technology, Digital DJ, San Jose, Calif., is planning to conduct field tests of the system in the San Francisco area this summer.

Digital DJ, which began promoting DARC in the U.S. market last year at NAB's Radio Show, demonstrated the system over the air for the first time at this year's spring show. KLUC-FM Las Vegas transmitted the signal side-by-side with its established RBDS signal without any interference.

The KLUC-FM/Digital DJ demonstration included a menu with five programming categories, including news clips provided by CNN; weather forecasts from WeatherNews International; special events, and traffic news.

Eventually, Digital DJ intends to become an information service provider to a national network of DARC FM users, which will be able to access the company's central database, said Lucille Allen, Digital DJ marketing manager.

The Seiko HSDS, on the other hand, has already been on the market for several years. Field tests began in 1987, followed by product introduction in the Portland, Ore., area in 1990, and in the Seattle area in 1992. Seiko hopes to expand the system nationwide in the next two years.

Data watch

"We have very short packets and utilize repeats. We feel this is the best system to combat multipath," said Gary Gaskill, director of system engineering, business development of Seiko Telecommunications Systems, Beaverton, Ore. Multiple FM stations transmitting the

continued on page 37 ▶

Broadcaster's Role in NII

▶ continued from page 18

is likely to be given a great deal of latitude in deciding the degree of the flexibility broadcasters will be granted.

Commission control

Broadcasters may have a head start in this arena as well. FCC Chairman Reed Hundt, in his satellite-transmitted speech to the convention (see page 7), appeared to be leaning toward flexibility.

"We, at the FCC, know that your continued commercial success is the precondition to development of new broadcast technologies," Hundt said. "If you proposed innovative techniques for exploiting scarce spectrum, without jeopardizing your role as 'public trustees,' we will examine your proposals with eagerness."

Lobbying fights with PCS, cable, telco will start up again once the issue is before the commission. Some consumer groups could exert some influence at the FCC.

"A broadcaster could carry half a dozen or more non-HDTV channels, which under current law need not conform to any of the public interest requirements traditionally imposed on broadcasters," said Andrew Schwartzman, executive director of the Media Access Project, during last month's Senate hearing. "All six channels would be under the editorial control of the same broadcaster, and existing cross-ownership rules that preclude purchase of any additional broadcast properties would be transgressed."

The commission's own Advisory Committee on Advanced Television Service may also weigh in against a broad interpretation of spectrum flexibility. The "grand alliance" of digital HDTV transmission sys-tem developers, formed through the efforts of the advisory committee's chairman, Richard Wiley, senior partner, Wiley, Rein & Fielding, is also objecting to multiple digital NTSC transmission.

"We suggest that is not the intent of advanced television in the United States," Robert Rast of General Instrument Corp., speaking for the alliance, told the Senate last month. "We're looking at providing more than ever had, not more of the same."

Ray Smith, chairman and CEO, Bell Atlantic

Duopoly progress

Without Congressional prompting, the FCC has already been reviewing its structural ownership rules for broadcasters.

Mass Media Bureau Chief Roy Stewart and FCC Chief Counsel Bill Kennard were scheduled to meet with Hundt immediately after the NAB convention to report their views on allowing duopolies in TV markets and expanding duopoly limits for radio.

Satellite DAB, cable TV, wireless cable, DBS and other media will be providing several services traditionally performed by broadcasters and some services broadcasters may be unable to deliver. Stewart said, "The commission has an obligation to look at the structural ownership rules and make sure they make sense in today's marketplace."

Reform of the ownership rules seems to be less controversial, but it does have its detractors. Changes in the ownership rules "change the time-tested principles the FCC has developed under the public interest standard of the Communications Act and substitutes a new test which elevates broadcasters' purported need to compete fairly with other media providers," Schwartzman said.

FOR MORE NAB NEWS COVERAGE, SEE PAGE 37.

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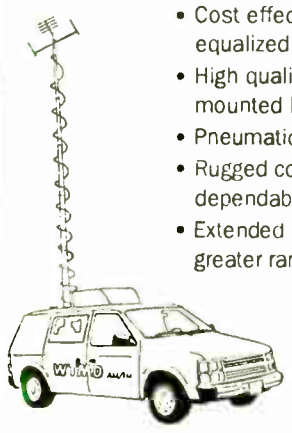

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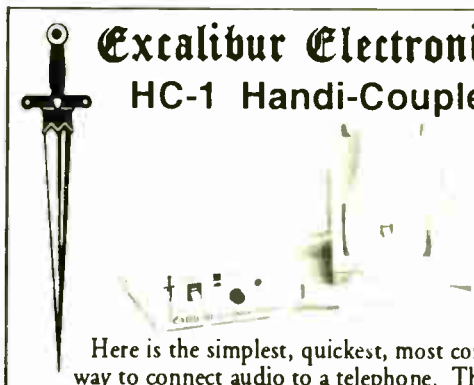

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Tube Talk's rave on a made-in-Denmark compressor, see **page 29**.

PRODUCT EVALUATION

Sony MiniDisc Is Ready for Market

by Chris O'Brien

WASHINGTON Welcome to the next innovation to hit the broadcast professional: the Sony MDS-B1 MiniDisc recorder. Following up on the consumer MiniDisc recorder that hit the market in 1993, Sony has brought the broadcaster into the loop by introducing the MDS-B1.

The MDS-B1 and MDS-B2P (player only) are the result of marketing strategists at Sony who saw the MD technology as an ideal digital replacement for the antiquated analog cart technology—with its digital sound, re-recordability and near instant access to tracks.

The Sony MDS-B1 is priced at about $3,000. In comparison, the consumer Walkman-type MiniDisc recorder costs about $600 to $800, based on Washington Metro area prices. (Sony also makes a consumer home recorder for about $1,000.) The price for the MDS-B1 may seem high, but considering that the unit offers both record and playback functions, it is well worth the investment.

Compression technology

The MDS-B1 uses the MiniDisc technology, a compressed audio format that allows up to 74 minutes of audio to be recorded on a magneto optical disc that measures approximately 2.5 inches by 2.5 inches. The actual disc, looking like a mini-CD, is housed in a plastic caddy that has a metal shroud that opens when inserted in the machine.

The compression (or data reduction) algorithm is called ATRAC (Adaptive Transform Acoustic Coding). The digital process is a perceptual coding technique that conserves bit space by ignoring signals that are inaudible when in the presence of more audible or louder frequencies. The technique is said to use only about 20 percent of the storage space that a conventional 16-bit CD containing the same audio uses.

The MiniDisc technology claims near CD-like specifications including 90 dB signal-to-noise ratio and dynamic range. While there are those who quibble about the audible differences between CD and MD, there is no comparison audio-wise between analog carts and MD (more on that later). Another plus for MiniDisc is that unlike recordable CDs, the MiniDisc can be recorded over and over.

Sony's MDS-B1 recorder and MDS-B2P player are designed for the broadcast market.

Tiny media

Practically speaking, the MiniDisc can store a great deal of data depending on the length. (I used both 60-minute and 74-minute lengths.) While the small size is certainly space saving, however, a jock could easily lose a disc behind the console or stick it in his pocket and forget where he put it. Compared to a cart, the small size will take some getting used to.

The MDS-B1 is well-suited for the studio environment since its design is consistent in dimension to most cart machines and CD cart players. The actual engineering part of the hook up is simple with four XLR connectors feeding an analog signal in and out. In our tests, I did not hook up the analog "in" plugs while in the on-air control room, as I was using the MDS-B1 as a playback unit only. However, in the production studio all four XLRs were connected and the MDS-B1 was used for numerous recording projects. The display window provides all pertinent information regarding a particular track on playback or, upon recording, displays a level meter.

In an effort to put the Sony MDS-B1 to the test, I utilized it both in the production studio and in the on-air control room at WRCT-FM, a modern country/country rock format station. I found the MDS-B1

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SIGNAL-TO-NOISE

Using Power Macintoshes as Digital Audio Workstations

by Frank Beacham

NEW YORK Apple's recent introduction of the new Power Macintosh line of computers not only represents the next generation of personal computing but a turning point in the evolution of digital audio workstations.

Michael Spindler, president and CEO of Apple, told me that the new computing platform will soon admit "the ordinary person" into the heretofore high ticket world of digital audio and video workstations.

What he means is the cost of entry-level, non-linear, computer-based multimedia editing is about to crash.

This will be especially so for audio. Every new Power Mac comes standard with a custom-designed Apple chip that records and plays back stereo sound with 16-bit resolution at sampling rates of up to 44.1 kHz, the CD standard. All one needs to turn a plain vanilla, off-the-shelf Power Mac into a digital audio recording/editing system is application software.

Enhanced processing

"What you'll see over the period of the next four or five months is a lot of the digital audio editing applications will be moved to native and will empower the processor," said David Limp, a Power PC production manager at Apple. ("Moved to native" is Silicon Valley lingo that means the software will be rewritten to take advantage of the brute processing capability of the new PowerPC chip that drives the Power Macs.)

This new audio quality is a major leap forward for Apple. Most older Macs had 8-bit sampling capabilities, resulting in dismal audio quality. The older "AV" line of Macs from last year achieved 16-bit audio through digital signal processing (DSP). "The processing power built into the Power PC chip surpasses that of what DSP can

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PRODUCT EVALUATION

Versatility Highlights dbx Spectral Enhancer

by Ty Ford

BALTIMORE Most people know the story of how the Aphex Aural Exciter came to be. A malfunctioning circuit that was generating a profusion of spurious harmonics became an effects processor.

Since then, audio design engineers have found numerous ways to modify the audio spectrum. One of the latest is the dbx Model 296 Spectral Enhancer ($349).

The Model 296 is a single rack space, two channel box that incorporates a hiss reduction circuit, a high frequency and a low frequency "detail" circuit. Audio first passes through the hiss reduction section and is then routed separately through the HF (high frequency) and LF (low frequency) detail circuits before being recombined with the dry signal at the output.

Product Manager Jawxillion Loeb said the high frequency detail circuit of the Model 296 does not rely on harmonics to achieve its brightness.

Inputs and outputs are balanced and unbalanced respectively and use quarter-inch jacks. The balanced TRS-input jacks also will accommodate unbalanced TS plugs. Maximum input level is quoted at +20 dBu with the input gain controls providing a range of 0 to +14 dB. You can run a separate signal through each channel or process a stereo signal.

Power is supplied by a wall wart. Each channel has its own hardwired bypass which is useful for making comparisons and also allows the unit to pass audio even when it is not powered up.

The front panel display includes a clipping LED and a row of LEDs that tracks the movement of the dynamic filter. Each channel also has its own gain, hiss reduction, LF (Low Frequency) Detail and HF (High Frequency) Detail knob. The manual is simple, concise and contains no schematics.

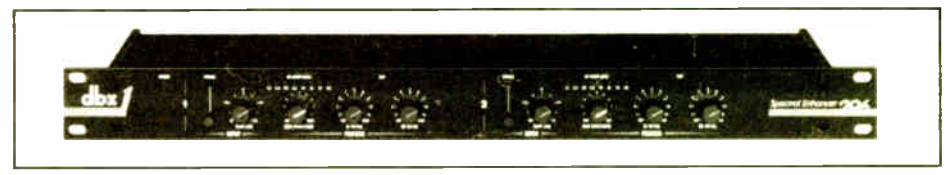
Less hiss

The dynamic shelving filter in the Model 296, offers up to 9.5 db of noise reduction while leaving high frequency program content untouched. The filter looks at signal over 5 kHz, tries to differentiate between hiss and signal, and it removes what it guesses is the hiss. You can, of course, apply too much hiss reduction and lose the "openness" of the high end.

According to the manual, the hiss reduction circuit and the HF Detail circuit are interactive. As you increase the amount of hiss reduction, the amount of available HF Detail is reduced.

According to Loeb, the HF Detail circuit is a dynamic equalizer that matches the system's dynamic operation to a psychoacoustic response cure. It compares HF content to total peak content to determine how much HF is added to the signal. If there's already enough HF, the device won't add much. Boosting occurs in the 4-5 kHz range and up. The circuit won't create any high frequencies if there weren't any to begin with.

The LF detail circuit typically shifts the emphasis of the bass frequencies to a lower bass while reducing upper bass. According to Loeb, that means, for example, as you increase the LF Detail the 50 Hz increases and the 100 Hz is reduced.



The dbx Model 296 features low/high frequency adjustment and hiss reduction.

In use

Using just the noise reduction circuitry, with the unit set at unity gain, I adjusted the hiss reduction so that the corner frequency of the filter was 2.4 kHz, which is a lot of hiss reduction. I chose 2.4 kHz because it took that much to quell the small amount of noise that passes through the outputs of my mixer in its quiescent state.

The hiss reduction circuitry knobs were at the 12:30 position, which meant that I was using the circuit at just over half strength. The hiss reduction didn't noticeably cut off the high frequencies from the Gefell M71 condenser mic I was using until after the one o'clock position. Any further increase to the hiss reduction circuit reduced the openness of the high end and gave my voice a kind of "dull, cardboard" quality that I really didn't like.

My next test consisted of trying to improve some music on an analog cassette encoded with Dolby B that had been sent to me. For whatever reason, the music on the tape was dull sounding.

Due to the tape's Dolby B processing, there wasn't a lot of hiss so I left the hiss reduction circuit at minimum. I had only to raise the HF Detail pot a little before the top end began to emerge. Nice highs and improved intelligibility with minimum effort.

Making the adjustment

I then increased the LF Detail until the bottom seemed right. Using the bypass switches, I compared my settings to the unprocessed audio. After continued comparisons over a few minutes, I decided to back off the amount of effect because what had sounded just right at first began to sound too "edgy and harsh." If you get too carried away with the adjustments, you can really screw up the audio. Even so, there was still a noticeable improvement in the audio. Because the cassette contained songs from vinyl albums as well as CDs, I had to readjust the settings from cut to cut to maintain an even sound.

Next on the list was finding out how well the Model 296 Spectral Enhancer worked with the somewhat noisy but ubiquitous Roland MT-32 MIDI sound module. Using one of the muted electric piano timbres, I confirmed that the Model 296 will not make high frequencies where none exist. My attempts to do so created some very unnatural, edgy and ringing sounds. You might like them, I didn't.

The hiss reducer worked well, but I had to back off of my original settings and allow some noise to pass. Otherwise the difference between the "no noise" that I heard when I wasn't playing and the puffs of noise around the sound when I was playing became distracting.

To my surprise, I found that even moderate to severe amounts of hiss reduction didn't greatly reduce the amount of reverb ring out from the MT-32. Perhaps because the dynamic window was being held open by the hiss level. Loeb suggests that hiss reduction be applied before reverb effects are added to maintain the integrity of the reverb ring out.

Because there is no stereo mode, adjustments to a stereo signal must be identical to prevent the stereo image from "sloshing" around. The more different the settings between channels, the greater the "sloshing." The more perverse production folks will probably find new and creative ways to incorporate this motion by-product into their next production.

If you've got a space left in your effects rack that's aching to be filled, and you have the need to reduce hiss and to add lows and highs, the dbx Model 296 Spectral Enhancer may be your next buy. For moreinformation, call dbx at 510-351-3500.

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PRODUCT EVALUATION

Budget Multitrack: The AKAI DR4d

by Ty Ford

BALTIMORE For many production facilities, the unfulfilled wish list of digital audio devices is beginning to yellow with age. It's a money thing. Without a pushy client who demands digital, there's no real reason to drop big bucks to "upgrade" if you don't have to. Besides, the path is more cluttered with choices than ever before.

If the tape-based Alesis ADAT and Tascam DA-88 are still a bit pricey for you, maybe a test drive of the AKAI DR4d will cause you to reach for your checkbook. At $2,495 for four channels and an internal 213MB hard drive, the DR4d I tested is one of the more reasonably priced entries in the random access digital recorder market.

Quality sound

In recording and playback of the DR4d, I was impressed by the sound quality of the 18 bit 64x A/D and 18-bit 8x D/A converters. I also was impressed by the quietness of the internal hard drive.

The DR4d samples at 32 kHz, 44.1 kHz or 48 kHz. With the 213MB internal hard drive, and the 32 kHz sample rate, you get about 56 minutes of mono or about 14 minutes of four-track time. Larger drives, both internal and external, can be added to the SCSI bus for additional time. The system will support a total of 33GB.

Drives are automatically configured so that recording is continuous across partitions and drives. AKAI has a list of approved third party drives—from a 105MB Syquest to a 2.4GB Seagate. (One caution here, the hard drive market is presently in turmoil. There are sufficiently wide enough interpretations of the SCSI spec to cause problems. Only buy from a seller that will keep you out of the mud.)

According to AKAI's Mike McRoberts, up to four DR4d units can be linked, providing a maximum of 16 channels (four per unit), without sacrificing audio channels to synchronization. The first DR4d operates as master, the others as slaves. The proprietary AL-X50 sync cables do not pass audio; they only carry sync information.

AKAI's DR4d

The version I tested had all the available modules plus the remote control panel. You can use the first digital I/O module—each has switchable AES/EBU or SP/DIF ports—that comes with the system to direct digital audio to each of the four tracks of the DR4d. Recording four tracks of digital simultaneously requires the second digital I/O.

Options

In its stripped-down form, the DR4d does not include the SMPTE card ($199), MIDI card ($159), the second digital I/O module ($299) or the DL4 remote control panel ($849). In the current software version, the DR4d will only slave to SMPTE and will only master with MIDI. McRoberts said the next version of the software will output SMPTE, allow the unit to master, and using MMC (MIDI Machine Control), allow it to slave to a MIDI sequencer.

Product Capsule: **AKAI DR4d**

Thumbs Up	Thumbs Down
✓ instant start	✓ no workstation-like waveform display
✓ good sound	
✓ simple operating system	

For more information, contact James Martin at AKAI, 217-336-5114; or circle **Reader Service 25**.

The standard configuration includes four analog inputs and outputs using quarter-inch TRS jacks mounted on the unit's back panel. Input and output sensitivity is selectable (-10 or +4) via four switches on the back panel. Each switch controls the sensitivity of a pair of inputs or outputs. So, while you could record into the first two inputs at -10, you could also record to inputs three and four at +4, or -10.

The system supports DAT backup through the digital I/O or to a magneto-optical disk via the SCSI-B bus. You can backup the whole system or select specific sections by in/out points. When backing to DAT, the system pulls off two channels at a time.

Digital de-emphasis

The DR4d can de-emphasize old digital recordings that were recorded with pre-emphasis, but you cannot put emphasized and de-emphasized audio on the same track. And, you cannot just de-emphasize one track, you have to choose 1+2 or 3+4. Per the manual, the DR4d ignores the consumer Serial Copy Management anti-copy code.

The DR4d is a significant improvement over linear tape-based multitrack

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PRODUCT EVALUATION

Small Audix Nearfields Have 'Smooth' Sound

by Bruce Bartlett
with Jenny Bartlett

ELKHART, Ind. If you've been looking for an accurate, wide-range mini-monitor, look no further. The Audix MM-15 sound is outstanding!

According to Audix, the MM-15 was designed for an ideal balance between size, low-frequency response and good performance at low cost. Priced at just $279 a pair, the MM-15 is affordable by any station.

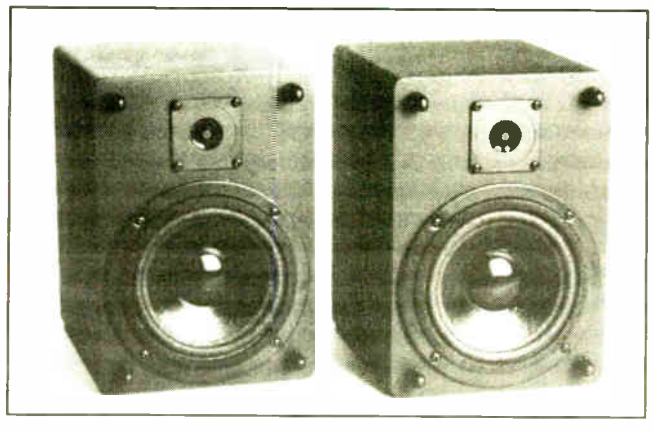
It really is a compact speaker, measuring 9-inches (height) x 6-inches (width) x 9-inches (depth). A pair of these fit in well as part of an audio editing workstation. They also excel as nearfield monitors for mixdowns and radio productions.

Features

The MM-15 is a ported 2-way system. The woofer is a 5-inch polypropylene unit with a rubber surround. It crosses over at 3.2 kHz to a 3/4-inch polycarbonate dome tweeter, which is ferrofluid cooled. The crossover gives a "seamless" transition between drivers, according to Audix.

Featuring a durable sand-coat finish, the MM-15 looks impressive. Its removable grille is made of stretched black fabric over a wooden frame. The cabinet walls are solid and heavy, and they seem acoustically inert. On the back of the cabinet is the port—as well as two gold-plated binding posts. They are clearly marked and easy to access.

Although these units were not magnetically shielded, this results in better bass, according to the company. Cliff Castle at Audix told me that a magnetic-shield cap can make the woofer's magnetic field weaker in the gap, which reduces bass.



Audix MM-15 monitors are offered in magnetically shielded and non-shielded versions.

The rated sensitivity is 86 dB/W/m. While this is low for a studio monitor, it's not a problem because amplifier power is easy to find. The MM-15 played quite loud when driven with a Crown D-75, which is 45 watts/channel into 4 ohms. Recommended power is 15 to 100 watts.

The MM-15 designers traded off some sensitivity to get better low-frequency response. Audix specs the frequency response as 50 Hz to 18 kHz +/-3 dB, which is amazing for a loudspeaker this size. Impedance is rated at 4 ohms, and maximum SPL is 106 dB at one meter.

Measurements

Using a Techron TEF-20 sound analyzer, I measured the anechoic frequency response of the MM-15. It's impressively flat and wide range: 70 Hz to 20 kHz +/-3 dB. These measurements indicate better high frequency response than claimed within 3 dB, but the bass did not reach 50 Hz. However, this is the response in full space; the bass probably would go a bit deeper if the loudspeaker were next to a surface such as a mixing console.

There's a minor dip in the upper midrange that gives the MM-15 its gentle, low-fatigue sound. Off-axis response is nearly as flat as the on-axis. When the MM-15 is mounted on a wall, the response is much rougher. The grille creates a notch at 6 kHz. According to the measured Energy Time Curve, transient response is very good.

Product Capsule: **Audix MM-15 Monitor**

Thumbs Up	Thumbs Down
✓ smooth, uncolored sound	✓ lacks deep bass
✓ compact size	✓ not magnetically shielded (see text)
✓ solid construction	

For more information, contact Audix Corp. at 503-692-4426; or circle **Reader Service 46**.

The MM-15 sounded best to me when mounted nearfield, two feet from the wall behind them, about four feet apart and four feet from me. Wall mounting made the sound less clear.

Listening tests

I listened to the Audix MM-15 with a variety of CDs and master tapes. Here are my impressions of four representative CDs. These opinions reflect my own taste and bias, and are not an endorsement or critique by **Radio World**.

•*Kamakiriad*, Donald Fagen, Reprise Records 9 45230-2, (pop):

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PRODUCT GUIDE

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

Denon DN-650F CD Player

Denon has introduced a new professional CD player, the DN-650F, designed for broadcast and production facilities.

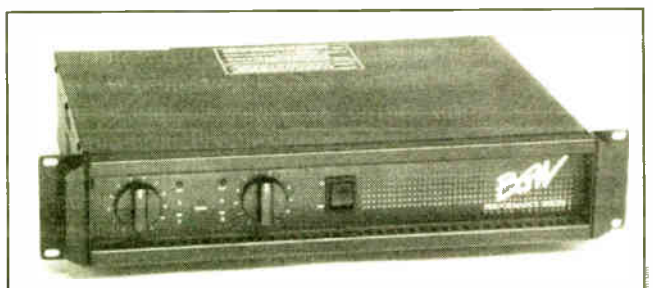
Features include End Monitor, End of Message and Fade-In modes, Instant Start and slider-controlled pitch adjustment, plus or minus 8 percent. The DN-650F uses Denon's quality 8-times oversampling digital filter and 18-bit Super Linear converters. Connectors include balanced, dual XLR and S/PDIF digital out.

For more information, contact Michael Stelts at Denon, 201-575-7810; or circle **Reader Service 31**.

BGW Series 1 Power Amplifier

The BGW Performance Series 1 is a lightweight, two-rack space 150 watts per channel amp designed for the audio professional.

The unit features XLR and quarter-inch connectors five-way binding posts, wide bandwidth and easy-serviceable circuitry.



For more information, contact BGW at 800-468-2677 (California 310-973-8090); or circle **Reader Service 55**.

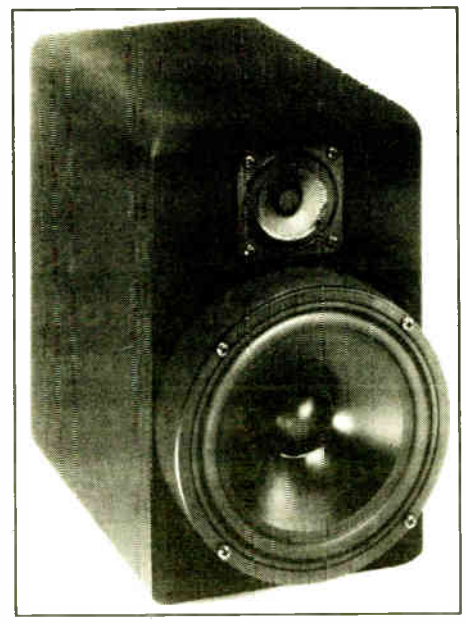
EFI Omni-Phase Power Line Filter

EFI's Omni-Phase line includes the new SE (service entrance) or SWT (sine wave tracking) surge suppressors.

Enhancements include audible alarm, improved safety and optional all-weather enclosure. Omni-Phase products come with a five year warranty.

For more information, contact EFI at 800-729-3496; or circle **Reader Service 10**.

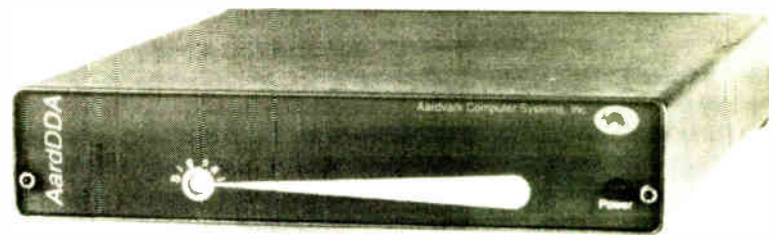
Sequerra NFM-Pro Nearfield Monitors



For those who want to spend a bit more for reference nearfield monitors, Richard Sequerra's NFM-Pro packs state-of-the art design, features and sound.

The time-aligned speaker contains a 6.5 inch polypropylene cone with butly rubber surround and two-inch cone tweeter with shear radiator. The electronic crossover is an Air Core Hi-Q inductor and contains a tweeter attenuator. Frequency response is rated 70 hz-20 kHz within 1 dB. Dimensions are 11 inches (height), 6.75 inches (width) and 11 inches (depth).

For information and pricing, contact Richard Sequerra Associates at 203-325-1791; or circle **Reader Service 8**.

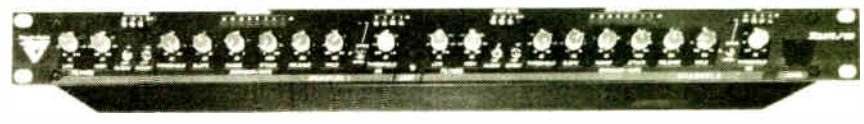


AardDDA Digital Distribution Amp

Engineered to provide superior audio distribution in the studio or broadcast facility, the AardDDA features a 1 x 6 configuration.

The features include transformer-isolated inputs/outputs that are said to minimize jitter and ground loop noise. All six outputs are individually buffered. The unit is compact and can be atilized for field work.

For more information, contact Aardvark Computer Systems; at 313-665-8899; or circle **Reader Service 50**.



Valley Audio Model 460 X-Gate/NR

In the tradition of the legendary Kepex II, Valley audio has announced a new analog processor, the Model 460 X-Gate/NR.

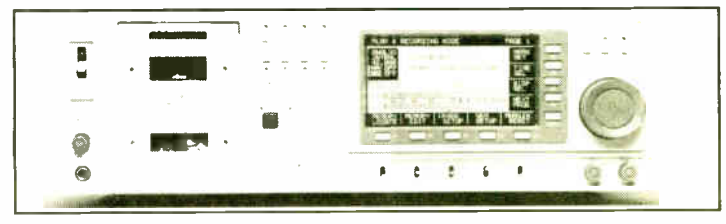
The unit is a full function, channel sweep frequency expander gate with single-ended noise reduction. Features include comprehensive detector hold, switchable stereo linking and wide sweep, steep slope filters. XLR and unbalanced quarter-inch TRS connectors are provided.

For more information, contact Valley Audio at 800-800-4345; or circle **Reader Service 72**.

Fostex D-30 Timecode Master DAT Recorder

Fostex has introduced its top-of-the-line DAT recorder, the D-30, which is intended for for audio post-production and broadcast production.

The recorder is equipped with an internal timecode generator and high speed reader that handles all SMPTE formats. The D-30 includes two RS-422 ports with Sony nine-pin protocol and BVU 950 emulation.



The D-30 also features a four-head design, heavy duty transport, on-board RAM, which allows Instant Start, and a Jog /Shuttle wheel. Price is $10,995.

For more information, contact David Cunningham at Fostex, 310-921-1112; or circle **Reader Service 13**.

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Tube-Tech LCA 2A: A Great Compressor

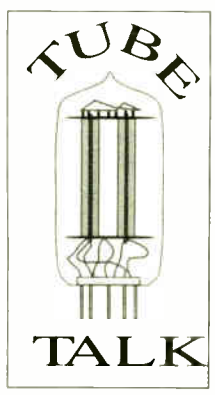
by John Diamantis

WASHINGTON I recently auditioned the Tube-Tech LCA 2A stereo compressor and limiter imported from Denmark, an all tube-based, except for the power supplies and the sidechain circuit, audio processor.

The LCA 2A features separately adjustable compressor and limiter in each channel. The control signals for the processing are of the servo or feedback type (the tap-off point taken after the gain controlling device) and allow for linked or unlinked channel operation.

Internal features

The audio path is fully balanced push-pull from input to output. A push-pull tube circuit uses a pair of amplifiers for each stage of the circuit, driven in opposed phase, to cancel out noise, distortion and control feedthrough, as well as provide additional gain and drive from the output stage.



One side of the circuit "pushes" the signal into the load, while the other "pulls," hence the name. Additionally, the Tube-Tech LCA 2A uses no global or negative feedback and still manages very good performance specs.

The VCA, or voltage controlled amplifier, is a selected dual triode 12AU7 operating like a push-pull, variable mu stage. The control voltage is applied to the grid of each triode through the secondary of the input transformer, changing the tube's bias, and thus its gain, which creates the compression.

This control signal is mixed with the input signal, which is applied at the input transformer primary. The plate circuit of the VCA is transformer coupled to the output stage—a two-stage, push-pull amplifier. The plate of the second stage of the output amplifier is then transformer coupled to the output.

A section of the documentation pertains to VCA balance adjustment, which needs to be checked, if not performed, every six months, and definitely performed at tube change time. Seems to be simple enough, if you have at least a signal generator/analyzer handy. *(Remember: this is a tube circuit; dangerous high voltages are present! Be careful!)*

High-grade tubes

The supplied tubes are made by Golden Dragon in China. Expensive, but worth it. They offer great sound, low microphonics, are pretty consistent tube to tube, and they sport a "cool looking" dragon logo on each tube. The rest of the parts appear to be high quality, although the adjustment pots, while smooth, didn't have that luxurious silken feel you get with a higher priced pot.

The packaging of the Tube-Tech LCA 2A is a combination of vintage and modern. The enclosure is made of thick gauge aluminum painted "Tube-Tech blue" (like their other products) and assembled with machine screws into threaded inserts. The adjustment knobs are black, hexagonal and retro looking. Inside, there are three high quality circuit board assemblies: one large one for the audio and power supply, the other two are for the side chain and controls. Connections to the unit are made via XLR connectors. Nice stuff.

User evaluation

I connected power to the LCA 2A and let it cook overnight. Despite vent holes around the side of the cabinet, the unit runs rather warm. I'd recommend giving it some breathing space in your rack, especially around heat sensitive components.

Operationally, the unit is like most other studio type compressor limiters. There are separate controls for each channel. There are also separate controls within each channel for compression threshold and limiter threshold. Compression ratio is adjustable from 1.6:1 to 20:1. There are continuously variable controls for attack and release time, as well as a six-position preset attack and release control. The parameters for the limiter section are fixed.

I connected the LCA 2A first to an output from our WBIG-FM program distribution amp (format: oldies). The first thing I noticed was a slightly bright, but very clean presentation, with good dynamic control.

Set up for about 6-10 dB of compression, at a slope of 3:1, with the preset attack release control set at position 5 (3 mS attack, 0.5 to 4 second release), and about 1-2 dB of limiting, the LCA 2A kept the average program level within a nice tight window, without sounding "squished" or otherwise manipulated.

Increasing the ratio toward maximum, the sound became "denser," but never became fatiguing. Adjusting the preset attack release control to its other, faster positions, changed the sound more dramatically, from tight and punchy to almost over the edge. Changing to continuous attack and release allowed a myriad of effects, from gentle leveling to dynamic mayhem. Advancing the limiting control beyond four of 5 dB of limiting, especially with fast compressor attack and release times, could create modulation distortion, particularly on repetitive bass passages.

Flexible parameters

With voice, the flexibility of the Tube-Tech LCA 2A again allowed every kind of dynamic effect, from gentle control, to "iron lung" type effects (the kind of audio where the breaths are louder than the narration). At no time, however, was the audio muffled or muddy sounding: the sound of the LCA 2A was crisp and clean.

Next, I connected the unit to our WGMS-FM program distribution amp (format: classical). I was pleasantly surprised at how well the LCA 2A sounded with this music. Set up similarly to my first trial with the oldies program feed, the result was smooth, and unobtrusive.

I then placed the LCA 2A in the air chain, and after careful adjustment, it was possible to correct for operator level error, and keep the average level on musical climaxes from slamming into the peak limiters, all while maintaining the artistic integrity of the performance.

For you spec seekers, here are the test measurements, as measured on a Potomac Instruments AG51/AA51 test

continued on page 30 ▶

Trying Out the Tube-Tech LCA 2A

▶ continued from page 29

set and a recently calibrated Tektronix 5L4N spectrum analyzer.

On the bench

Overall, the Tube-Tech LCA 2A met or exceeded all of its specifications, within a 10 percent margin. THD at 1 kHz was <0.05 percent with up to 25 dB of gain reduction, any ratio, with attack and release controls centered. By the way, this distortion was odd order only, as the push pull topology cancels out the even order products. Third harmonic predominated, with fifth and seventh present, but in lesser quantities. This probably accounts for the crisp quality noticed while auditioning this unit.

Maximum output, with the LCA 2A terminated with 600 ohms, at 40 Hz, was +26 dBm for 1 percent THD. At 1 kHz, the unit would put out 36 dBm! SMPTE IMD, compression disabled, was 0.02 percentat +4 dBm out, 0.12 percent at +20 dBm. The LCA 2A will provide plenty of output headroom for any application. My audio generator set at +20 dBm maximum couldn't overload the input either.

The only specification not mentioned in the "service manual" is the maximum amount of compression available. I measured it at 25-26 dB, after which gross distortion set in. I wouldn't be alarmed at this figure, as many other processors act similarly, plus I think it's a more than generous amount.

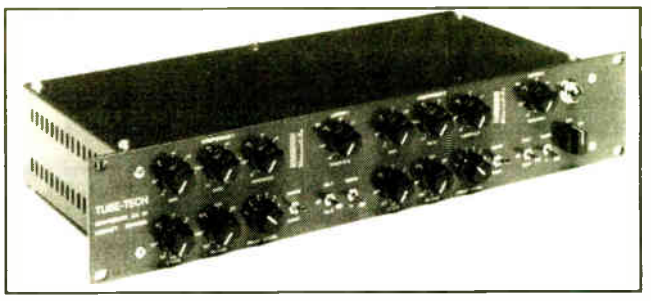
Crosstalk was measured with one channel driven with 1 kHz, at +4 dBm, the other channels input terminated, controls normalled. The result was -70 dB; just a bit shy of the specified -75 dB, but Tube-Tech's literature didn't specify their measurement method. Noise, measured wide bandwidth, was -75 dB, referenced to +4 dBm. Spec is -78; close enough. Frequency response was down 0.5 dB at 20 Hz and 100 kHz.

During the three weeks I had the unit for audition, the LCA 2A performed flawlessly. I know I may be gushing a little bit, but I really like this processor. While at $2,990 the Tube-Tech LCA 2A isn't cheap, it's whole order of magnitude better than your typical dynamic processors, which all seem to sound alike (and in my opinion, not very good). Highly recommended.

For more information, contact Audio Techniques at 212-586-5989; or circle **Reader Service 173**.

★ ★ ★

I've talked to a lot of people lately who are very interested in getting involved with vacuum tube based audio products, but who are concerned about the availability of tubes. In recent years, in spite of the fact we've lost one a major Yugoslavian tube supplier, there has been renaissance of tube pricing and availability from Russian and Chinese companies.



The LCA 2A compressor/limiter is pricey, but is top quality.

Sovtek, and Svetlana, as well as the factories in China make quality tubes for consumer and pro users.

I've been testing some Sovtek 12AX7WB triodes that so far are quiet, reliable, and sound good, that cost $3.50 each in quantities of 10. Good power tubes like the 5881 and 6CA7 are available for less than $8.00 each, and are readily available. Look for more on tube availability in upcoming issues of Tube Talk.

□□□

John Diamantis is engineering manager for WBIG-FM, WGMS-FM and WTEM (AM) in Washington, D.C.

Power Macs Used as DAWS

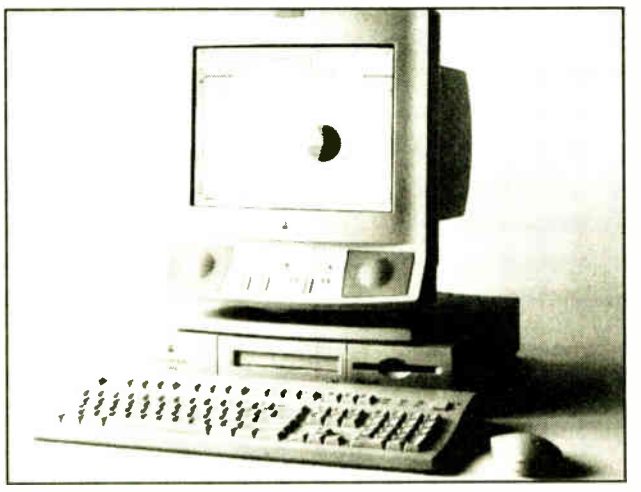
▶ continued from page 23

give us today so we did all the audio functionality on a separate chip," Limp said.

So, here's the bottom line question. Does the Power Mac—which ranges in list price from about $1,800 to $6,000 depending on configuration—have the built-in capability to become a stand-alone professional audio workstation?

The answer depends on who you ask and your perception of the word "professional." Two manufacturers of high end Mac-based audio workstations—Sonic Solutions and Digi-design—say the stand-alone Power Mac won't cut it for professional use. "I don't think it's a professional platform without a signal processing card," said Mary Sauer, vice president of Sonic Solutions. "The first versions of the Power PC are still I/O hogs. They don't have the SCSI (scuzzy) handling that would make them acceptable for the professional."

Sauer is saying that the digital port on the stock Power Mac that allows data to be input and output is a bottleneck that will slow down the movement of large chunks of digital audio data from the hard disk. This, she said, will result in the Power Mac's inability to sustain real time playback of multiple channels of audio.



The new Power Macintoshes can also do DOS/Windows and digital audio.

Not there yet

"The fact that it's 16-bit, 44.1 kHz does not mean its pro quality," said Rob Currie, vice president at Digi-design. "They used good chips, but they didn't go the extra length to build a product that's designed for the small percentage of the market that will use it for professional audio.

"How many radio engineers are going to look askance at a (consumer) stereo mini-jack for input," he continued. "Most of the people we talk to just go nuts if there's not an XLR hanging off the thing."

But, Currie said, Apple has made a great new product for those who now use all-in-one mixer/multitrack analog cassette studios for home recording. "These machines open up high quality entry level audio," he said.

Wait and see

Sauer and Currie make valid, sensible arguments as to the technical limitations of the Power Mac's ability to be a stand-alone audio editing system. But it's these same manufacturers who will tell you that analog cassette-based multitrack "porta" studios are also not professional products.

How many "professional" works by serious recording artists have been made on cheap multitrack cassette systems? The number would probably surprise you.

I suspect the Power Mac—when it gets into the hands of serious artists—will eventually have a major impact on all audio production from the low to the high end. As David Nagel, vice president of the AppleSoft Division, put it: "You will see the whole multimedia authoring process moving down the food chain to lower and lower priced machines. Of course, when that happens, more and more people will do it."

The scenario is constantly changing. The first digital audio workstations cost over $100,000. Now truly professional workstations can be bought for a tenth of that price. Will the Power Mac eventually bring the cost of digital audio editing down to the cost of word processing? Is this the audio workstation for "the rest of us?" Stay tuned.

□□□

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

DIGITAL DOMAIN

Classic FM Utilizes Fiber in Broadcasts

by Mel Lambert

LOS ANGELES As we ponder the future of satellite or local delivery systems for our new generation of digital radio signals, I recently came across an interesting example of a technique that might appeal to smaller networks, or as an alternative to more costly formats. Great Britain's Classic FM is a recently established commercial station (as opposed to the license-funded BBC operations) that broadcasts its signal throughout the entire United Kingdom from central studios in London. The station began broadcasting in September 1992, and to date has been a roaring success; this summer it will begin broadcasting to the Netherlands, with a separate program stream to the UK output.

Classic FM is the first such organization to be licensed to provide a country-wide service, and faced some difficult technical decisions. An obvious choice might have been to adopt a satellite-based deliver system to local transmitter sites around the country. (After all, there are several transponders available whose footprint reaches north into Scotland and Northern Ireland.)

Special needs

There were several reasons, however, why satellite delivery was rejected. Classic FM needed to provide individual addressing or grouping of transmitters with separate feeds, which would have required the use of multiple satellite channels and hence a cost several times that of a wired system.

Also, the only satellite systems readily available three years ago were expensive and, at the time, UK legislation did not allow private uplinks. In addition, the company was required to provide some way for the London-based DJ and engineering staff to monitor off-air signals throughout the country, and ensure that no technical problems had taken the service off the air.

During the planning stages, consultant Quentin Howard, development director of the GWR Group, evaluated various alternative solutions.

The technical brief, Howard recalls, involved the interconnection of some 22 transmitter sites (to provide an initial coverage to 86 percent of Britain's population); thirteen more locations will be added during the next several years to provide additional coverage. Most of the initial transmitter sites operate at 250 kW ERP; smaller, filler sites run at 50 or 150 kW ERP. Antenna space was leased from the BBC, which owns and operates sites the length and breadth of the United Kingdom, while National Transcontinental Ltd. received a contract to supply and maintain the FM transmitters.

Having divided the country into six different regions—Classic FM wanted to be able to supply commercials, air checks and even weather reports to targeted audiences—it was decided that three ring

continued on page 36 ▶

Audix MM-15 Nearfields

▶ continued from page 27

A beautifully smooth sound, never harsh, yet with good presence. Very good tonal balance. Tight bass, but not quite as tight as Digital Designs' DD161b, another excellent performer I recently tested for **RW**. Smooth percussion, sweet cymbals. Easy to listen to. Plenty of bass; doesn't seem to need a subwoofer.

•*Reckless*, Bryan Adams, A&M CD 5013B (rock):

Clear but not harsh. Bass is full. Deep-bass power is missing, but these are little speakers. Good percussive impact; lots of dynamic range. Sharp imaging.

•*Second Stage*, Delos D/CD 3504: *The Firebird*, Stravinsky, Telarc CD-80039B (classical):

In the beginning of The Firebird, the very deep bass-drum roll is a mere whisper. (You might want to supplement the MM-15s with some good headphones to monitor the deep bass.) Strings sound very sweet, smooth and musical. Basses are warm and full. Flute has a breathy edge, but it is not exaggerated. Tonal balance is just right. Timbres are uncolored, and the overall sound is effortless and realistic.

•*Blame It On My Youth*, Holly Cole Trio, Manhattan CDP7 97349 2B (jazz):

Slightly warm or chesty vocals, but not a serious problem. Just the right amount of edge on the voice. Bass is full but the deepest lows are absent.

The Audix MM-15 sounds expensive. Even though the MM-15 is small, you don't have to apologize for its sound. It delivers very smooth, uncolored sound with good bass for its size.

Dynamic range, imaging and transient response are impressive. The overall effect is effortless and non-fatiguing with a wide sweet spot. What's more, it is rugged, compact and easy to connect. The Audix MM-15 is a bargain, and I highly recommended it.

□□□

Bruce Bartlett is a microphone engineer and technical writer for Crown International, 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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INNOVATION AT WORK.

Sony MD Cart Recorder

▶ continued from page 23

to be a great addition in both studios.

In the production studio, I found the MDS-B1 to be a perfect tool for archiving production. In the past, we have used a DAT machines to archive our production, so I felt it only fair to compare both technologies.

Easier than DAT

I found the Sony MDS-B1 outpaced the DAT in the following areas:

•Cue to track. Once data has been stored on the MiniDisc it can be accessed instantaneously simply by punching in the track number on the attached keypad or by using the arrow keys on the face of the unit. The DAT machine left me waiting through the fast forward or rewind modes.

•Ease in recording. The MDS-B1 automatically cues to the next available blank track once the record key has been punched. This little feature prevents inadvertent overdubbing.

•Track titling. The MDS-B1 allows custom titling via the QWERTY-style keypad "remote" attachment. While DAT machines also offer this capability, I was impressed by the simplicity of the MDS-B1 titling procedure.

In the second part of our test, I in-stalled the MDS-B1 in the on-air control room. I utilized the unit as a quick access unit during my morning show.

I stored about 70 drops and music beds (news, weather, sports) on one MiniDisc and labeled each track so that I would be able to find a particular cut just by paging through the MiniDisc and looking for the appropriate title to come up on the unit's screen.

The MDS-B1 was perfect for the morning show because everything I needed was all in one place, and I didn't need to rifle through a stack of carts every time I needed a particular sound element. If I needed a track to repeat, I simply switched the REPEAT1/OFF/REPEAT ALL switch to the appropriate setting. In a morning show environment where seconds count, the MDS-B1 is a champ.

And it sounds?

To my ears, the sound quality of the MDS-B1 is first rate and certainly better than a cart machine. As I mentioned in my introduction, noise is significantly less and there is more punch to the audio. The overall sound of the MDS-B1 is excellent.

With a greater dynamic range than a cart machine, the MDS-B1 provides consistent sound quality that is only slightly below that of a standard CD player. I was able to listen to several professionally manufactured MiniDiscs from Sony and our local record store. I found the sound quality surprisingly good—far exceeding any professionally manufactured analog cassette.

(By the way, for all of you digital compression nay-sayers, my station aired material from the MDS-B1. This meant the MD audio passed through a Dolby digital STL that uses its own compression algorithm. With these audio passes through both the MD and Dolby schemes, I could not hear any obvious audio artifacts on my FM tuners.)

Internally, the MDS-B1 seems to be rugged and reliable. The transport should be more reliable than a cart machine because the unit is not able to fall victim to worn pads, jammed carts or dirty play record heads; the laser is the only thing that touches the disc.

The MDS-B1, however, did have a few minor drawbacks:

•The external "remote" keypad gets in the way in the on-air studio. But it is acceptable in the production room.

•There is no "program track" switch on the face of the unit itself. You can only program a track via the external keypad. In the control room, this often got a little hectic.

The MDS-B1 is certainly a tool any production director would love to have in the production studio. Its "out-of-the-box" user-friendliness is certainly one of the characteristics that I found most appealing.

Summary

Many producers and announcers are scared away by a lot of the new digital equipment because the operation is often complex. The bottom line is that if you can operate a cart machine or home CD player, you can operate the Sony MDS-B1. All in all, the MDS-B1 scores a 4.5 out of a possible 5 in my book.

□□□

Chris O'Brien is the program director and morning show personality for WRCY, "Thunder 107.7," in Washington, D.C. Studio Sessions Editor John Gatski also contributed background information to this report.

Product Capsule: Sony MDS-B1 MiniDisc

Thumbs Up	Thumbs Down
✓ good sound from tiny media	✓ remote sometimes can get in the way
✓ instantaneous track cue	✓ no program track switch on machine (remote only)
✓ easy track titling	

For more information, contact Sony at **800-635-SONY** or circle **Reader Service 5**.

Multitrack AKAI Well-Suited for Radio

▶ continued from page 26

recorders, especially if you have not yet become addicted to being able to see tracks of audio on a workstation video display. Copy, Copy+Insert, Move, Move+Insert, Erase, Delete and Insert editing are all supported, as is a one-step-back UNDO button. After taking the time to learn how to select the in-points, the out-points and destination locations, the editing process is relatively easy. At first, I questioned the extra step that most editing functions require, but I later reconciled that this can keep you from making an edit mistake.

The DR4d passed my "cut the center of the breaths out" edit test very nicely. You can either ERASE the offending audio, leaving a dead space, or DELETE the audio between the IN/OUT point, pulling the audio after the out point up to the in point. The UNDO button, a necessity for anyone doing obsessively finicky chopping, provides the ability to toggle back and forth between the edited and unedited versions in less than a second.

Another handy editing feature allows the routing of a copied track to any of the other tracks. You select the track or tracks to copy, select the destination tracks, hit the button and, boom, you are done. It took only seven seconds to copy a 34-second mono track from one location to another. There's a dedicated "LOOP" mode that continuously repeats any section between in/out points.

Manual, footswitch and auto-punch in/out are all supported and both the main unit and the remote control panel have a footswitch jack. The headphone amp, which allows you to hear all four channels simultaneously, has enough gain to please the average hearing-impaired audio production person.

SMPTE/MIDI

The SMPTE module was so new that documentation was not yet available from AKAI. A phone call to McRoberts resulted in the info I needed to configure the card. It supports 24, 25, 29.97, 30 and 30 drop frame SMPTE.

Using a Tascam PortaStudio One with SMPTE time code on one audio channel, I was able to get the DR4d to lock to time code in two to three seconds. All SMPTE should be this easy.

MIDI was more challenging. Running Vision 1.44 on a Mac-compatible Outbound notebook computer, with Apple MIDI Manager selected in the OMS setup, prevented "receive sync" from being selected in Vision's menu. In order to get anything to happen, I had to create a new OMS studio setup file. Vision would then lock to the DR4d, but the BPM (beats per minute) indicator on the Vision screen registered a value of 1/4 the tempo, and the time display was spinning at four times its normal rate.

Nonetheless, the machines were locked, and both sounded fine. After several unsuccessful attempts to make things look right, I settled for having them sound right.

With many hard disk systems, there is a delay between the time you hit the "play" button and the audio is heard. This is not the case with the DR4d. When you hit the play button, the audio is there instantly.

This quick-start feature, when combined with the DR4d's ability to store eight direct locate points and 100 stack locate points by number, makes the unit a contender for any task that requires rapid access to that many different cuts, provided you know the number of each cut.

Direct locate points are accessed by pressing the 1-8 buttons on either the main unit or remote control panel. Stack points require you to hit the stack button and enter a two digit number (from 00 to 99). At the moment, there is no way to scroll through the stack numbers to see where they are assigned. Also, you have to enter the first ten stack points (01, 02, 03, etc.) by first hitting "0," followed by the single digit of your choice. It would be nice to not have to enter the "0".

Both kinds of locate points may be on-the-fly in both playback and record without stopping. Provided you remember the number you punched in, this feature can be used to locate good takes or mistakes in less than a second. Contrary to what the term "stack" might imply, you can only locate to one point at a time, and you can only enter a locate point while in "STOP". You can also locate by hitting the "locate" button and entering the Hr/Mn/Sec/Fr address via the key pad.

Varipitch

The Varipitch feature is centered around the 44.1 kHz sample rate (-27.44 percent to +8.84 percent). So while you can raise the pitch of a 32 kHz sampled recording up to 50 percent, you can't lower it past 32 kHz, and you can only lower the 48 kHz sample rate by 33 percent. You cannot "varipitch" just one track; it's a global thing. As you change the pitch, you affect the playback time. You also cannot change pitch while in play or record. You can, however, record at other than unity pitch to create some interesting harmonies and effects.

Overall, the AKAI DR4d is a very capable, well-engineered device at a good price. I predict that it will do well in the radio, audio-for-video and project studio markets.

□ □ □

To order Ty Ford's book, "Advanced Audio Production Techniques," call 800-366-2665.

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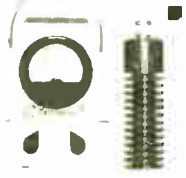

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READER SERVICE NO. 22

NAMM Show a Hotbed of Digital Gear

by Mike Rivers

ANAHEIM, Calif. Although the National Association of Music Merchants (NAMM) Winter Market, held here annually at the Convention Center, is primarily oriented to music dealers, many music stores have become suppliers to the broadcast market. There are always products of interest, and some that, although not targeted to broadcasters, have applications in the production room.

Audio workstation news

First, some old news brought up to date. Yamaha's CBX-D5 hard-disk based audio recording system announced at last year's show is finally in production after a few false starts and rumors of the project being canceled. The CBX-D5 is a SCSI device which will provide the hardware interface for any computer platform to become an audio workstation. Steinberg's Cubase Audio software for Windows, which was designed around the CBX-D5 finally has hardware support.

Digital Audio Labs (DAL), one of the pioneers in audio interfaces for the IBM PC, is now shipping the CardD Plus, which supports simultaneous record and playback. This allows you to do punch-ins while monitoring previously recorded tracks just like a real multitrack recorder. In April, DAL will ship a digital-I/O-only version for $495 which will allow you to use your DAT as the A/D/A converter (a sensible and cost-saving decision) and keep the audio away from the hash floating around inside the computer case. DAL also introduced a new software product at the show, Fast Eddie, a Windows sound file editor.

Innovate Quality Software's SAW recording/editing program for Windows seems to be receiving new features every couple of weeks. It's now doing eight track production, and, with the new Digital Audio Labs CardD Plus or Turtle Beach Multisound series of I/O cards, can now record simultaneously with playback, making overdubbing as we know it in the traditional studio world possible.

This year's crop of Macintosh computers with built-in audio support, the Quadra 840 AV and 660 AV, now have professional quality software to support that capability.

Opcode's Studio Vision AV allows you to work with audio with the many of the same paradigms as working with a sequencer program. Alaska Software's DigiTrax audio editing software for the Mac AVs offers a more traditional "tape and mixer" view, and provides up to six tracks of digital audio recording, non-destructive editing, digital parametric EQ, and familiar tape recorder-like user interface including auto-locator and auto punch-in/out.

Session 8 for Mac

Digidesign announced availability of their Session 8 system (available for the PC for about a year) for the Macintosh. This is a hardware/software combination that puts a full eight-track production system on the computer. Also new from Digidesign is a multichannel interface between the Alesis ADAT 8-track digital recorder and ProTools and Session 8.

A wealth of new "plug-in" tools for Digidesign's popular Sound Designer software were announced and, to some extent, demonstrated, by several manufacturers. They included Arboretum Systems' Hyperprism, Crystal River Engineering's Spatial Effects, and K.S. Waves Ltd parametric EQ.

Rockwell Digital announced a new utility, Track Transfer, which merges tracks from two separate Pro Tools sessions for mixdown, and Version 2 of their Region Manager, a utility that splits regions into separate audio files.

A new entry into the professional hard disk recording comes from Soundscape, which introduced a system based around a four-track rack mount building block that interfaces to a PC through a host adapter card.

Although primarily a musical instrument, the Emulator III has become a popular production tool. E-mu has upgraded the operating software for the Emulator IIIx, adding time compression/expansion and pitch shifting. Another new feature is a process called Transform Multiplication.

The hardware

For those who prefer the hardware approach to integrated disk based recording, Vestrax has introduced the HDR-6 and HDR-4 digital multitrack recorders. These units, six and four tracks respectively, are begging comparison to the

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Classic FM Uses Fiber For Relays

▶ continued from page 31

networks could be used to cover the entire transmitter network.

The system is based on a fiber-optic network developed by British Telecom, and which offers a 2.048 Mbit capacity. To provide built-in redundancy, dual rings are laid out in clockwise and counter-clockwise directions from the London studios, and carry five 15 kHz audio signals—two stereos for the main and alternate feeds, plus the mono signal for reverse monitoring.

Using fiber

Because two "rings" are used, stereo off-air monitoring is available, using one leg for left and the other for right. In addition, a 64-Kbit channel provides automated transmitter control, RDS data and related functions.

To pack a large amount of audio into 2.048 Mbits required some choices being made regarding data compression. In the end, Classic FM opted for linear, 14-bit coding; since the station's signal is modestly compressed with +/-15 dB of AGC before being routed to the network, the reduced dynamic range fits well into a 14-bit dynamics envelope. Digital audio data compression was rejected.

Transmitters are designated as either "A" or "B" sites; the former cover major population areas, and contain redundant Codec systems, while the latter serve smaller communities. At the "A" sites, two completely independent decode/ encode systems connect across the clockwise and counterclockwise rings, and feed the transmitter through a change-over switch.

At both "A" and "B" transmitter sites, the output from an stereo off-air receiver is digitized and injected into a dedicated slot within the bitstream for its journey back via both the main and reserve fiber-optic loops to the studios in London. As the automatic system sequentially routes the monitor signal to a dedicated loudspeaker channels, a companion map that lights to show which site is currently being analyzed. The entire network is also monitored by a separate X25 packet network.

According to Howard, "The quality of the network really is excellent, and it has met our needs extremely well. We have worked alongside British Telecom to develop what I still regard as the most reliable and flexible means of distribution for Classic FM."

Listening figures for classic FM are reportedly at 5 million.

□□□

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

Copyright Issues Complex on Info Highway

by Randy Sukow

LAS VEGAS Broadcasters looking for the first time at the possible profits from using the spectrum for much more than traditional radio and television service, were warned not forget the legal details, especial the copyright details.

Panelists at an NAB session said it is not enough to assume a station's copyright authorization to broadcast music, sound recordings, video clips, graphics and text data will be valid when they are repackaged in new alternative digital media.

Most of the examples given by the panel involved TV-related multimedia copyright protection. But many of the same issues could apply to radio broadcasters on a smaller scale in coming years when they begin digital audio broadcasting and digital data transmission.

Fuzzy rules

Knowing the copyright rules is like having "a Fuzzbuster on the information superhighway," said John Stewart, partner in the law firm of Crowell & Moring, Washington. But it is not a very efficient device because so many of the digital multimedia rules have not been written.

As digital media become increasingly diverse and imaginative, copyright law becomes obsolete. "(Copyright) is not a clear area as a rule," said R. Bruce Rich, a partner of Weil, Gotshal & Manges, New York.

For example, Fox Television distributes an international version of its "America's Most Wanted" TV series under the title "Manhunter." The network was surprised to learn that it did not have full international copyrights to several elements of the show, such as short music jingles or snippets and video clips used in dramatizations, said Molly Pauker, vice president, corporate and legal affairs, in Fox TV's Washington office. All potentially "copyrightable" events had to be reviewed before the show could be distributed.

Fox is finding similar review necessary for digital media. Assuming the FCC eventually approves spectrum flexibility in TV broadcasters' HDTV channel, Fox's "principal business goal" is to deliver multiple NTSC channels, Pauker said. It already has tentative plans to establish news, movie and all-sports channels for that allocation. But first, the network must determine whether it has "digital media" rights to the programs.

"There is much more pressure on us to do more things in-house" as far as creating programming that could be used in alternative digital media, said Charlene Vanlier, vice president and Washington counsel for Capital Cities/ABC.

Fortunately, as the operator of radio networks, broadcast and cable TV networks and several broadcast stations,

Continued from page 20

CapCities/ABC already owns vast amounts of audio and video programming that it can redistribute at will. "We're zeroing in on how to perfect what we have for the future," Vanlier said.

Pay-per-view TV, interactive games, video and still clip services and virtual reality programs are a few of the products CapCities/ABC has already begun developing using its own program libraries.

Clarification needed

For those that do not have such resources at their disposal, it is up to the federal government to clear up the confusion. "The courts are pragmatically recognizing that they have to go back to the Congress and rewrite the laws," Rich said.

Rich listed a few important digital-media copyright cases that have already reached the courts. The court in the Southern District of New York is reviewing a case filed by a group of free-lance writers who claim the "New York Times" distributed articles written for the newspaper on CD-ROM without first obtaining electronic distribution rights.

(Electronic newspapers are one of the applications suggested for data transmission over FM subcarriers.)

In California, a class action suit has been filed against CompuServe, the electronic billboard service, by composers who claim that users have been transmitting and recording copyrighted digital audio music over the CompuServe system. In a similar case tried in Florida last year, a different billboard service lost, Rich said.

Music is one of the most confusing aspects of copyright law, Stewart said, in part because "there is no hard-and-fast rule about what is fair use."

The Supreme Court recently clarified the situation somewhat in the 2 Live Crew parody case. The court granted limited "fair use" of copyrighted material for commercial purposes—parodies—but stopped short of allowing protected works from being used for radio and TV advertisements without permission, Stewart said. (See *From the Trenches*, page 59.)

Copyrights for digital music could be much more expensive for radio broadcasters once DAB service begins. House Copyright Subcommittee Chairman William Hughes (D-N.J.) is backing a bill to require payment of performance copyright fee to music artists in addition to the composers fees already paid through ASCAP and BMI. Hughes has placed a high priority on passing the bill before his retirement from Congress at the end of the current session.

Broadcasters can take some comfort in the fact that the sponsor of the Senate version of the bill, Diane Feinstein (D-Calif.), seems less willing to move it this year.

"(Feinstein) probably does not want to be in the middle of a fight between the recording industry and broadcasters," said Katie King, legislative aid to Senate Commerce Committee member Larry Pressler (R-S.D.). "There may be a hearing in May, but I don't know whether we can expect anything else."

NII Role for Broadcasters

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same information in overlapping areas provides enough redundancy so that the Seiko wrist-watch/HSDS receivers (which sell for up to $125) consistently receive a strong signal.

Redundancy is a must with the Seiko system, rather than extensive error correction as used in the DARC system, Gaskill said, because HSDS receivers run on small batteries "no bigger than a nickel" that last about 18 months. Extensive error correction would require more power consumption and bigger batteries, he said.

Paging services, traffic reporting news and entertainment information and global positioning are some of the applications HSDS already uses.

Those applications and many others could be performed just as easily by other wireless technologies. "All the services we wish to send out over SCA (subsidiary communications authorization) can be sent over PCS (personal communications services), only they are two-way," Kelley said. "The competition is gaining, but we're well ahead."

Telephone and cable companies are expected to begin bidding for PCS spectrum assignments under auction rules recently approved by the FCC. PCS, will be much more than an upgrade of cellular voice communications system. It will be a two-way conduit for faxes, computer data, still pictures and many other forms of digital information.

But broadcasters have the advantage of already being installed and established nationwide. Subcarrier transmission equipment installation will be a comparatively easy job for FM stations compared to the millions that will have to be invested by PCS companies to install cells throughout the country, Kelley said.

The fact that radio data will be one-way by definition is not necessarily a drawback, Kelley said. There will be a market for several one-way forms of digital data. FM stations also have the advantage of a stronger RF signal that can cover more area than PCS cells.

Consumers on the move, especially in automobiles, appear to be the prime potential consumers of high-speed radio data services. "The only way a broadcaster has an advantage is through mobile applications," Kelley said.

Radio a Good Match to Multimedia

by Randy Sukow

LAS VEGAS Radio broadcasters may have a long wait to find out when or if they will be allowed flexibility to use meaningful portions of their spectrum for supplemental data services. If they get impatient, they could explore multimedia access to the superhighway.

Radio stations are content providers and, as such, hold valuable property to those investing in the emerging "multimedia" of CD-ROM and international fiber optic data networks, such as Internet.

"It is a very, very powerful technology that will become, in my estimation, fully integrated and fully integral to our daily lives," Bill Comcowich, president, UltiTech Inc., Stamford, Conn., a long time player in the multimedia business, said during an NAB '94 session.

Some radio people have already discovered this path.

"This is radio on demand," said Thom Whalen of the Canadian Broadcast Corp., which has been offering radio shows over Internet since last December (**RW**, Feb. 9). "It means that someone sitting anywhere in the world at any time can download (radio) programs into a computer and listen to them."

CBC delivered about 104 audio files a day to 39 different countries (mostly to Canada and the U.S.) during its first month on Internet. Currently it offers about 300 programs over the network.

KKSF(FM) San Francisco is another radio operation taking an early look at multimedia (**RW**, March 23). Those calling up its Internet address are greeted with a menu of five options.

"A menu item called 'On-air Features' basically plugs various features we have during the day at KKSF. We talk about the news and traffic situation and things like that," said Tim Pozar, the station's director of engineering.

"Artist Profiles" is another menu item. "This changes every week. We have a couple of artists and we play a number of cuts off of their CDs," Pozar said.

Those and other menu items at the KKSF Internet address, such as general station information and station personnel picture/bio options, tend to promote the station while giving it an avenue into the digital future. Promotion may be the primary way radio uses multimedia, Comcowich said.

Advertising-supported media are beginning to use CD-ROM as tools during sales presentations. "Forbes" magazine, for example, uses it for all its presentations, Comcowich said: "A computer presentation can be more effective than the standard presentation."

Stations that own the rights to their own library of sound clips and music cuts may be able to use them for many other CD-ROM applications, such as education, entertainment and reference information.

DAR Proponents Progress

by Randy Sukow

LAS VEGAS The organizers of the tests for the proposed digital audio radio (DAR) transmission systems were able to report significant progress during a panel session at NAB 1994.

By mid-April, laboratory tests initiated earlier this year at NASA's Lewis Research Center in Cleveland were expected to be past the initial installation and equipment calibration phases.

For the first time the organizers—the Electronics Industries Association (EIA) and the National Radio Systems Committee (NRSC)—were willing to estimate when the laboratory phase is likely to end: Autumn 1994 or about 24 weeks after the spring NAB.

The organizers were also able to give the most detailed description to date of the DAR subjective tests to be held at the Canadian Research Center (CRC) in Ottawa. If all goes as planned, those tests will begin in late May or early June.

But there is still no solid estimate of when all testing will end and the EIA and NRSC can finish their final reports for consideration by the FCC. The last round of tests, over-the-air field trials have yet to be organized.

The groups are a little behind, however, in the organization of field tests. "We've only had a couple of meetings in the field test area," said Consultant Tom Keller, who is overseeing the test project for EIA.

Nine systems are being proposed by five different entities: two variations of the Eureka 147 out-of-band system; the VOA/JPL S-band satellite delivery system; the AT&T Bell Labs in-band, adjacent-channel system; two variations of the Amati Communications Corp./AT&T in-band, on-channel (IBOC) system; two variations of U.S.A. Digital's FM IBOC, and one version of its AM IBOC system.

The lab tests consist of several dozen separate trials aimed at answering two key questions: How well do the digital features of each system perform? Do the systems interfere in any way with established analog radio stations on the AM and FM bands?

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continued on page 45 ▶

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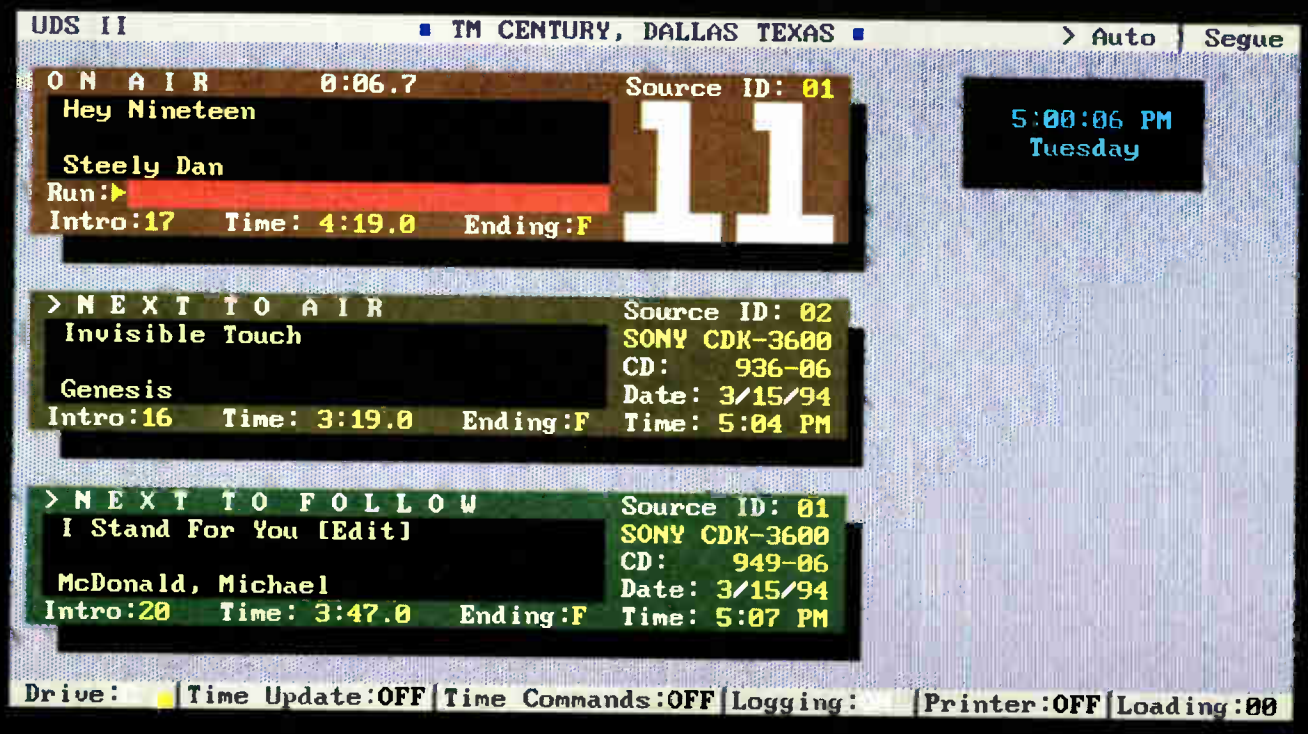

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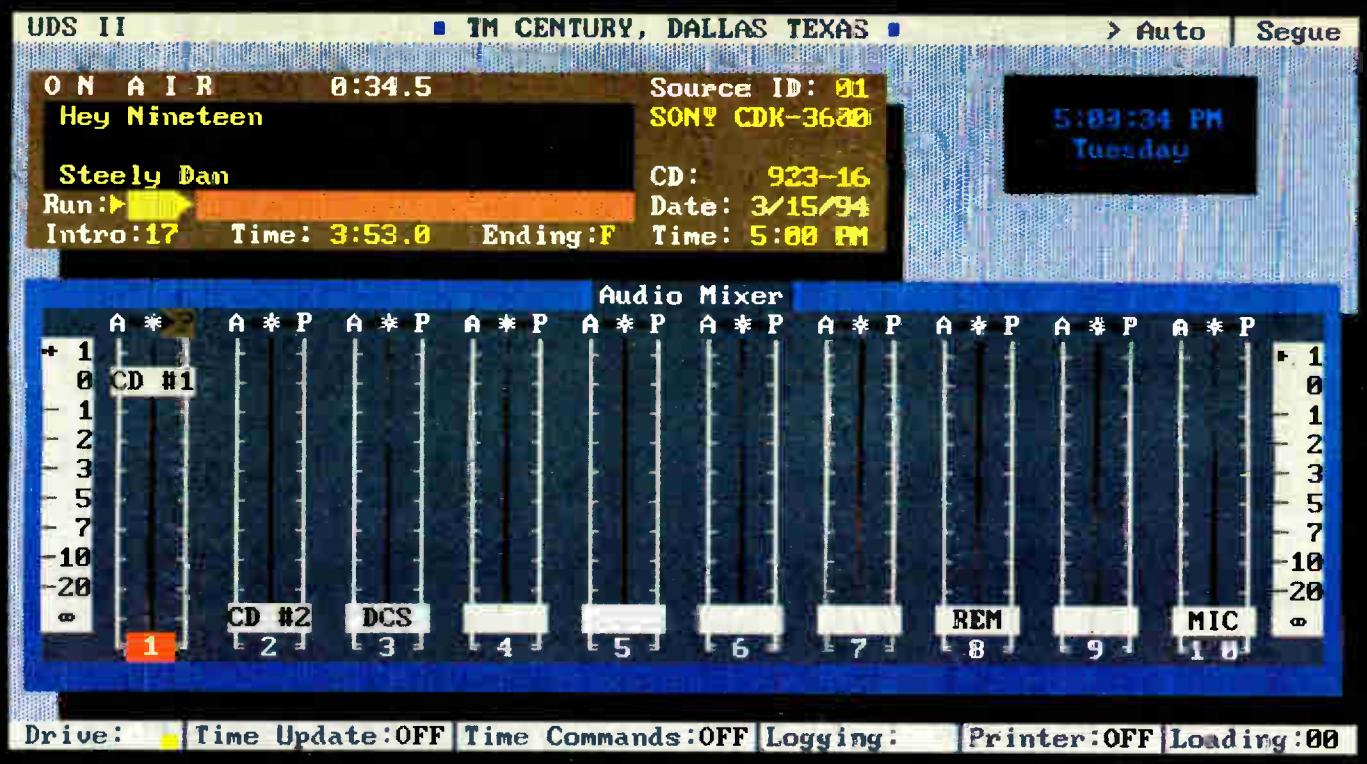

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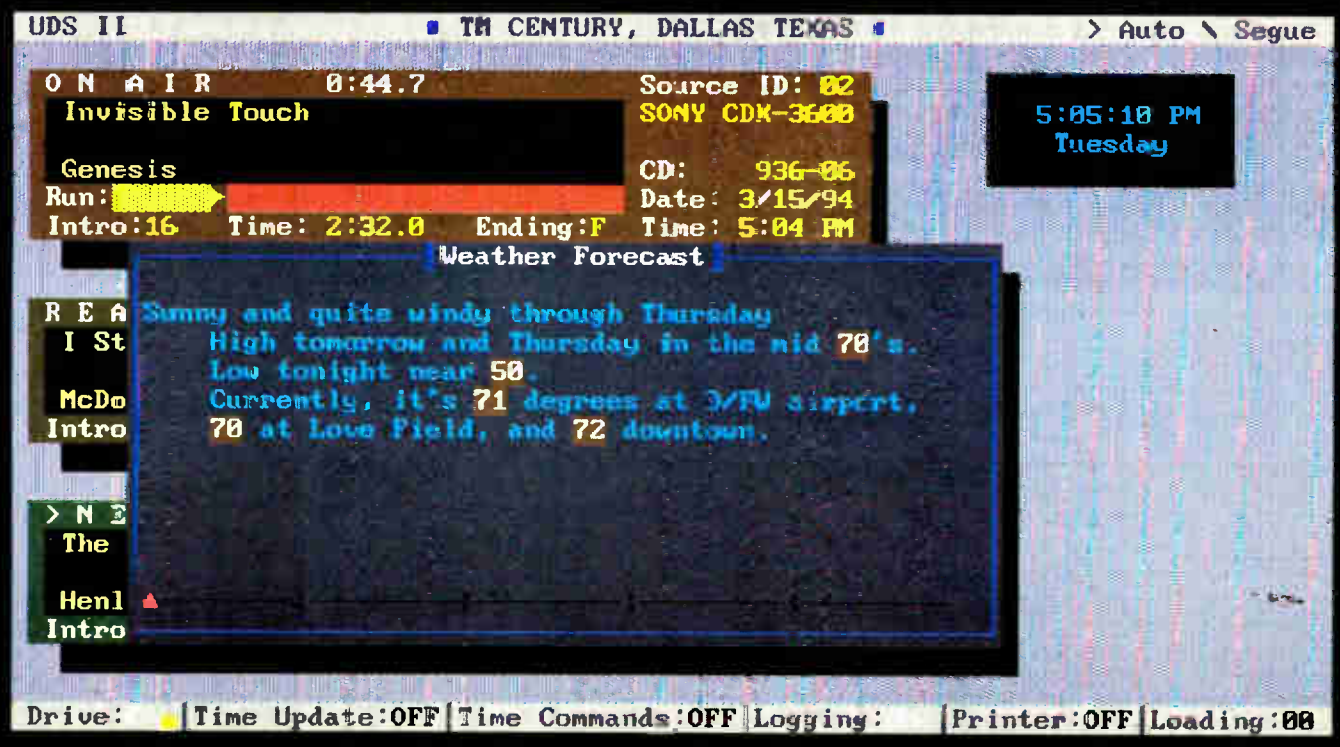

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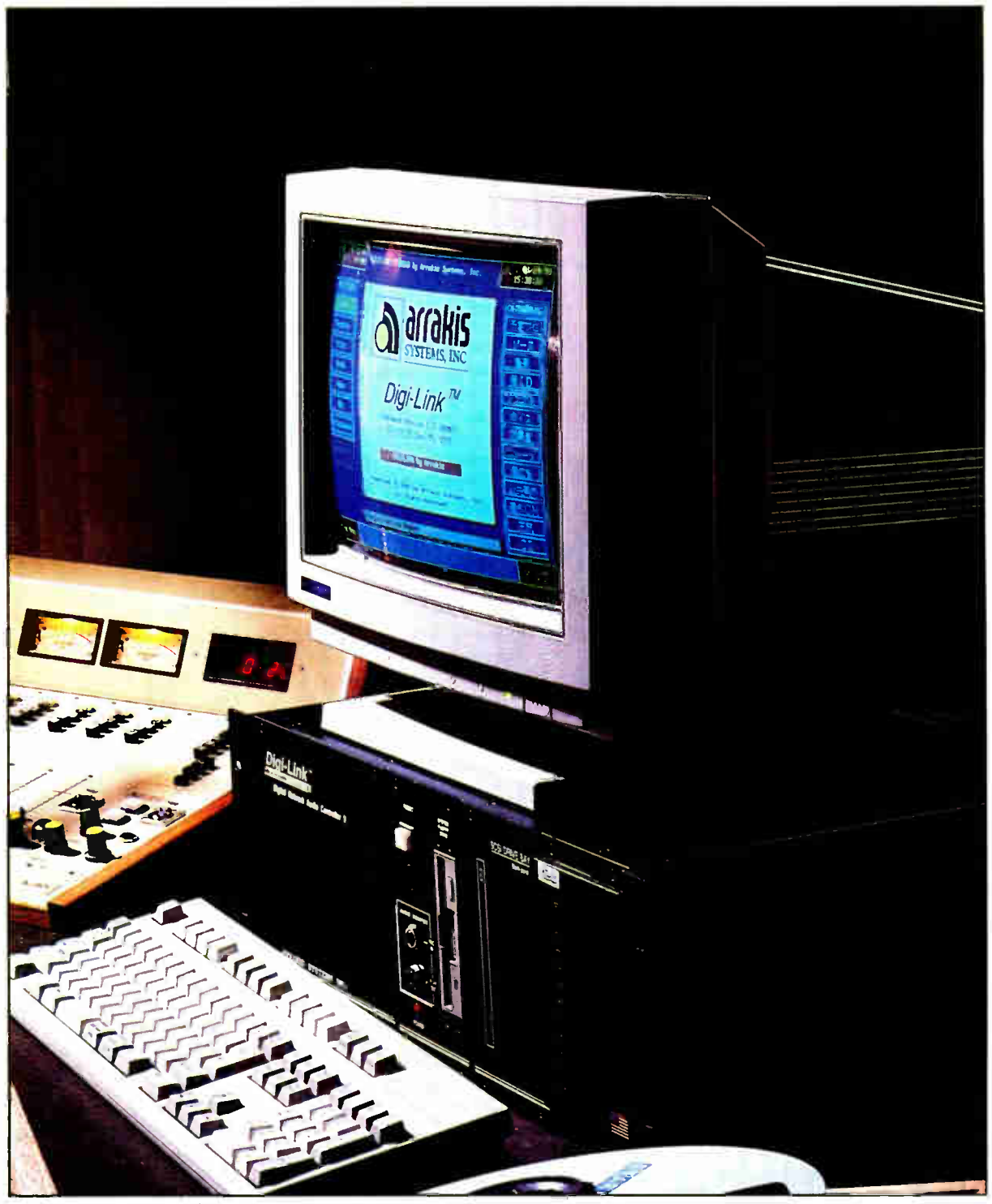

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EBS Delay Viewed as Foolish Move

by Randy Sukow

LAS VEGAS The developers of the proposed new technologies to replace the current Emergency Broadcast System (EBS) said the National Association of Broadcasters acted foolishly by moving to delay final FCC approval of a new system (**RW**, April 6).

The cost benefit of avoiding an estimated $1,000-$3,000 in immediate capital costs is overshadowed by savings in operational expenses built into the proposed EBS systems, they said.

Darryl Parker, marketing manager, TFT Inc., gave a specific number—$63 million in annual operating budget savings for the broadcast industry if all stations were to implement TFT's EIS 911 system. TFT also estimated station savings at a median of over $5,000.

Gerald LeBow, president, Sage Alerting Systems, Stamford, Conn., developer of the Sage Emergency Warning System (EWS) based on communicating through radio data service (RDS) technology, is usually a fierce rival of TFT. But he could not have agreed more with its cost analysis.

"I think TFT did a very admirable job in describing the real and implied cost savings of going from an old technology with old devices to a new technology with new devices," LeBow said.

NAB is protesting an FCC mandate to purchase new EBS equipment, especially in tandem with other new FCC costs expected this year.

Savings plan

"The device we came up with was designed for low cost, as mandated by the FCC," Parker said when describing how TFT designers planned features of the EIS system. EIS equipment is meant to connect with current EBS receivers to keep installation costs down. The EIS 911 box and installation total about $1,000.

But stations will notice the greatest savings in long-term operating costs, Parker said. The current system requires an operator trained in use of EBS equipment to be on-hand to monitor and maintain the EBS receiver. The current system also requires weekly on-air tests of EBS equipment.

Many broadcasters complain that the public has become desensitized to the familiar two-tone EBS tests and are unlikely to pay attention to the tones when a real emergency occurs.

The EIS system (as well as the proposed Sage and Information Systems Laboratories [ISL] systems) can be tested silently, without the audible tone. Time used for weekly on-air tests can now be added to a station's advertising inventory.

The three proposed systems are also digital and automated so that monies now spent to maintain, repair and monitor the current system, keep a log of all EBS alerts and tests, as well as train personnel to perform those functions, are slashed or eliminated.

"I think there are even more cost savings that weren't considered (by TFT)," LeBow said. One major cost is lost audience suffered during weekly tests. "Every time you run those tones, you know what they are doing. They are dialing away," he said.

Parker told **RW** that TFT also decided to leave potential FCC fines for noncompliance with EBS rules or improperly operating EBS equipment out of its analysis. But stations using the new automated, low-maintenance EBS systems would be less likely to be found in violation by FCC field inspectors, he said.

Waiting game

FCC Field Operations Bureau (FOB) Chief Richard Smith was barred by *ex parte* rules from going into great detail on the rules his department has prepared. But he did acknowledge that "automation will relieve the pressure of having to have someone manually activate the system."

Smith said it was "frustrating" to be unable to share the full details of the final order. "I was going to proudly announce a new system to you [at the NAB convention], but we're going to have to wait a little longer," he said.

NAB is protesting an FCC mandate to purchase new EBS equipment, especially in tandem with other new FCC costs expected this year, including FCC spectrum user fees. The association also questions the need for any national emergency warning system. The public has historically been adequately warned of impending disasters, such as the recent Hurricanes Andrew and Hugo, through regular news and weather reporting, NAB says.

NAB protests are credited with removing EBS from the FCC's docket since last February, when the FOB was ready to move it. Action on the item is now expected for the regular May FCC meeting at the earliest.

Parker and ISL Senior Scientist Barry Shay did not react directly to the NAB actions, but LeBow used his time to angrily rebuke the association.

"The NAB has really got a plan," LeBow said. "I think it is unconscionable that NAB takes this posture that they can show the broadcasters they can save them money by holding up a new technology." He called on broadcasters interested in upgrading the EBS system to let the FCC and NAB know their feelings.

WRSAME war

Meanwhile, the three major EBS proponents had one more chance to air their remaining differences over the new EBS system.

Parker and Shay both endorsed use of WRSAME (the National Weather Service's emergency alert codes) as a nonproprietary, universal EBS communications protocol. "It's only logical that we should use WRSAME because it has been in use since 1989," Parker said.

Paul Montoya, president, Broadcast Services of Colorado, who organized the FCC's Denver-area EBS field trials in June 1993, and participated in later field tests in Baltimore, said that if it is not WRSAME, some other universal, nonproprietary protocols should be approved by the FCC.

"If those standards are not set first, we could be in real trouble," Montoya said, especially if an emergency affects a wide area covering several states and the various EBS stations and emergency officials are unable to communicate with each other.

The Sage system is also capable of receiving and decoding WRSAME, but LeBow opposed its use as the universal EBS protocol. WRSAME is not yet widely used, even by National Weather Service stations, he said.

Emergency officials in the New Jersey area, where Sage recently signed a deal to link the New Jersey State Police with area broadcasters with the EWS system, do not expect WRSAME to be in universal use until after 2000, LeBow said.

LeBow said the standard should instead be based on Sage's RDS technology, which, he said, "has been operating for quite a while." RDS alerting systems have been in operation for several years in Germany and in Texas, where Sage Alerting links oil rigs in the Gulf of Mexico to warn coastal towns if there is a major spill.

The New Jersey EWS system will link eight primary radio stations in the state as well as four stations in nearby New York, Delaware and Pennsylvania, with state emergency offices. It will also reach 34 of the state's cable TV headends. The system is expected to be fully operational by the end of the year.

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DAR Proponents Reporting Progress

▶ continued from page 38

1. Threshold of audibility (TOA), defined as "the point where you can just hear something. It could be a pop or it could be a distortion," Keller said.

2. Point of failure (POF), which Keller described as "the point where the system is totally unusable." That point had still not been defined exactly for laboratory purposes as of last month.

3. Expert observation and commentary (EO&C), to describe aspects of the signal that cannot be defined objectively.

Early lab tests

Two of the earliest substantial lab tests will involve measuring and describing various forms of signal failure (which will feature heavy use of multipath simulation) and measuring each system's level of performance with impairments, such as impulse noise or airplane flutter.

Those tests, along with later transmission quality tests results will be among the most important, Keller said, because digital audio tapes from them will be sent north as the basis for the subjective tests.

Like the lab tests, subjective tests will be divided into two general lines of inquiry, audio quality and quality after impairment.

Three expert listeners will be used for the audio quality tests. They will listen to the test materials over headphones and speakers, over two different channels. One channel will be a reference channel (which will be revealed to the listeners) and a test channel.

The impairment tests will be more complicated. Six experts will listen to three channels, a reference channel, a "hidden reference" channel and the test channel.

To complete the tests, the CRC will need a small army of volunteer expert listeners. Gerald Chouinard, CRC's director of radio broadcast technologies, said he is looking for volunteers who have had some experience with listening tests.

Volunteers for the audio quality tests will be asked to spend two days in Ottawa, and those volunteering for the impairment tests for two weeks.

Satellite shadow

Many broadcasters are hoping that EIA, NRSC and CRC can complete their testing of DAR transmission systems before the FCC moves to approve satellite digital audio broadcasting. The commission has several satellite proposals before it and eventual approval of such a service is widely considered inevitable.

NAB is hoping to delay satellite DAB approval to coincide with approval of an in-band, on-channel system for broadcasters. Early satellite DAB "could be devastating for local radio," NAB President Eddie Fritts.

FCC Chairman Reed Hundt's brief statement on the subject, during his satellite-delivered address, could be interpreted as encouraging to broadcasters. Hundt promised that as the FCC analyzes the various DAB systems, it "will pay studious attention to the competitive realities for terrestrial broadcasters."

□□□

For more information on how to volunteer for the subjective tests, contact Andy Laird of Heritage Media, 805-288-2200, or Herb Squire, chief engineer, WQEW(AM)-WQXR-FM New York, 212-633-7681.

NAB CONVENTION NEWS

Beer and Wine Labeling Bills Not Likely to Pass in 1994

Another area where NAB could claim some measure of victory last month was in delaying action on Senator Strom Thurmond's (R-S.C.) proposal to require disclaimers to be read at the end of beer and wine advertisements on radio and TV.

"Thanks to terrific grassroots lobbying, we have—so far—discouraged further legislative action," said NAB President Eddie Fritts, who said the Thurmond bill "would strangle (broadcast) beer and wine advertising."

One of the guest legislators at last month's convention, Senator Harry Reid (D-Nev.), spoke in favor of the NAB position: "We can't control every aspect of everyone's life. I think we should look at the good that comes from those ads." PSAs to warn against drunk driving sponsored by the alcohol industry, for example, have been positive influences, Reid said.

But Reid said it will be hard for many senators to vote against the bill should it come to a vote. There is great sympathy for Thurmond, whose daughter was killed by a drunk driver a year ago.

Thurmond is currently struggling to win the votes to get the bill out of the Senate Commerce Committee. As a courtesy to a fellow South Carolinian, Commerce Committee Chairman Ernest Hollings has promised to present the committee for a vote when Thurmond asks for it, said John Windhausen, senior counsel to the committee.

"We don't know when Senator Thurmond is going to ask for that vote," Windhausen said.

Even if the beer and wine bill makes it out of committee in the Senate, the bill has even less momentum in the House. The Energy and Commerce Committee will be occupied by health care legislation most of the year and will have little time to move less urgent legislation, such as beer and wine, said Gail Giblin, legislative director for Jack Fields (R-Texas), ranking minority member of the House Telecommunications Subcom-mittee.

LMAs Present Compliance Problems at Renewal Time

Broadcast licensees that have entered into local marketing agreements (LMAs) were warned that they must be extra careful to stay within compliance of the FCC's rules, as the commission prepares to begin another round of radio license renewal proceedings, beginning next year.

Licensees, not brokered stations that take over a licensee's facilities, are responsible for any violations of technical, political advertising, indecency or any other FCC rules. "Don't tell me at renewal time that station XYZ was supposed to take care of that," said Mass Media Bureau Chief Roy Stewart.

Brian Madden of the Washington law firm of Leventhal, Senter & Lehrman, listed five things broadcasters should be ready to show the commission at renewal time:

1. The station's programming is responsive to the needs of the community.

Licensees, not brokered stations, are responsible for any violations of technical or any other FCC rules.

2. The station airs ample amounts of public service programming.
3. The station has a strong reputation in the community.
4. The station has organized out-reach programs to become part of the community.
5. The station has complied with FCC regulations.

"It gets terribly complicated to apply (the five rules) to an LMA or a duopoly because these are new concepts," Madden said.

NAB is setting up a series of regional seminars nationwide to help stations prepare for the renewal process. The first seminars will be held in Maryland, Virginia, West Virginia and the District of Columbia, where stations will be the first to come under renewal scrutiny starting June 1, 1995.(See box page 47.)

Democrats Disagree Over The Need for Fairness Doctrine

Republicans, it has often been observed, tend to split on the issue of the fairness doctrine, the now-defunct FCC regulation that once required broadcasters to provide balanced coverage of controversial issues, which many in Congress have attempted to revive and codify since 1987.

Some GOP legislators view the doctrine as an attack on the marketplace of ideas guaranteed by the First Amendment, while others see it as a way to fight back against liberal bias in the media.

A similar split among Senate Democrats was demonstrated during the NAB convention last month. Senator Harry Reid (D-Nev.), appearing at a Congressional issues breakfast, said: "I want everyone to know here that I can't stand Rush Limbaugh,...but I think, far from improving debate, the fairness doctrine would make stations gun-shy over any controversy."

Less than an hour later and from the same dais (after Reid left the room), John Windhausen, senior counsel to the Senate Commerce Committee, asked broadcasters to: "Stop arguing that the fairness doctrine is going to get rid of Rush Limbaugh. I think we all know it's not going to get rid of Rush Limbaugh. Senator Hollings continues to support the fairness doctrine, but he in no way is intending to try to get rid of any particular talk show host or to discourage debate."

Codification of the fairness doctrine was expected to move smoothly through the Congress after the election of Bill Clinton, who is believed to support it. But protests from Limbaugh and many other sources stalled a codification bill last year. Gail Giblin, legislative director for Jack Fields (R-Texas), ranking minority member of the House Telecommunications Subcommittee, credited religious broadcasters, who "really got mobilized and helped contribute to the way we are dealing with the legislation."

continued on next page ▶

Senator Harry Reid (D-Nev.)

▶ continued from previous page

Australians Demonstrate How Not To Auction Spectrum

Now that the FCC has finished formulating rules for auctioning of frequencies for personal communications services (PCS) later this year, it will be hoping to avoid some of the pitfalls Australia suffered in earlier experiences with spectrum auctioning.

Auctioning has been "a pretty strange way to go about business, except, of course, if you're in government and you desperately need to raise revenue," said Senator Richard Alston,

deputy leader of the opposition Liberal party in the Australian Parliament, during NAB's "International Communications Symposium."

Australia is currently in the process of auctioning two licenses for satellite pay-TV service. The process has taken over a year and is still not completed, Alston said.

Under the auction rules, the top bidder was given a period to pay a deposit on the bid to assume control of the license. Otherwise, the license would fall to the next highest bidder. In the end, the two licenses were awarded for a combined $194 million Australian (approximately $140 million in the U.S.), but only after several bidders defaulted.

"I've enjoyed it in terms of political farce," said Alston, who called the Australian auction process "a classic case of how not to go about these things."

The pay-TV auction was held, Alston said, in spite of a failed attempt to auction two FM radio licenses in 1989. The highest bid was for $31 million Australian ($22 million, U.S.) and the second license was awarded for $10 million ($7.1 million, U.S.) after a $22 million bidder defaulted.

The highest bidder recently went into liquidation and the second license holder has changed hands so many times that it is unrecognizable today, Alston said.

"Looking back on it," he said, "it would be silly to bid more than $10,000 for those licenses because there are now additional FM broadcasters that have come in for nothing."

Radio Renewal Seminars

The NAB added three dates and locations to its series of one-day regional seminars to prepare radio broadcasters for the 1995-98 round of license renewals.

The newly announced seminars will be held Thursday, July 14 at the Holiday Inn/Woodlawn, Charlotte, N.C., for North Carolina and South Carolina broadcasters; Thursday, Sept. 22 at the Radisson Hotel/Airport in Orlando, Fla., for broadcasters in Puerto Rico, Florida and the Virgin Islands, and Thursday, November 17 at the Holiday Inn/Airport in Columbus, Ga., for Georgia and Alabama broadcasters.

The practical "how-to" seminars will be free to the first person from each NAB member station. $35 for the second person and $50 for the third. The fee for non-members is $300. The seminars will focus on small and medium market stations, but executives from stations in markets of all sizes are welcome to attend.

Previously announced seminars are scheduled for May 10 at the Holiday Inn Monticello in Charlottesville, Va., and May 17 at the Holiday Inn Charleston House in Charleston, W.Va., for broadcasters in Maryland, the District of Columbia, Virginia and West Virginia.

The NAB legal department will develop the seminars and materials. Speakers will include NAB attorneys, NAB EEO specialists and outside experts.

NAB will schedule seminars about 13 months before the renewal deadline in each region of the country and will coordinate with state broadcaster associations. Broadcasters must pre-register to attend. Each seminar will run from 9 a.m. to 4 p.m. with lunch included.

For more information about the seminars or to register, call NAB Radio's Christina Griffin at 202-429-5350.

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Circle (171) On Reader Service Card

Canadian Radio Reacts to DAR Plans

by James Careless

OTTAWA, Canada Commercial radio operators in Canada are not as optimistic about Digital Audio Broadcasting (DAB) as would be assumed based on the strong support for Eureka-147 coming from proponents of the system.

"I think that digital radio is further away than anyone thinks," said Boyd Craig, vice president at CKX-AM-FM in Brandon, Manitoba.

His views are echoed by Danny Kingsbury, vice president of programming at CILQ(FM) and CHOG(AM) in Toronto. "I believe we're much further away from this than the optimists believe," he said.

The optimists would be the industry/government "Task Force on the Introduction of Digital Radio." The organization is the guiding force behind the campaign to bring L-band DAB to Canada, a campaign that aims to get commercial DAB on line by 1995.

Reality of situation

However, the fact that the Task Force succeeded in proving the feasibility of the DAB format does not mean that private broadcasters are ready to jump on the DAB bandwagon. The reason they hesitate has little or nothing to do with the technology of DAB. To some extent, it is a given among Canadian radio executives that it works.

Instead, what bothers both programmers and engineers alike is whether it is economically wise to spend millions installing DAB transmitters during a recession, particularly when 60 percent of all Canadian stations already are losing money.

Michel Tremblay, executive vice president of the Canadian Association of Broadcasters, which represents private and local outlets, admitted that DAB might create financial challenges for small market stations, but stressed that it will also prompt new services such as datacasting. As well, he said, broadcasters will share costs since six stations run on a single antenna.

Michael Binder with Industry Canada said that DAB service could represent a savior for radio in the nation. "We want to make sure stations remain viable and grow and prosper," he said at the recent Second International Symposium on DAB in Toronto. "We also want to ensure that all Canadians have access to new technology.

"This is not government pushing on the industry," he added. "The industry is looking for new opportunities to revitalize itself."

Still, that does not convince broadcasters like Gordon Gibb, production manager for CKRU(AM) and CKWF(FM) in Peterborough, Ontario, a city of 60,000 with four stations (plus one TV outlet and various print media).

"There's such competition for the advertising dollar now," Gibb said. "It was always tough among the four radio stations, but there's so many other players in the market now. Can this market survive with four radio stations? Maybe not."

The bottom line for people like Gibb is that they want to be sure DAB will pay off before investing in it. Times are too tight to invest in a failure.

Consumer concerns

However, the Task Force has yet to convince broadcasters that consumers actually want DAB, said Dave Youell, chief engineer at CFUN(AM) and CHQM-AM-FM in Vancouver, British Columbia. "What they should do is to get their market research under control," he said. "I haven't seen any figures as to how many units are really going to be sold."

Kurt Arseneault, chief engineer at CHNS(AM) and CHFX(FM) in Halifax, Nova Scotia, agreed. "I'm just not sure how many people are going to rush out and buy radios. Probably 90 percent of the people cannot tell the difference between FM and digital."

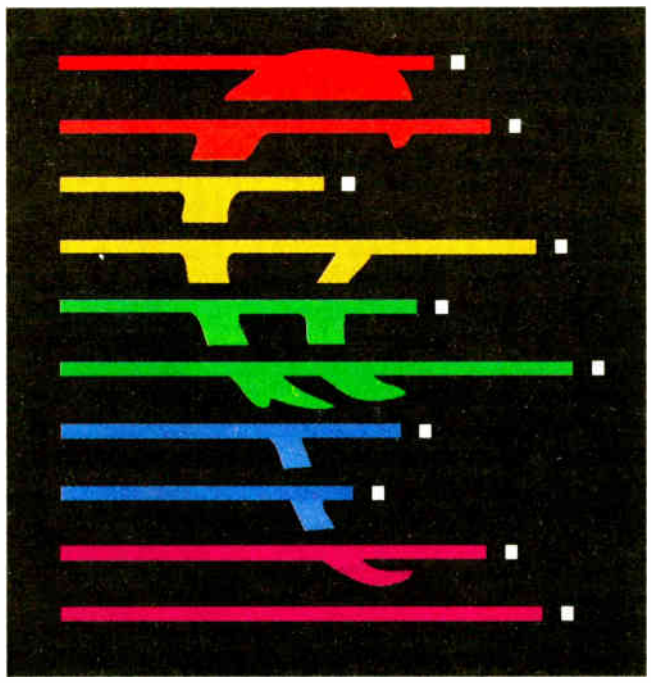
But even those who can tell the difference may not buy digital receivers, said Dave Youell. "Is Aunt Mae going to give up her $50 AM mantle radio and turn around and buy a $200 digital radio? At this point in time," he said, "I don't think she is."

This is the equation troubling private radio in Canada and motivating them to take a 'wait and see' attitude to DAB.

"The consumer does not have a digital receiver," Craig said. "And I don't know that there's going to be enough of these in five years that a digital radio station could be commercially viable."

This, in itself, is sufficient to slow down the drive toward commercial DAB in Canada. But there are two other factors worrying private broadcasters as well.

The first is the current lack of a single world standard, and the possibility that one may not actually be chosen.



Not AM stereo, again

To Canadian broadcasters, this possibility raises an ugly demon from the depths of their memories: namely, AM stereo.

AM stereo is a complete and utter flop in Canada. The lack of receivers (except in Chrysler cars) ensured that the technology is about as popular with consumers as quadraphonic and 8-track tape.

This means that stations that paid to install AM stereo transmitters essentially wasted their money; something that they don't want to do again.

Hence, for broadcasters like Toronto's Danny Kingsbury, a single world standard is a must. "Although this is a different scenario that AM Stereo, there are some similarities," he said. "We must agree as an industry on agreeing on the technology alone, otherwise we're going to be in the same kind of problem where we have three or four different AM stereo technologies out there."

Kingsbury's fears about DAB are perhaps more succinctly described by Arseneault. "I just hope we don't blow this the way we blew AM stereo," he said.

The second factor casting doubt on L-band DAB is the American persistence in backing a different form of digital radio: namely 'in-band'.

Canadians like Dave Youell are not comfortable with the notion of the world's biggest marketplace—and next door neighbor—not supporting Canadian DAB.

Without a strong consumer desire to replace their analog radios with digital sets—as LPs, for instance, were replaced by CDs—the case for viable commercial Canadian DAB appears shaky, at least in the short term.

That's why every single station contacted expressed caution when asked if they would jump in the digital marketplace as soon as technologically possible.

Their views are best summed up by Denis Diom, director of engineering at CHOM(FM) in Montreal. "We'll consider it as soon as it comes on line," said Diom. "That's for sure. The only thing is that whether we'll spend great amounts of money at the beginning is doubtful. No one has promised a receiver until '97. That's about three years down the road. By that time, we might...might want to spend a little bit of money."

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James Careless covers the industry from Canada for Radio World.

WORKBENCH

Stock Circuits Make Thrifty Compressors

by John Bisset

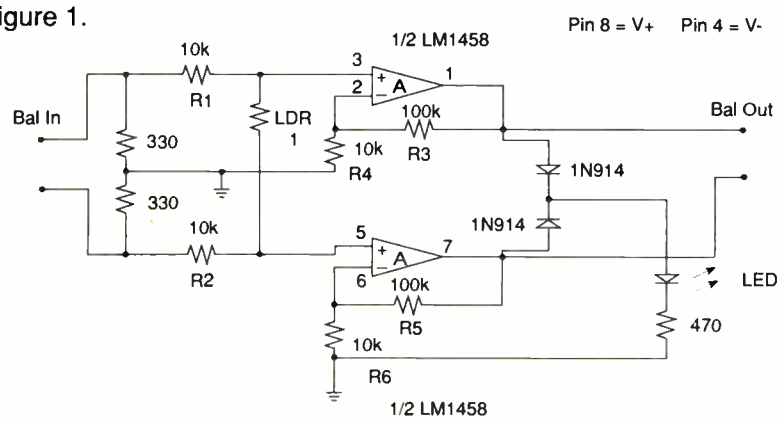
FALLS CHURCH, Va. Tom Lange with the Sheboygan Area School District in Wisconsin, recently needed a cheap and clean compressor that worked on balanced lines for an audio feed that had very unpredictable levels.

Tom's solution was a new twist on the LED/LDR compressor circuits that we all cut our teeth on. He started with the usual unbalanced scheme, using an LDR in the feedback loop of the op-amp. The need for balanced in and out led him to the system shown in the schematic (Figure 1).

The overall gain of the amplifier can be controlled by shunting a resistor across the positive inputs of each op-amp. This is due to the 10K resistors (R-1, and R-2) which are in series with the input signal. When the balanced signal is reduced, each op-amp receives less signal, and, a reduced output is reflected.

A compressor is created by installing resistance dependence on the amplitude of the amplifier's output. LDR-1 is subjected to light generated from an LED driven by the rectified output current. Uncontrolled gain is determined by the ratio of R-3 to R-4 (and R-5 to R-6).

Figure 1.



Tom warns that you will have to experiment with various LDRs because their resistance versus light level can vary widely. Tom's ideal picks are LDRs exhibiting a "dark" resistance of 100K ohms or higher. Some LDRs will react more slowly to LED intensity changes, so if you want a fast-attacking compressor, pay attention to these change rates.

LDRs with a resistance of 1K ohm or less at peak LED brightness are easy to find. Mouser, Jameco and Radio Shack all carry them. Tom Lange can be reached in Sheboygan at 414-459-4020.

★ ★ ★

LDR suppliers are easy to track down if you have the new Hearst Business Publishing's "Electronics Engineers Master" (EEM), a four-volume set with over 4,000 pages of data from more than 1,000 leading electronics manufacturers. This year's EEM includes over 4,000 product categories and addresses for over 5,000 manufacturers.

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Hearst also publishes the "IC Master" catalog, a three-volume set with product information on over 100,000 commercially available ICs. It also includes manufacturer and distributor addresses and an industry-wide cross reference of over 100,000 current and discontinued devices that are functional equivalents. For information, circle **Reader Service 14**.

□□□

John Bisset is a principal with the contract engineering group Multiphase Consulting. Submissions to Workbench may be sent to his attention, in care of **RW**, *or faxed to 703-764-0751. He can also be reached at 703-323-7180. Published submissions qualify for recertification credit for all SBE certification levels.*

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Please make every effort to secure all of the articles yourself. Northern Virginia Community College and **RW** *are not in a position to supply readers with back issues.*

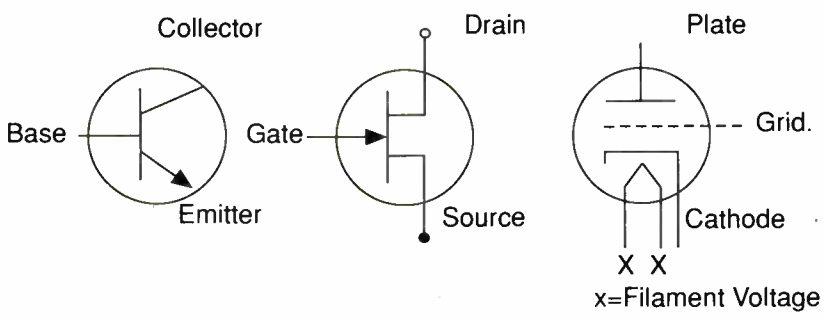
by Ed Montgomery

Part VIII of XII

ANNANDALE, Va. The transistor, field-effect transistor (FET) and vacuum tube all have correspondingly similar parts.

Electrons flow through either a transistor's emitter, an FET's source or a tube's cathode. The flow may be regulated by the base, gate or grid, to the collector, drain or plate, depending on the device.

Figure 1.



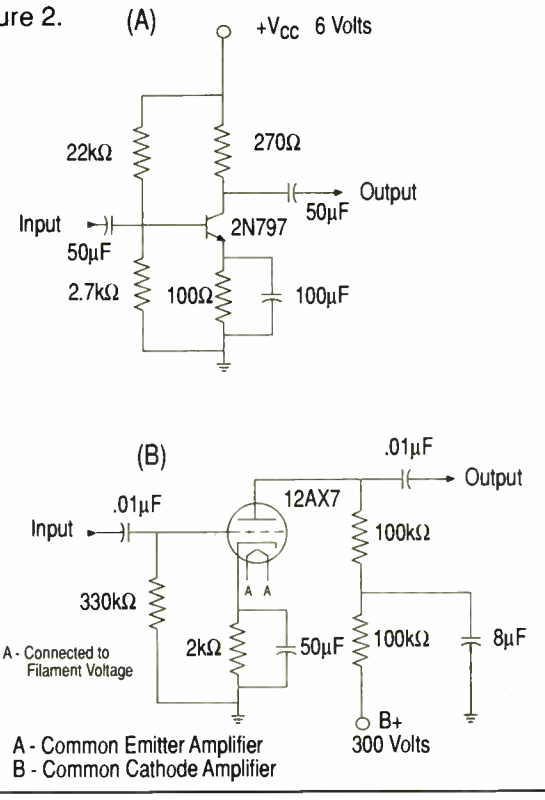
This is illustrated in Figure One.

Vacuum tubes do the same work as transistors. The main drawback to the tube is its size and the amount of electric power required to make it amplify a signal as well as a transistor. The schematics in Figure Two show the differences between an audio amplifier using a 12AX7 vacuum tube and another using a 2N797 bipolar transistor.

Transistors and tubes can be configured in three different ways to operate as amplifiers. The two devices operate similarly when wired in these configurations. The wiring arrangement depends on the element of the device to be grounded. Ground is often referred to as "common" in electronics.

The amplifier terms for transistors are "common emitter," "common base" and "common collector," depending on the type of amplifier being used. For vacuum tubes, the terms are "common cathode," "common grid" and "common plate"; for FETs they are "common source," "common gate" or "common drain." Each configuration exhibits its own amplification characteristics.

Figure 2.



The common base amplifier is illustrated in Figure Three. Its design produces a very high-voltage amplification, but no current amplification. This type of configuration can be used to match one impedance source to another.

Common base amplifiers have a low impedance input in the range of 30 ohms. The output of this circuit can reach 1 million ohms. The common base arrangement, often called a voltage amplifier, offers a considerable power gain.

Common base and grounded amplifiers are often used in radio-frequency applications. The center component is grounded reducing the development of stray capacitance that could produce spurious oscillation. The high output impedance of the common base amplifier corresponds to the high impedance found in parallel resonant circuits.

The configuration of the common emitter amplifier, illustrated in Figure Four, is known as a power amplifier when the emitter is grounded because the common emitter configuration amplifies both current and voltage.

The common emitter amplifier can amplify both voltage and current. It is probably the most popular circuit, used as a linear amplifier in audio and video applications. The common emitter arrangement has the highest input impedance of all three amplifiers, the lowest output impedance. It is the only arrangement that will produce an inversion of the signal when it is amplified.

A positive going signal at the base input to this amplifier will produce a negative going amplified signal across the load resistor. If a resistor of equal value to the load is placed in the collector circuit, this amplifier can be turned into a phase splitter. The output goes across the emitter in-phase with the input signal, as well as across the load out-of-phase with the input signal. This type of an amplifier can be used to supply equal but opposite signals to a push-pull power amplifier.

Common collector, also called emitter-follower amplifiers, can change impedances. Input impedance is usually very high while output impedance is low. The amplifier has no voltage gain, but its ability to amplify current is high.

Emitter-followers are often used to supply a signal to a low impedance load such as a speaker. Common collector circuits are also known as isolation or buffer amplifiers. The high input impedance of these stages requiring very little current does not load down preceding amplifier stages.

Over the years, various transistor arrangements have produced several standard output designs. Prepackaged circuits, popularly known as operational amplifiers, are available to perform many functions.

Operational amplifiers were first designed in the 1940s for computer circuits. The name derives from the concept of a circuit producing a high amplification gain. By changing the feedback elements, different functions are performed allowing one amplifier to do many things.

Electronics advanced a step beyond opamps with the introduction of integrated circuits (ICs) in 1958. ICs sparked growth in the electronics business greater than anything engineers ever anticipated by replacing the conventional methods of discrete

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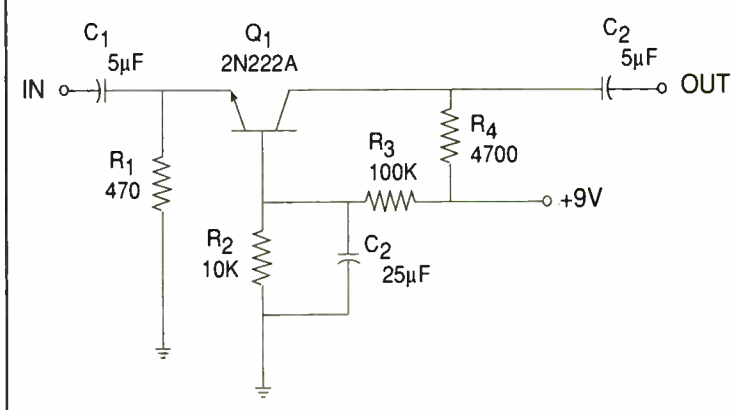
Figure 3.



COLE'S LAW

Watch Out for FCC's New EE*O(uch)* Regulations

by Harry Cole

WASHINGTON Over the last 10 or 15 years of broadcast regulation, deregulation and reregulation, there has been at least one constant: the FCC's equal employment opportunity (EEO) rules, which prohibit employment discrimination by broadcast licensees.

Well get ready for more change. Broadcasters now face significantly increased burdens to comply with the newly rewritten EEO standards.

Changing times

EEO compliance was once easily measurable through a station's employment profile compared to the profile of the labor force in the station's local area. Regulators looked at the minority population of the area's work force and then looked at the station's employment list.

If the percentage of minorities at the station in full-time positions and in higher-level jobs was at least 50 percent of parity with the work force, the station would probably pass.

That traditional reliance on qualitative employment profiles shifted in the late 1980s. The commission began focusing on a licensee's efforts to hire women and minorities and document most, if not all of those efforts. Failure to produce that documentation became the basis for penalties.

The theory was that if the licensee did not keep adequate records, there was no way it could know whether it was maintaining adequate EEO progress, even if there was no evidence of any actual discriminatory hiring or promotion practices.

That shift was bad enough; now get ready for more bad news. The commission's new EEO rules, approved in February, include a new method for calculating fines. To be absolutely clear about this, I'll quote the passage in the new rules describing the kind of "conduct" that will trigger a $12,500 base forfeiture:

"Failure to recruit so as to attract an adequate pool of minority/female applicants or hires for at least 66 percent of all vacancies during the license term being reviewed. (Evidence of this violation will include (1) inadequate record-keeping and/or (2) inadequate self-assessment throughout the license term.)"

Now you can face fines of more than 12 grand for not having "attracted" an "adequate pool" of job applicants for at least 66 percent of your job openings.

Now you can face fines of more than 12 grand for not having "attracted" an "adequate pool" of job applicants for at least 66 percent of your job openings. Unfortunately, the FCC does not explain what an "adequate pool" is.

But a licensee is automatically in violation if the FCC finds its pool inadequately filled, regardless of the nature and extent of documented efforts to attract women and minority applicants.

New math

The base fine of $12,500 is just a starting point. It can be increased or decreased based on several criteria (which still don't go very far in clarifying the ambiguities of the policy).

A fine may go up by 50 percent or more ($6,250+$12,500=$18,750) if the licensee has failed to attract an adequate pool for at least 33 percent of all vacancies during the license term, if there have been a "large number" of hiring opportunities that "did not translate into an adequate pool of minority/female applicants or employees hired," or if a "large pool of minorities/women in the relevant labor force did not translate into an adequate pool of minority/female applicants or employees hired."

Just try to get a firm grasp of what any of these violations might entail.

Perhaps the most annoying aspect of the new rules is that a licensee can have a fine increased if it has a previous EEO violation, a move to discourage recidivism in this age of three strikes and you're out.

Little relief

The problem is that the FCC "standards" are so vague that a licensee could conceivably get tagged with an initial violation in spite of good-faith efforts to comply with the all the rules. A second violation could mean a $23,000 fine, reporting conditions, a short-term renewal, and possibly a hearing leading up to a forfeiture of $250,000.

There are also downward adjustments. You be the judge of how much protection against unfair penalties they provide.

The base fine may be cut in half if "minority hiring represents 50 percent of the minority profile of the relevant labor force" for all employment and upper-four employment. (Oddly, this section does not mention female hiring, only minorities.)

A licensee can get the same reduction and "presumptive removal of short-term renewal," if minority hiring represents 100 percent of the minority profile of the relevant labor force, unless the evidence indicates "substantial absence of an EEO program." The possibility of short-term renewal kicks back in then.

If a licensee's staff represents 50 percent of parity with the relevant labor force, the fine may also be reduced to $6,250. In other words, what guaranteed a clean bill of health a few years ago now draws at least $6,250 in forfeiture.

Explanations such as "few hiring opportunities" and "low percentage of minorities in relevant population" may also be grounds for a reduction, but they are not "get-out-of-jail" free cards.

This brief analysis of the new EEO rules barely scratches the surface of the possible consequences. But it hopefully shows that broadcasters that do not take them seriously face serious trouble. The policy is unclear and not fully developed, making the broadcasters' positions all the more risky.

This is one area, perhaps more than any other, where a broadcaster should stay in regular contact with communications counsel, and develop and implement hiring standards and practices that are as safe as possible.

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

Amplifier Applications

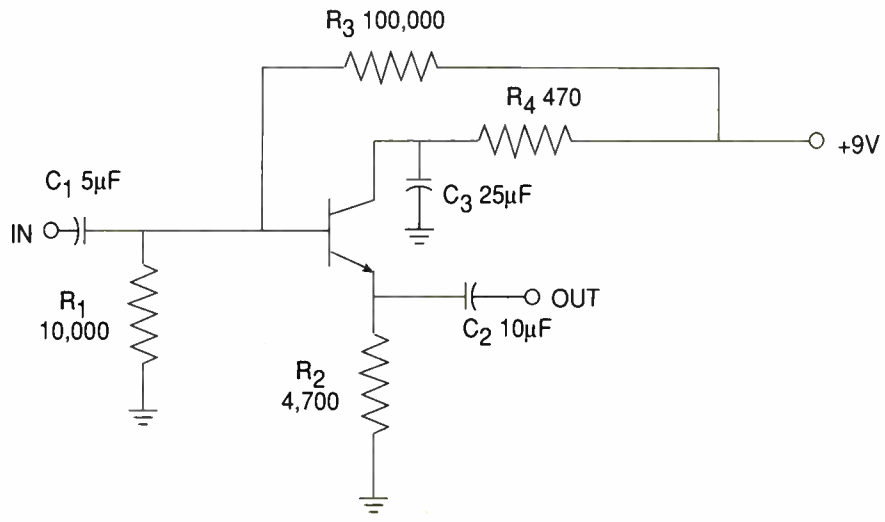
▶ continued from previous page

device circuitry.

ICs do not need individual components soldered to a circuit board, because all of the components are in the "chip." A crystal with all transistors, diodes, resistors and capacitors is "grown" into the material when it is manufactured. ICs reduce the number of components required, reduce the size of circuit boards and generally use less power.

ICs often produce circuits that require fewer alignment steps, and often increase the reliability of the circuit because there are fewer components to fail.

Figure 4.



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

There Are No DAW Demons to Fear

Digital Production Can Be Easy, Interesting And Can Prepare You for Future Audio Demands

by Brad Jones

ATLANTA Why do recording engineers, producers of radio spots, production directors and general audio people over 38 years of age tend to run when they are confronted with the idea of recording, editing and building audio on a digital workstation with an IBM-compatible PC or Macintosh PC front end?

Perhaps in the early days, PCs put such a bad taste in people's mouths that it soured them on all computers. Are PC's the root of all evil for "middle aged" end users?

I contend that had it not been for PCs, and if Macintosh had been the first system middle aged audio guys had access to, everyone would be more willing to jump into digital workstations no matter what type of front end was on the system.

The fear of flying in the digital domain has held back many competent producers. They are unwilling to take that first step into digital because it means using a computer. That's a shame.

Simple transition

These fears can and should be overcome. Anyone can learn digital production, which is by far the greatest invention since we left the wire recorders of the 1930s.

There is no need to be afraid of that keyboard. You do not have to learn a whole new language to get inside your system, or have a technician standing less than 25 feet away when you power up. It is as easy as when you first turned on a multitrack tape recorder, very simple.

All engineers make a few changes when they enter the business. They experiment with different microphones to find the desired sound. They must learn how to EQ things and how to use those outboard effects units for that special reverb at just the right moment.

Just make a few more adjustments to the way you work. You will be well prepared for the changes and new audio demands of the next century, which is only a little over five years from now. Digital spots will be every bit as good as the old analog spots that won all those awards.

You will be showing those 20-year-old kids how to bring a so-so script alive, rather than letting 20-year-old kids show you how to work a digital workstation.

It's true. You can learn digital without learning a new computer, but be aware that if you do not learn the computer, you may soon be replaced by that 20-year-old kid, and before you are old enough to retire.

The fear of flying in the digital domain has held back many competent producers. They are unwilling to take that first step into digital because it means using a computer. That's a shame.

If you just learn one of those digital systems that does not use a computer at all—no keyboard and all the same buttons as on the same old hardware you are used to—you will be learning a dead-end system.

Any system that does not have a Macintosh front end is severely limited. It will not grow into the applications you will need in the next three to five years. It probably has dedicated hardware and dedicated buttons that only do what you need them to do today, not what you will need them to do tomorrow.

Computer flexibility

A system that has a computer on the front end is always able to expand. The money you save today by not buying a system with a computer on the front end, will eventually cost you much more. Spend a few extra dollars today, so that you know you can do all those cool things that your competition will be doing in the future.

You do not have to be an expert on Macintosh computers to use of a good digital workstation. The computer is only a means of getting the sound and designs you are looking for out of all those chips and cards inside the workstation. As faster DSPs are developed, you will not have to buy a new workstation or computer. Just buy new chips to put on your cards.

Also, why store audio on a RAM-based system, when technology has given us much safer and faster ways to store digital data?

If these arguments do not quite make sense to you, then ask some digital workstation dealers about Mac-based systems compared to systems that are not Mac-based.

Ask about obsolescence.

Is there really is a need for learning the intricacies of the Macintosh just to turn the computer on?

If you do not ask, you will not know.

Do not waste your money on some fancy hardware that appears to give you complete digital control, when, in essence, you are buying a 1994 box that will come and go quicker than AM stereo.

Look at all the digital workstations in the market before you make a decision. Look beyond the boxes that only do your analog work in the digital format. Digital workstation are a means to produce what you need. Determine how workstations will address those needs.

There is probably a workstation out there that is right for you. It will make your life easier and give your spots a greater creative edge.

It will give you instant access to all your sound files and data. (No more threading up tape and then waiting for it to rewind.)

It will allow you to change your mind about a spot, and start production over as many times as you wish.

Otherwise, maybe you could find a job working in an antique store that sells old analog tape recorders, sharp razor blades and splicing tape.

□□□

Brad Jones works for Interface Audio, Atlanta, and has been a professional audio engineer for more than 18 years. He is currently president of the Atlanta Society of Audio Professionals.

63 Years Ago

Reprinted from Radio World, April 18, 1931. Editor's note: The RW of old, printed for a time in the 1920s and 1930s and today's RW are unrelated except in name.

SYNCHRONIZED SENDING GIVES SOME TROUBLE

The synchronization experiments now being conducted by the National Broadcasting Company with stations WEAF and WJZ, New York; WBAL, Baltimore, and WTCI, Hartford, are successful in so far as the mechanical problems are concerned, and the stations have been completely synchronized, according to C. B. Jolliffe, chief engineer of the Radio Commission.

From the listeners' point of view, however, they have not been so successful, for there has been considerable interference and many complaints have been received by the commission, he added.

In certain areas synchronization has increased the fading, which at this time of the year is serious. The tests have proved that service area has been improved but that in some localities it has made conditions worse.

Near Baltimore there is an especially bad reception area at this time, Dr. Jolliffe said.

WJZ synchronizes with WBAL and WEAF with WTIC. This synchronization enables WBAL and WTIC to operate full time. Both these stations are assigned to 1,060 kc. channel on a time-sharing basis. Each station broadcasts on the 1,060 kc. wave during its allotted time, while the one not using the wave broadcasts on the wave of either WEAF or WJZ. Thus, when WTIC uses the 1,060 kc. wave, WBAL is synchronized with WJZ, using WJZ's wave and program, and when WBAL uses the 1,060 wave, WTIC broadcasts on the wave of WEAF, using WEAF'S program.

Okay, so your new FM processor finally arrives. You install it. But now, no matter what you do, or how you adjust it, you can't get it to sound better than your old processor. On some stuff, it actually sounds worse.

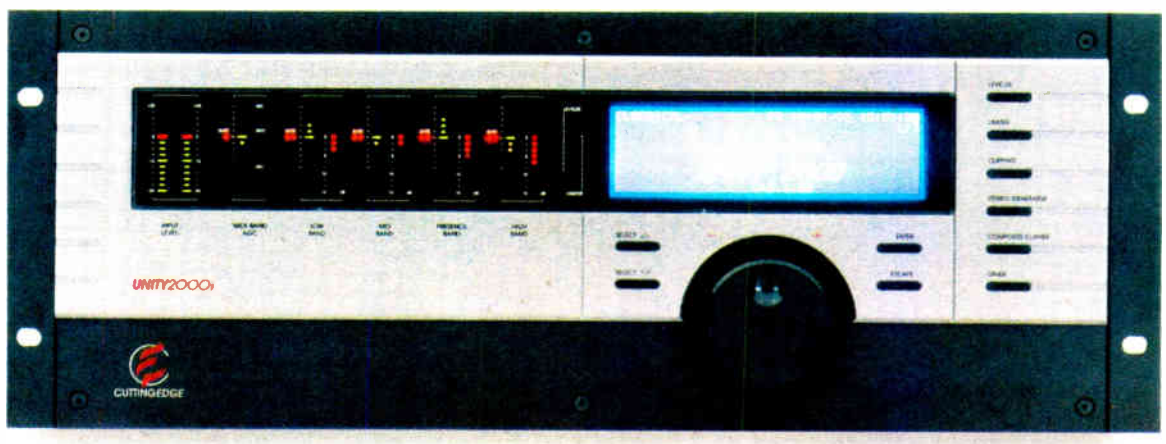
You Realize:

1. ***"All-digital" doesn't always mean better performance.***

2. ***There's more to a great processor than specs and reputation.***

3. ***It might be too late to get your money back.***

4. ***You should have purchased the Unity 2000i.***



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KEYBOARD CONNECTION

Program Upgrade Decisions Are Never Simple

by Barry Mishkind

TUCSON, Ariz. Sometimes it seems you barely get the shrink wrap off a box of software before the upgrade offers begin arriving in the mail. When should you make the move and buy the latest version?

Upgrading can be expensive. Software manufacturers expect you to own a "license" for each copy in use. If you have eight computers equipped with Word for Windows, Microsoft expects each computer to have its own registered copy of W4W, rather than one copy you've installed eight places.

As soon as you finish calculating the cost of making every computer in the house legal, you can take a look at those upgrade notices.

Sales pitch

If you buy a program and are happy with it, you do not need an upgrade. So software companies add new features to extend programs' capabilities. Upgrades generate income for software companies because they provide a steady stream of revenue from customers they have already sold.

The upgrade price is usually a fraction of the normal retail cost, and a good deal. On the other hand, I have several programs in my library that I have upgraded over the years. The total of the upgrade fees has actually exceeded the cost of the original programs.

A survey conducted by a major software company offered some very interesting insights on upgrades. As program version numbers increase, the number of features used by the average user decreases rapidly. The average user simply does not need the enhancements.

The bottom line, if a program does everything you need, keep it and be happy. I still use a DOS program from 1987 for quick editing. I run Word for Windows for more complex applications. If you find important regular tasks difficult with current programs, an upgrade may solve your problems.

As you consider which features you need, look at all the competing software manufacturers' products. Each continually leapfrogs over others with new features. Many of the mainstream programs now offer "competitive upgrades," a chance to upgrade from a competitor's program to theirs for a modest price.

Support

The 1990s have brought an increased emphasis on profits, and customer service has suffered in many industries. Computer software is no exception. Most major companies have abandoned toll-free help lines for service contracts or 900 numbers.

Most still offer at least 90 days of free service, but it is important to make decisions on software based on the expected level of help needed. If you need a lot of hand holding to install something, call the support number soon after purchase or service could be costly.

From time to time, I try to alert you to some books that will help explain various programs and help you get the most out of them. They are often written for those who do not get along well with the instruction manuals provided with the software.

Herbert Schildt (Osborne McGraw-Hill, 1994) has just written "Mostly Windows with Just Enough DOS", a friendly guide which helps users clearly understand the relationship between DOS and Windows.

If you decide to take advantage of the Quattro Pro 5 or Paradox 4.5 special prices mentioned earlier, check out the Special Editions of "Using Quattro Pro 5" or "Using Paradox" from Que Books. The "Using" series also includes "Using Word for Windows 6."

I cannot overemphasize the importance of filling out those upgrade registration cards. While you may never wish to upgrade, you may receive a pleasant surprise. Microsoft, for example, recently upgraded Word for Windows to Version 6.0a, sending a free upgrade to all registered users.

Speaking of recent updates, Symantec just released The Norton Utilities, Version 8. These excellent utilities have saved me from disaster many a time. NU 8 now fully supports Windows as well as DOS. The utilities analyze and fine tune your Windows setup, eliminating the need to exit to DOS to defragment your hard drive.

Other enhancements include "interrupt conflict" testing, which can help solve problems when new add-in boards are installed. NU 8 also has full support for hard drive compression like Doublespace and Stacker.

The newly upgraded Microsoft Mouse has an improved ergonomic design to fit your hand much more comfortably. The new Mouse Manager has features to speed up your work. The mouse cursor can be set to "snap" to the closest default button or to immediately jump to the middle of the screen.

□ □ □

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

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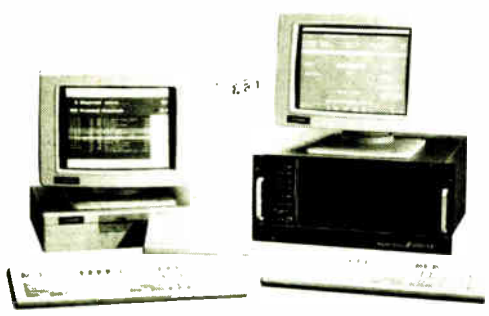

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STATION SKETCHES

Avoid Power Tubes' Early Demise

by Tom Vernon

HARRISBURG, Pa. The death of a power tube is the point when cathode emission drops to the point that licensed power can no longer be maintained, or, in the case of AM modulators, 100 percent modulation is no longer possible.

In practical terms, the transmitter's filament voltage serves as a very linear power output control. As the tube fails, PA efficiency drops and the transmitter is unable to modulate to 100 percent.

Headroom check

There are two types of electron emitters used in modern power tubes: thoriated tungsten and oxide cathodes. Typically, oxide cathodes are associated with lower power tubes, so in this discussion on transmitter tubes, the focus is on thoriated tungsten emitters.

You may want to begin by checking how much headroom exists with the tubes in your particular application. If you can only make rated power or peak modulation with the filaments operated at nominal voltage, such as with transmitters that operate at increased power to compensate for phasor loss, life extension programs are probably not an option.

If you can operate below nominal filament voltage and still maintain good output/distortion figures, read on.

The requisite materials needed include tube data sheets and test equipment. Tube information can usually be obtained from the tube or transmitter manufacturer. Data sheets for older tubes such as 813s, 845s and 357s may be harder to find.

Seasoning tips

The most important piece of test equipment is a true RMS voltmeter having an accuracy of at least one percent. Remember that this definition excludes older calibrated RMS meters that do not have the required precision.

AM stations will need a distortion meter, oscilloscope and thermocouple RF ammeter. FM stations can use the output meter built in their FM transmitters to observe power output.

Brand new tubes must first be seasoned by operating with filament voltage only for about an hour. This allows the getter to heat up enough to remove any impurities in the vacuum. If this procedure is not followed, gas in the tube may cause flashover when high voltage is applied, and damage associated circuitry.

FMs should use this opportunity to check the grid current meter and look for internal grid shorts. Most transmitters have bias voltage applied while the filament is on. If this is the case, the meter should read zero with no RF applied.

Next, turn on the plate voltage and operate

continued on page 61 ▶

Excellent News For '2 Live Al'

FROM THE TRENCHES

by Alan Peterson

Dear Luci,

I'm happy to report I have a new friend, the U.S. Supreme Court. Its recent ruling on 2 Live Crew's parody case guarantees I'll be able to keep my job at least one more ratings period.

The case is actually quite fascinating. Parody writers can enjoy "fair use" of an originally copyrighted piece, as long as the message or meaning of the piece is substantially unlike the original, and the parody doesn't ruin the original holder's ability to sell the song for performance or recording.

This is good news for production people, morning shows and comedy services all over the country. It means I won't get in trouble for messing with Robin Gibb's "Boys Do Fall in Love" ("Where Is Michael's Glove?" on my super-reel) and Enya's "Orinoco Flow" ("All This #$%@& Snow").

This issue has caused trouble before. Rick Dees of KIIS-FM Los Angeles caught an earful several years back with a Johnny Mathis parody called "When Sunny Sniffs Glue," which I thought was uproariously funny. Mr. Mathis's people thought otherwise and raised a rhubarb. Dees won that one, but when I asked him for a comment on the court's decision, his people politely declined.

WHTZ(FM) New York's Prodo King, Dave Foxx, says that when his station does a parody, it's "generally with the artist, or in an artist-friendly fashion." With all the record companies right within earshot of WHTZ's signal, it's a safe bet to take. The original artist of a popular song often gets a kick out of singing a rewrite of his latest moneymaker. Check any Weird Al Yankovic album. Most of his "victims" couldn't wait to hear what he came up with.

I'm wondering how this will shake out at the station level. My big fear is that creative directors will use the ruling to declare open season on all popular songs to be rewritten as commercial beds for Ed's Hardware.

They had better not do that. Commercial use of any copyrighted music is verboten unless the owner is paid for use of the song. I had to look that up two years ago when a supermarket chain in New England was considering "Sea Cruise" as a commercial jingle. They ditched the idea when they heard it would cost them $500 for a three-month license.

What a surprise to find out a station's ASCAP or BMI licensing only covers performance of a song and not unlimited use of snippets wherever and whenever one feels like it.

Another interesting question is whether the Supreme Court ruling affects how samples of songs might be woven into new compositions. The best policy here still appears to be, as the ads in the music magazines say, "credit and compensate your sources."

If you lift the harmonica riff from "Love Me Do," the guitar passage from "Turn, Turn, Turn" and try to lay them over the drum track to "Beat It" with vocals flown in from "I'm Not in Love," you'll be hard-pressed to call the end result a parody. (You also may be hard-pressed to actually listen to it.)

The real winners of the Supreme Court decision aren't just 2 Live Crew, but, as I said earlier, comedy services. They can still send out goofy song knock-offs with their weekly packages. Morning shows can still get people to call up and sing the bawdy version of the "Popeye" theme, and I still get to fire up my MIDI machinery and crank out thoroughly lame ditties for our AM and PM drive shows, all with the approval (or at least tolerance) of good ol' Uncle Sam.

Incidentally, stroll to the library and look up the lives of Cole Porter and John Philip Sousa the next time you get a chance. Both were prolific and hugely successful composers who were quite fond of parodying their own melodies. Sousa did it to entertain children, and Porter to entertain his friends and acquaintances. (Porter's parody of "You're the Top" is especially raw.)

Spring is here and the sun is back out. The Supreme Court decision makes it clear there is nothing new under it. It's time to put away my tax season song parodies and get to work on the summer stuff.

—Al

□□□

Got a song parody you're just bustin' to play? Send Al Peterson a copy at WNNK(FM), 3400 N. Sixth St., Harrisburg, PA 17110. He's got some real gems for you in return on his own tape. No, he won't turn you in.

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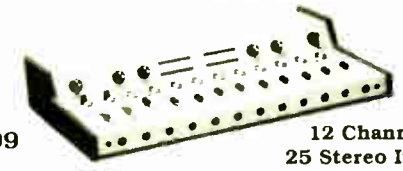

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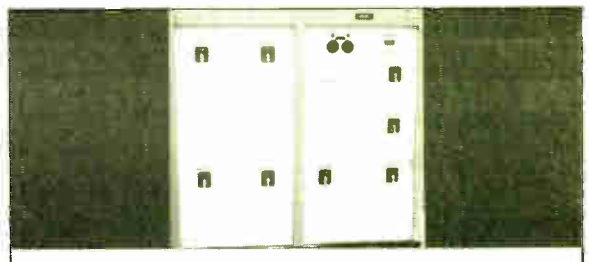

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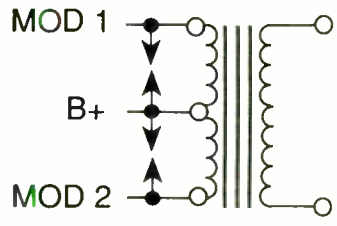
Extending Tubes' Lives

▶ continued from page 59

the stage at 50 percent of normal plate current for about 15 minutes, and check for stable operation. Once this procedure is complete, operate at full power.

Figure 1.



When a modulation transformer loses its safety gaps, it fails to dissipate transient energy that might cause damage.

AM transmitters should simply operate at full filament voltage for about an hour.

With either AM or FM, continue to operate at full rated filament voltage for about 200 hours. This is when contaminates are most prevalent, and at full filament voltage, the getter will do a good job of removing them.

During the first 200 hours of operation, filament emission will actually increase. Begin measurements after this emission has stabilized. Note that this initial period of seasoning new power tubes with filament voltage only is important even if you're not running a life extension program.

Maximizing tube life requires maintaining filament operating temperatures within close tolerances. This temperature is directly related to the total RMS power applied to the filament, which is best illustrated by the fact that a three percent increase in filament voltage will cause a 20 degree K increase in temperature. This in turn causes a 20 percent increase in peak emission, and a 50 percent reduction in tube life.

Filament voltage must be maintained within a very narrow window, and it must be possible to adjust this voltage in 0.1 volt increments.

Overvoltage can lower efficiency, increase the electric bill and, in extreme cases, damage the grid structure. Undervoltage can be equally disastrous. When the filament operates at a cold temperatures, it acts as a getter and attracts contaminates. Once these contaminates are attached to the filament, that area will boil off electrons, and the overall emission drops.

★ ★ ★

Thanks to all of you who phoned with comments or questions on my articles about troubleshooting modulators. Many of you had common concerns, and I thought I would share some of them here.

Modulation transformers need to have spark gaps across their primaries, as shown in Figure 1. These gaps are often lost over the years, or are not adjusted properly. They function to protect the transformer, reactor and PA tubes from transients.

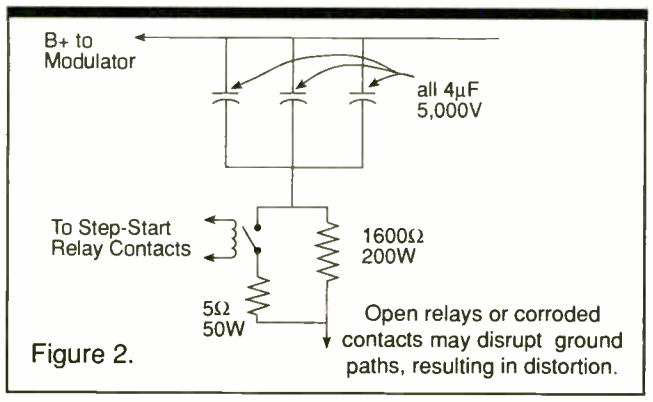


Figure 2.

Gaps should be kept clean, and adjusted to arc just beyond your highest level of modulation. Spacing varies as a function of altitude and humidity, but 1/16 of an inch would be a good place to start with 5 kW transmitters.

Seemingly unsolvable problems with modulator distortion are often traced to trouble in the step-start relays, which are meant to protect the transmitter from high in-rush currents when the plate voltage is first applied. They do this by allowing large current-limiting resistors to be in series with HV components in the circuit for about three seconds, then shorting them out.

If the contacts on these relays are dirty, or they fail to close after three seconds, they may interrupt the audio ground path for the modulator or audio deck, or disrupt it in other ways.

There is no standard step start circuit; variations exist between manufacturers. Figure 2 is typical, however. You may have to do some serious signal tracing on the large schematic for your transmitter to find these relays and their associated resistors, as they often are drawn far from the modulator.

□ □ □

Tom Vernon divides his time between consulting and completion of a Ph.D. He is occasionally sighted at WXPN(FM) Philadelphia. Call him at 717-367-5595.

NAMM Show a Hotbed Of Production Gear

▶ continued from page 34

Akai DR4d recorder. Vestrax packs more functions into the box than Akai. It's quite similar in concept to the popular cassette-based multitrack recorder/mixers that are the mainstays of home studios and small production rooms.

I love it when a great toy turns out to have a practical application, and TuneBuilder from AirWorks Media is such a product. TuneBuilder is a combination of computer software and licensed production music massaged by the program's author. The audio has been digitized and the (approximately 30 second) music clips have been indexed so as to identify all the musically-workable edit points within each sound file.

Effects gadgets

Alesis, now legendary in the music trade show business for announcing products in advance, has announced an update to one of the most popular multi-effects processors. The Quadraverb 2 is a two channel, eight-processor multi-effect unit with fully flexible internal routing.

Downsizing is a popular buzzword these days, and Digitech has been doing some. The new TSR-12 is a multi-effects processor with all the effects in their TSR-24, but the algorithms are not user programmable.

Sony's HR-GP5 and HR-MP5 effects boxes are half-rack sized units with a list price of $700, almost identical in appearance, with the GP5 being targeted to the guitarist, and the MP5 being a general purpose multi-effects unit.

The Lexicon JamMan is an interesting tool if you're into creating rhythmic music bits by looping sounds. The best way to think of this box is as a self-triggering sound-on-sound recorder with an eight second (expandable to 32 second) loop time.

□ □ □

Mike Rivers operates the Washington MIDI Users Group BBS (703-532-7860). He can be reached on line through the MIDILink Network, or via Internet at mrivers@d-and-d.com.

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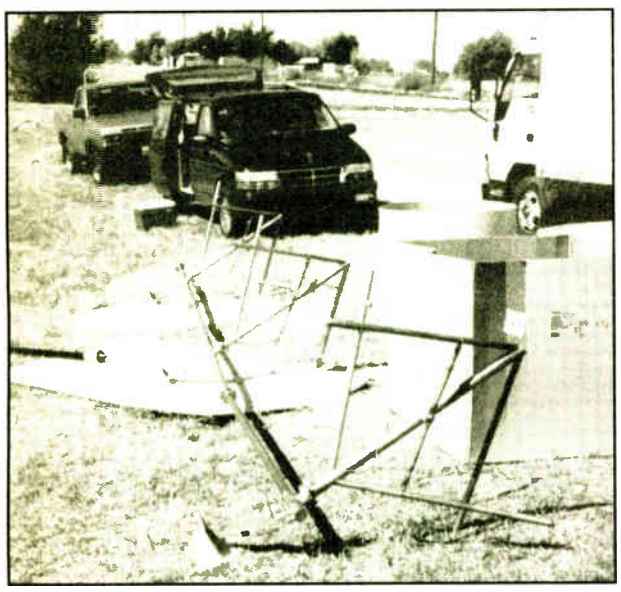
USER REPORT

Jampro Antennas Integral to BBN Network

by Leo T. Galletta
Network Operations Manager
Bible Broadcasting Network Inc.

CHARLOTTE, N.C. In the last quarter of 1993, the Bible Broadcasting Network (BBN) engineering crew built two new FM facilities and made major renovations to a third. In each project, **Jampro** antennas



The Jampro antenna is ready for mounting on the tower in Lubbock, Texas.

made our work easier, gave us a top quality signal and saved us money.

The quality and durability of these arrays were evident during our renovation of WHVT(FM) in Clyde, Ohio. This class A in north-central Ohio needed its entire transmission system replaced. As WHVT is a BBN affiliate, we provided the labor they needed and some equipment we had on hand.

Antenna refit

We had a JSCP Penetrator five-bay antenna stored in our warehouse that we originally purchased in 1985 for WYFB(FM), our 50 kW facility in Gainesville, Fla. The antenna had been through one transmission line move in 1987, and was eventually removed from service after WYFB upgraded to a 100 kW directional array two years later.

Because both stations broadcast at 90.5 MHz, we called Jampro to ask about reducing the five-bay array to three bays for use with WHVT. Jampro provided us with all the information we needed to make the change. They pulled the file on the antenna and went to work.

I really appreciate the way Al Jason, Jim Oliver, Eric Dye and the whole Jampro staff responded to our needs. And especially how they never laugh when we ask harebrained "what if" questions.

The matching section required modifications to insure 50-ohm impedance. This was done by replacing the tuning sleeve in the bottom section of feed line. We did this in the field with our torch set; it was fairly easy to remove and destroy the original sleeve since the JSCP has 3-1/8-inch feed lines. After a little clean up, the new section Jampro provided was installed and resoldered.

Ron Muffley, head of our network engineering department, Jerry Kuhn, a BBN staff engineer, and I then went to work reassembling the array. We took the precaution of installing new bullets, "O" rings, and a pop-off valve.

Easy installation

These Jampros antennas really go together well. The feed line and bay flanges are stamped with matching numbers, eliminating the chance of a mix-up. In about an hour, it was assembled and ready for the tower crew to hoist into position.

We purged the system with about 1,000 psi of nitrogen and then, due to the modification, tested it out with an IFR service monitor to insure that the impedance matching was correct. No measurable mismatch was evident.

All eyes were on the reverse power meter when we put the transmitter on line. True to form, the VSWR was almost flat, and we thanked the Lord for another good antenna installation.

Because we were unable to use radomes on this unit, we were a bit apprehensive about how it would react to snow and ice. We have heard that when used without radomes or deicers, the Jampros are a little more sensitive to ice than heavier "roto-tiller" type antennas. So far we have only seen higher reflected VSWR in heavy ice conditions, which is expected.

Our other two projects were in Texas. We put new facilities on line in Lubbock and Amarillo. Since these places were so far away from our headquarters in North Carolina, we decided to build both stations on the same trip.

Numerous listeners reported a much improved reception in all directions.

Both stations are educational FMs: KYFT(FM), 5 kW in Lubbock, and KYFA(FM), 2.25 kW in Amarillo. For each installation, we selected the Jampro JMPC model. This medium power array has an input rating of 10 kW and uses a 1-5/8-inch feed line. We went with three bays in Lubbock, driven by a QEI 5 kW transmitter, and in Amarillo two bays with a 3.5 kW transmitter.

Minimum load

As we were leasing tower space at both locations, we wanted to keep the loading to a minimum. The antennas weighed in at approximately 100 pounds and 150 pounds respectively, well within our weight limits.

Again, Jampro provided excellent support. The antennas arrived on time and in very good condition. They ship the feed lines and mounting hardware in wooden crates and the bays in wood reinforced, heavy duty cardboard boxes.

Easy installation

At both locations, BBN staff assembled the antennas and had them ready for hoisting before the tower crew was finished with the rigging. The antennas mounted easily to the tower leg using 5/16-inch stainless steel U-bolts.

Some manufacturers require—and others suggest—using anti-rotation supports for leg mounted configurations. This is probably not a bad idea, but we never have used them with our Jampros and never have experienced any rotation problems. This includes a JSCP three-bay array near Charleston, S.C., that survived Hurricane Hugo.

Once again the ratios looked very good, less than 1.1:1 at each facility. Both also are holding good pressure at about 3 psi.

But the real proof is in the performance of the antennas. After a drive around each city, we were all very pleased with the coverage. These little work horses are doing a really fine job.

BBN owns and operates 24 stations and has five affiliates, and our experience has found the skewed V dipole element used by the Jampro Penetrator to provide better "real-world" propagation and fill characteristics than loop or ring type radiators. The difference is most evident in the fringe to far-fringe areas.

continued on page 65 ▶

There are many reasons for choosing AEQ products. Here are just a few.

Control and Flexibility in your Remote Event Transmission

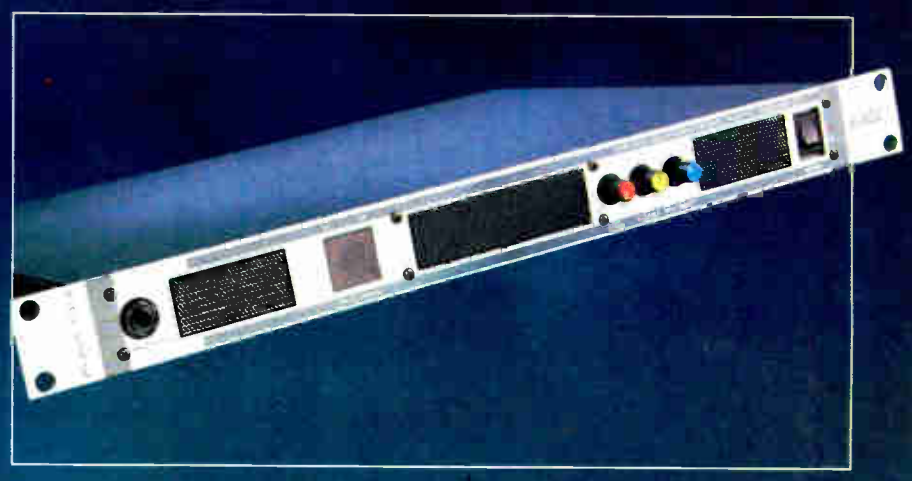
The AEQ Portable Mixer MP-10

- Ideal for remote event transmission.
- Easy to install and operate.
- Provides portability and autonomy.
- Carrying case included.

Special features:

- Five transformer balanced inputs selectable Mic / Line.
- Front panel input controls.
- Capable of linking mixers together to increase number of inputs.
- Transformer balanced outputs.
- Internal Ni-Cd rechargeable batteries provides 4 hour autonomy.
- Automatic switch to battery if power fails.
- Dialing keypad, dual mode Tone / Pulse.
- Three headphone output jacks.

Stereo Quality Monitoring at Mono Price



The AEQ AM-03 Stereo Audio Monitor

- Designed to meet the monitoring needs of technicians working in VTR rooms. OB vans, radio and TV controls, etc.
- All the controls are in the front panel to facilitate easy and accurate operation:

  Input selector (three selectable stereo inputs).
  Output channel selector and balance.
  Gain control and power switch.

Features:

- Three way audio system (mono for low and stereo for mid and high frequencies), consisting in five speakers. All contained in one unit 19" rack space.
- Electronically balanced inputs and output, with XLR connectors.
- Incorporated limiter for speakers protection.
- Audio phase meter.
- Headphones connector with automatic speakers disconnection.

The Ideal Combination

Digital Telephone Hybrid AEQ TH-02 EX

- Frequency Extender Mode as standard feature.
- Works with one or two telephone lines.
- The second line provides full Multiconference Mode. The operator and two callers can talk and listen to each other simultaneously.
- Hybrid null of 60 dB's.
- No adjustment required.
- Ideal companion to work with AEQ Portable Digital Line Extender TLE-02.

Portable Digital Line Extender AEQ TLE-02

- On Air phone call with audio presence, depth and clarity of voice. No "telephone sound".
- Easy to use. Designed for the non-technical user.
- Ideal for field reporters, totally portable. Light weight: 3.3 Lb.
- Great operation autonomy, using 8 AA batteries.
- Dialing pad in front panel, and Pulse / Tone selectable.
- Independent level control of Mic / Line input, auxiliary input and headphones.

Value & Peformance

AEQ Mixing Console BC-500

- The AEQ Mixing Console BC-500 is designed for those radio stations seeking great audio quality at a competitive price. Its designers paid great attention to the control layout: the logical control design ensures a quick learning period as well as a trouble free operation.
- Advanced true modular design allows total flexibility. The module chassis has built-in meters and speakers and comes in a standard configuration with the following capabilities:

- Six dual stereo inputs.
- Four mono inputs Mic / Line selectable.
- One Telephone Hybrid interface.
- Studio control Intercom monitor.
- One main stereo output plus mono sum output.
- Power supply for On Air signaling.
- The AEQ BC-500 comes with 4 blank modules to enhance this configuration.

AEQ

AEQ AMERICA, Inc.: 2211 South 48th Street, Suite H - Tempe, AZ USA 85282
Phone: 1 (602) 431 0334 - Fax: 1 (602) 431 0497

Circle (63) On Reader Service Card

USER REPORT

LDL Master Antenna and RF Combiner Serve Eight Stations

by George H. Werl Jr.
President
Commsulting Inc.

SUNFISH LAKE, Minn. Many FM broadcasters have trouble finding suitable tower space when they need to upgrade their transmission facilities. The problem becomes especially difficult when the number of stations looking to increase height and power exceeds the number of tall towers available to hold all of the antennas.

This was the case in Minneapolis-St. Paul, Minn., a few years ago. Eventually, eight class C FM stations joined forces and leased enough space on an existing tall tower for a single antenna. The Shoreview FM Project was born.

Interesting features

The stations selected **Alan Dick & Co. Ltd.** (ADC) to supply the master antenna and RF combiner system for the project. ADC, based in Cheltenham, England, is represented in the U.S. by its sister company, the Maryland-based **LDL Communications Inc.** Both companies are members of the LeBlanc Group of companies.

The ADC F88-108C12.3SP260ND2 antenna selected for the project is a 12-bay, three-around Spearhead panel antenna designed to operate over the entire FM band. However, it includes some rather interesting design features that are especially valuable for multi-station facilities.

The ADC 12-bay antenna is actually two stacked six-bay antennas fed in phase by separate transmission lines. Via a patch panel in the transmitter building, the entire antenna system can either be fed at full power, or the upper or lower half of the antenna system can be fed independently at half power.

We usually reach the limits of the test equipment long before we see any system intermodulation products.

Because the Shoreview FM Group represents almost two-thirds of the FM stations licensed to Minneapolis-St. Paul, this "built-in backup antenna" is certainly a nice feature to have. It was especially useful in January 1993, when lightning damaged the upper half of the antenna. After patching around the problem, the stations simply operated on the lower half of the antenna until the repairs were complete.

For the eight class C FM stations, the normal combined transmitter power is about 125 kW. At this power level, monitoring the antenna system's VSWR and general health is critical. Typical transmitter VSWR protection circuitry is inadequate for this task for several reasons, not the least of which is the inability of the transmitters to properly sense small antenna VSWR changes through the combiner and more than 1,000 feet of feedline.

Novel approach

The ADC antenna, however, provides a novel approach to solving this problem. A four-port hybrid is used at the input of each half of the antenna, with the two output ports providing the necessary quadrature feeds for circular polarization. The fourth port is fed back through a small heliax to reject loads located at ground level where the reject power is continuously monitored. This way, any problem or imbalance in the power distribution at the antenna input is immediately detected by an increase in the reject power.

After using the system during several Minnesota winters, I have found that small antenna changes, for example, due to icing, show up in the reject load sample long before the system VSWR changes. Generally, the combined eight station system VSWR measured at the feedlines to the antenna is 1.01:1 or better.

Of course, in any multiple FM installation, combining the individual stations while maintaining passband filter response, group delay and FCC requirements on intermodulation products is of primary importance.

ADC also provided our combiner, an eight station constant impedance bandpass design. We periodically run intermodulation product measurements on the system with equipment that measures better than 110 dB below the station carriers. We usually reach the limits of the test equipment long before we see any system intermodulation products.

We also use a computer-based monitoring/protection system supplied by LDL Communications. This computer system interfaces with the antenna and combiner to monitor individual station and system power flows, feedline gas pressure and a few other things including incoming three phase building power.

Valued computer

The computer monitors all parameters three times per second, calculates VSWRs and has the ability to take intelligent action, either by reducing transmitter output power or shutting transmitters down completely to protect system components from further damage.

The value of the computer in taking fast action was demonstrated by a lightning strike in January 1993. Damage to the antenna and combiner was limited to a single antenna component.

ADC has been very good in responding to repair and maintenance concerns, both people and parts have always been available when needed. What has given myself and ADC fits, however, is the U.S. Customs Service. Customs routinely has taken up to a week to process test equipment or parts coming to Minnesota from England through the Minneapolis-St. Paul airport.

The Shoreview FM Group specified lots of redundancy in the design of the antenna installation so, fortunately, customs delays have not resulted in lost airtime for any of the stations. Another caveat, when purchasing from any overseas vendor, be sure to invest in a set of metric tools.

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For information from LDL Communications, contact Jim Wilson in Maryland at 301-498-2200; fax: 301-498-7952; or circle **Reader Service 113.**

USER REPORT

LBA Unipole Scales the Mountains

by John Sidote
Chief Engineer
WELC-AM-FM

WELCH, W.Va. In 1989, when WELC(AM) began preparations to place its FM station on the air, we looked for the best way to co-locate an FM antenna on our AM tower—a 220-foot single tower non-directional system.

During these preparations, I attended our state broadcasters meeting where a group of engineers had organized an engineering session.

At that meeting a representative from **LBA Technologies**, based in Greenville, N.C., conducted a session on the unipole antenna system. During a break in the session, conversations with other engineers convinced me that an isocoupler would not be to WELC's best advantage.

Mountain state

To say the least, the terrain in West Virginia is not the best in the world for radio broadcasting, and the ground conductivity is probably one of the poorest. Our tower sits about 550 feet above our studios, on the top of one of West Virginia's many mountains. The only way to reach the site is by climbing up on foot.

The transmitter is housed at our studios and is connected to the tower by approximately 562 feet of transmission line. Our antenna grounding system was replaced a few years ago and is still in very good condition.

With all of these facts in mind, we decided to give the unipole a try.

We had several discussions with LBA Technologies before placing our order and making the initial preparations. These were necessary because the installation required us to go off the air for a time.

The unipole antenna arrived by truck in plenty of time. And the FM antenna installation was completed the day before the unipole installation took place.

LBA's engineer was very helpful in instructing the tower company how to assemble the system once we were ready to install it. The tower company used a winch system to get all of the necessary parts and equipment up the mountain to the tower.

Installation

We informed our listeners of what we were doing, and at 9 a.m. we signed off WELC(AM) to begin the installation.

Although LBA offered an antenna coupling unit designed to work with its system, we decided to keep our seven-year-old Harris coupling unit. The only modification it required was the change of one capacitor.

We then removed the tower lighting choke and also a static drain choke, and grounded the tower across the base insulator.

The actual installation took approximately four hours, and LBA's engineer tuned the unit in about two hours. Again, the tower company played an important role by making the necessary adjustment of the shorting ring on the tower to assure optimum impedance. In our case, it need to be located approximately two-thirds of the way up the tower.

By 4 p.m., WELC(AM) was back on-air at its full power of 5 kW. We use a Harris MW5-A and noticed an immediate improvement in transmitter efficiency and an apparent decrease in reflected power.

LBA Technologies even prepared the necessary paperwork for the FCC and for our files.

The antenna system has been in operation since October 1989 and has worked extremely well.

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For information from LBA, contact Brooke Norris in North Carolina at 919-757-0279; fax: 919-752-9155; or circle **Reader Service 74.**

BBN Network Uses Jampro

▶ continued from page 62

This was obvious in our Ohio project where we replaced that type of antenna with a Jampro. Numerous listeners reported a much improved reception in all directions, even up to 40 miles away. Not bad for 3 kW at 47 meters (154 feet AGL).

The Texas installations bring to 16 the total number of antennas BBN has purchased from Jampro and its predecessor, Cetec. Five of these are directional, and we can verify with our Potomac Instruments FIM-71 field intensity meter that these antennas cover the contours.

As this article is being written, six bays of a 12-bay array we purchased in 1978 are being refitted at the Jampro plant as an eight-bay for use at our newest station in Ogden, Utah.

Jampro antennas are rugged, built to last, easy to work with, and economical. We have used them across the country and in all types of terrains. Over the years we have found them to be an excellent investment.

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For information from Jampro, contact Marlene Young in California at 916-383-1177; fax: 916-383-1182; or circle **Reader Service 35.**

USER REPORT

LPB Adds Sounds to Holiday Sights

by G.K. Hale III
Vice President
Long Communications Group

WINSTON-SALEM, N.C. Tanglewood shines, and now it sounds great too. Tanglewood Park, in Clemmons, N.C., installed a new radio broadcast system to enhance its Christmas Festival of Lights. The Tanglewood Festival of Lights spreads 500,000 lights in some 45 groupings over 1,200 acres. With all of this, the people at Tanglewood wanted more, something to really set them apart.

They came to Long Communications Group of Winston-Salem, N.C., to design and install an audio system to provide music along with the great visuals. Long Communications looked into several types of systems, but decided to go with an AM radio radiating coaxial cable system. The broadcast system was deemed to be the best for several reasons:

- People, due to the cold, would be driving through the park with their windows closed.
- Car radios provide good quality sound and the sound level can be adjusted in each car to individual tastes.
- The system could be permanently installed and used throughout the year for other types of information dissemination.
- The radiating cable system is, by far, the least expensive type of system that would give good quality sound.

Long Communications chose **LPB Inc.** to provide the major components. LPB clients include Walt Disney World, Epcot Center, Opryland and Great Adventure theme parks, and they are familiar with large area radiating cable system design. The Tanglewood system consists of one main LPB transmitter and 13 LBP linear amplifiers servicing 4.4 miles of LPB's radiating coaxial cable. Audio input to the transmitter is from a double automatic-reversing cassette deck.

Long Communications built weatherproof, forced-air cooled cabinets to house the linear amplifiers and LBP provided the waterproof terminations and splitters. Tanglewood personnel buried the radiating cable, and at the 23 locations where the cable ran under pavement, PVC pipe was put in and the cable pulled through.

Tanglewood installed a lighted sign at the park entrance instructing visitors to tune their radios to AM 530. The system now runs 24 hours a day, all year round, providing music and information to park visitors.

We have received many compliments on the sound quality of this system, and I am pleased with the results of the LPB system.

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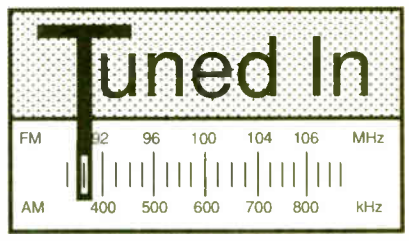
For information from LPB, contact John Devecka in Pennsylvania at 610-644-1123; fax: 610-644-8651; or circle **Reader Service 179.**



People, Promotions and Appointments

Bob Groome joined **Arrakis Systems** as senior technical sales. He specializes in the application and sales of Arrakis digital products.

Harris Allied tapped **Frank Grundstein** and **Carl W. Davis Jr.** as radio field sales representatives.

Dennis Ianiro was named account executive in the Los Angeles offices of **CBS Hispanic Radio Network**.

Digital Cable Radio (DCR) welcomed several people to staff. **Donna Brydges** filled a newly created position as associate acquisition manager. Also, in the newly created manager of retention marketing position is **John Nicholas**.

Company News

Comtech Antenna Systems Inc. released additional satellite antenna systems for Geostationary Operational Environmental Satellite (GOES) reception in Canada.

International Tapetronics Corp. (ITC) reached an agreement with **EZ Digital** to become the exclusive distributor of the Executive, Production and On-Air software modules. ITC will integrate these products into their DigiCenter 33-175 system.

On March 28, **Symetrix** moved to a new, 30,000-square-foot facility in Lynnwood, Wash. The new address is 14926 35th Avenue West, Lynnwood, WA 98037-2303; telephone: 206-787-3222; fax: 206-787-3211.

USER REPORT

Cortana Crow's Nest Shields Against Lightning

by Eliot A. Keller
General Manager
KRNA(FM)

IOWA CITY, Iowa In 1988 and 1989, KRNA(FM) suffered major lightning damage to its FM broadcast antenna, as well as to its strobe obstruction lighting system on its Williamsburg, Iowa, tower, located 19 miles west of Iowa City.

So in 1991, while we were making plans to construct a new, state-of-the-art transmitter site to go along with our frequency change (from 93.9 MHz to 94.1 MHz), lightning protection and grounding were important considerations.

In the end, we found the **Cortana** Crow's Nest to be the lightning protection system best suited to our installation.

Ultimate site

We were committed to building the ultimate transmitter site, within the limits of our budget. And we really wanted to do it right.

As we spoke with various vendors and users in the industry, our plans came together.

Our old tower was a 600-foot PiRod. The new tower is a Utility tower with E.R.I. Lambda sections at the top to support the Harris/E.R.I. antenna. The Lambda sections are "stealth"-designed not to interact at our 94.1 MHz frequency. The new tower is 954 feet above ground, more than half again taller than our old tower.

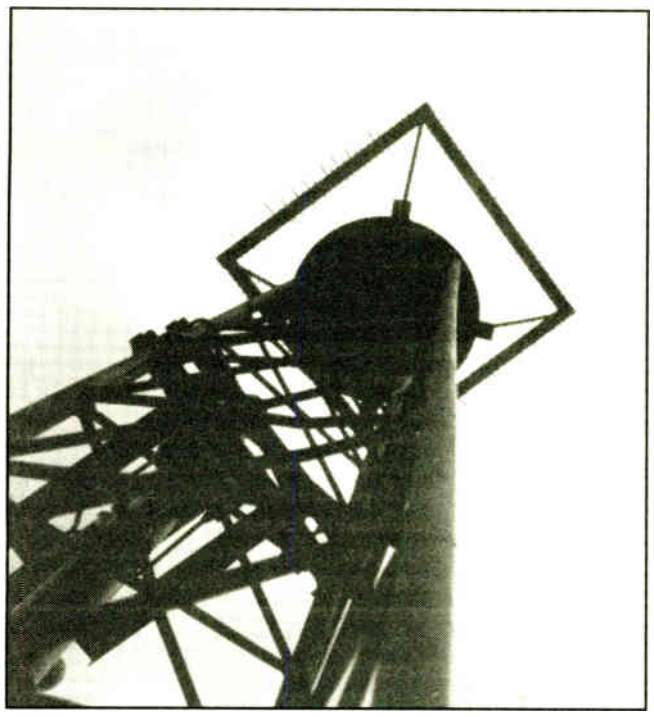
Also, we wanted to be as digital as possible to have the best possible audio and RF.

We chose the Harris digital FM exciter along with the Harris 35K transmitter. We actually were the beta test site for the Harris Digit™ next generation digital exciter (**RW** Nov. 23, 1993).

We chose the Optimod 8200 digital processor and the Moseley DSP6000 digital encoder/decoder. For our digital STL path we chose the PCL 6020 studio-transmitter link system.

We were assembling a state-of-the-art system, and we did not want to suffer the sort of lightning damage that hit our old tower site just six miles southwest of the new one.

So we continued our research and talked to more folks in the industry.



The Cortana Crow's Nest helps protect KRNA from lightning strikes.

We knew we needed a good grounding system. Each guy wire anchor point is tied to the central grounding point at the base of the tower. The central grounding point was a rechargeable, chemically activated grounding electrode.

Single entry

We tried to implement a single entry point for grounding of coax and obstruction light electrical power. We installed a surge suppressor on the incoming electrical power.

An Ufer grounding system—bonding concrete reinforcing rods (rebar) together, making them part of the grounding system—was considered; however, concerns about possible stress fractures caused by the possible expansion and contraction of the reinforcing rods when "energized" by lightning or electrostatic discharges ruled out the Ufer system. It just was not for KRNA.

The logical enhancement to the grounding system was some sort of lightning device. We narrowed the search to the ball, the bottle brush or the Cortana Crow's Nest.

Early in the process, concerns about wind-loading and ice loading ruled out an umbrella approach.

Dave Stockmar at Cortana was very helpful and responsive in answering our many questions about the Crow's Nest.

Successful record

Ultimately, we settled on the Crow's Nest. It had a successful track record elsewhere. It had less than 1 square foot of wind-loading, and even when coated with ice, the additional wind and ice loading would not present an object that required additional structural considerations. Other devices appeared to present greater wind and ice loading challenges. The Crow's Nest also seemed to be a good value for the money.

We live in Iowa, which is in the Midwest. We get ice. Ice is a factor that demands consideration, especially when constructing a 954-foot tall tower in our area.

The tower company crew installed the Cortana Crow's Nest above the Lambda sections, around the Flash Technology aviation obstruction light strobe. The crew reported relatively easy final assembly and installation.

The photo at left, taken by Doty-Moore Tower Service during the tower completion inspection, shows how the Crow's Nest fits at the top of the tower and allows full visibility of the obstruction top-marking strobe.

The combination of the Crow's Nest and a well-designed and well-installed grounding system appear to have done the job for KRNA. Numerous thunderstorms have passed through Iowa since the Crow's Nest was installed, including 1993—the year of all the rain and flooding in the Midwest. Storms were a nearly constant part of our life last June and July.

Despite the weather, we have not had any damage attributable to lightning in the two and a half years of operation from our new site.

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For information from Cortana, contact David Stockmar in New Mexico at 505-325-5337; fax: 505-326-2337; or circle **Reader Service 158.**

MARKETPLACE

Recently Introduced Products for the Radio Broadcast Professional

Studio in a Box

Fast Trac II from Henry Engineering is a comprehensive audio production system ideally suited for a wide range of broadcast and professional audio applications.

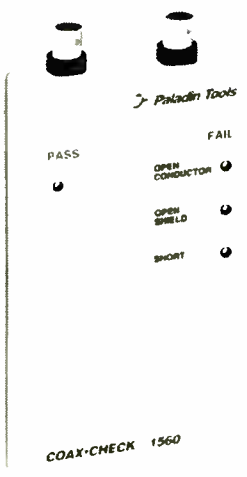
It functions as a stereo switcher, audio mixer, utility dubbing center, voice-over recording system, compact production facility or as the "control head" of a multitrack digital editing workstation.

Fast Trac II incorporates all the functions of a typical audio mixing console: input selection, level and balance control, mic-over-line mixing and complete monitoring. Additional features make the Fast Trac II perfect for specialized broadcast production tasks.

For information, contact Hank Landsberg in California at 818-355-3565; fax: 818-355-0077; or circle **Reader Service 87.**

Coaxial Cable Tester

Weidmüller Inc. Paladin Tools offers the Coax-Check 1560, an instrument designed to provide a simple pass-or-fail analysis for RG58, 59, 62 coaxial BNC type cables.



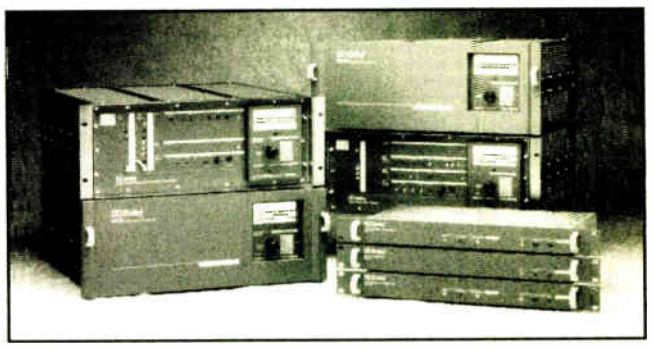
Coax-check test the continuity of both the conductor and braided shield. In addition, it identifies shorts resulting from contact between the conductor and shield.

A pass diagnosis is indicated by a green LED and failure is noted by a group of red LEDs indicating the problem.

For information, contact Weidmüller in California at 800-272-8665; fax: 800-272-5257; or circle **Reader Service 135.**

Four-Channel Digital STL

A four-channel version of Dolby's DSTL digital studio-to-transmitter link received FCC approval and is available. Based on the two-channel DSTL system, the new four-channel version allows broadcasters to take advantage of recent LMA/duopoly rules changes.



The DP5503 and DP5504 transmitter and receiver convey four program channels and two RS-232 data channels in an occupied bandwidth of only 400 kHz.

The system's spectrum efficiency allows it to coexist with FM STLs of DSTL systems on adjacent channels. The four-channel DSTL system uses Dolby AC-2 audio coding technology, an improved RF power amplifier, modular design, digital repeater capability and an optional on-board digital stereo generator.

The new DSTL includes a full 2 W power output as standard. For users of the two-channel DSTL, an upgrade to 2 W is available.

For information, contact Tom Daily in California at 415-558-0200; fax: 415-863-1373; or circle **Reader Service 126.**

Dual Feedback Exterminator

Sabine adds the FBX-1802 dual feedback exterminator to its line of automatic feedback controllers.

The two-channel FBX-1802 automatically senses feedback, determines its frequency and places a narrow notch filter to cancel only the feedback. It offers nine filters per channel.

The user can choose to lock the 1802's filters to prevent them from going deeper. Sound engineers also can select for each channel the total number of filters and the total number of fixed filters to be activated, as well as the width of the filters.

In addition, peak output is increased to 23 dBV and the FBX-1802's new algorithm greatly reduces the chance of mistaking music for feedback.

For information, contact Sabine in Florida at 904-371-3829; fax: 904-371-7441; or circle **Reader Service 109.**

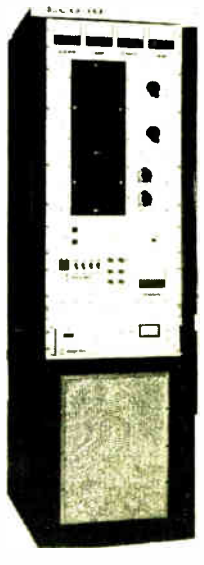
Economy Line Of Transmitters

Energy-Onix offers a new Eco Series of economically priced transmitters. Name and low price aside, the Eco 4, 6, 8 and 10 are full of features.

Eco units are built around the quarter wave, grounded grid, zero bias triode PA circuitry introduced by the company in the 1960s. VSWR foldback and protection, automatic power output control and line surge protection all remain standard Energy-Onix features, as does a solid state broadband IPA that doubles as an emergency backup transmitter.

The units also include "at a glance" control panel layout, but controller complexity has been reduced. The Eco is remote-control-ready and includes one-button start and remote overload reset.

The Eco series is packaged in a compact 24-inch wide by 72-inch high by 31-inch deep cabinet. Quick and easy access to all circuitry is gained through the hinged control panel, interlocked rear door, PA front panel and the lower front removable filter panel.



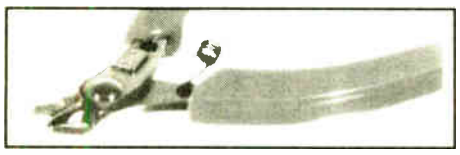
For information, contact Ernie Belanger in New York state at 518-828-1690; fax: 518-828-8476; or circle **Reader Service 7.**

Telephone Answering System

Format Productions offers the Friday answering system for sorting phone calls and distributing them with ease to the proper locations. Features include all solid state digital technology, four mailboxes with call-forward features, three announcement-only mailboxes, plus a built-in PC/fax channel, plus dozens of additional features all on a single phone line.

The system is menu driven and easy to use. The caller hears an opening menu and then makes the proper selection to direct the call. Broadcasting applications include weather, concert and sports updates, with one channel reserved for listener feedback.

For information, contact John Buck in Oregon at 800-440-4628; fax: 503-222-6408; or circle **Reader Service 182.**



The 'Gripper Nipper'

RF Industries Ltd. (RFI) enters the hand and cable preparation tool business with the "Gripper Nipper" RFA-4084.

This unique wire cutter holds the cut piece of wire firmly in the cutter until it is released. Opening the tool releases the small piece of wire just cut.

This keeps small pieces of wire from flying into the equipment, causing possible shorts in the circuitry—a major problem with most cutting pliers.

For information, contact Les Perlman in California at 800-233-1728; fax: 619-549-2345; or circle **Reader Service 184.**

Multimedia for Radio

California Digital offers the daX multimedia distribution technology designed to deliver instantly digital audio, digital color pictures and digitized editable text to low cost daX hard disk storage devices at affiliate locations.

In addition, the daX multimedia system uses low-cost digital satellite or fiber optic circuits to distribute an unprecedented range of network programming options to affiliated stations. This allows affiliates to access and air any of the network's offerings at times convenient for local broadcast times.

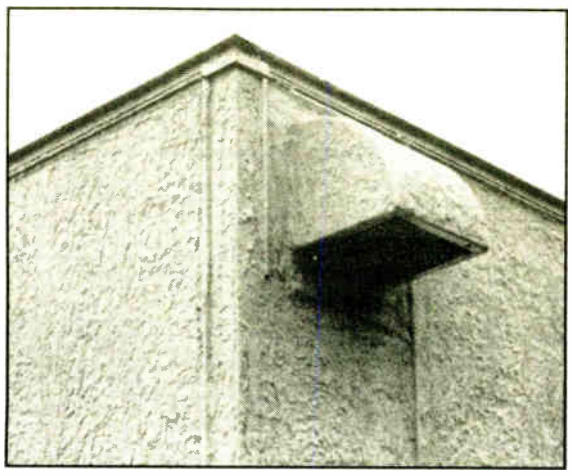
For information, contact Eileen Coombe in California at 805-523-2310; fax: 805-523-0480; or circle **Reader Service 27.**

Digital Display DC Power Supplies

Leader Instruments Corp. added nine cost-effective bench-type DC power supplies, Model 700 series, to its product line. These single-output units cover maximum output voltages from 18 to 110 VDC, from 3 to 20 amperes.

All feature constant voltage or constant current operation and provide LED digital readout of both voltage and load current. Ripple as well as line and load regulation are kept low, and reverse polarity protection coupled with fast overload recovery are standard on all units.

For information, contact Leader Instruments in New York at 800-645-5104; fax: 516-231-5295; or circle **Reader Service 156.**



Stucco Shelter Façade

FWT offers a new stucco façade for use on shelter walls. FWT's stucco façade helps ease municipal zoning requirements that sites be aesthetically pleasing by blending with the surrounding community where a site is located.

The stucco can match both the color and texture of a deployment site, making it particularly valuable for rooftop applications. Non-combustible requirements of urban structures also can be met, because most stucco façades are added to FWT's lightweight, non-combustible aluminum shelters.

For information, contact FWT in Texas at 800-334-1481; fax: 817-429-6010; or circle **Reader Service 185.**

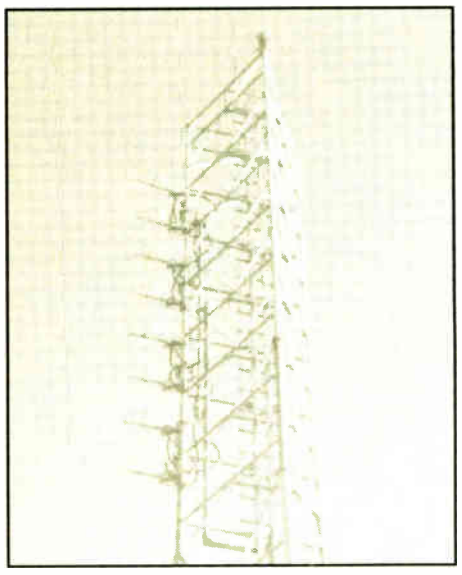
The Anywhere Tuner

JT Communications offers the RTU-1 tuner. It combines a conventional AM/FM tuner with a built-in telephone interface. With simple commands from a standard DTMF telephone, the tuner can listen to the competition and compare stations with a simple press of a button. Two external contact closures are available for remote control of a tape recorder.

The user can conduct instant surveys of an area in which the RTU is located. Using an FCC-approved interface internal to the RTU-1, auto answer and auto hang-up are available.

For information, contact Jim Trapani in Florida at 904-236-0744; fax: 904-236-5130; or circle **Reader Service 54.**

TECHNOLOGY UPDATES



DIELECTRIC

Dieletric Communications Manufactures Cost Effective Side Mount Ring Antenna

RAYMOND, Maine Dielectric **Communications** offers its broadband, circularly polarized, side-mount, ring-style FM antenna as a cost effective alternative to panel antennas. The DCR-M Quadrapole FM antenna has been redesigned to incorporate VSWR bandwidth in excess of 10 MHz, with less than 1.1:1.0 VSWR.

Until now, multifrequency facilities requiring a master antenna with bandwidths in excess of 5 to 6 MHz had to utilize costly panel antenna systems. In addition, the windload and deadweight associated with a panel antenna often make extensive tower modifications necessary.

Recently, Dielectric installed a ten-bay DCR-MBRD 3/4 wavelength antenna atop Cheyenne Mountain in Colorado Springs, Colo. This antenna has a bandwidth well in excess of 10 MHz and, due to the bay spacing, downward radiation has been greatly reduced.

For information, contact Jay Martin, FM systems engineer, in Maine at 800-341-9678; fax: 207-655-7120; or circle **Reader Service 29.**

STAINLESS

Stainless Provides Complete Tower Solutions for Broadcasters

ATLANTA The **Stainless Organization** offers affordable solutions and turnkey services for broadcasters. During the past few years, Stainless has introduced new product lines and enhanced its services to meet the demand for total project responsibility. In AM applications, for example, Stainless offers a complete, customized antenna system that includes antenna design, materials and fabrication, special lighting and grounding systems, and installation, construction and testing.

For FM, the Stainless line of towers from 100 to 2,000 feet gives broadcasters the option of pole-mounted or side-mounted FM antennas using a reduced face-width support section. Each of these designs is a cost-effective method of enhancing an FM pattern.

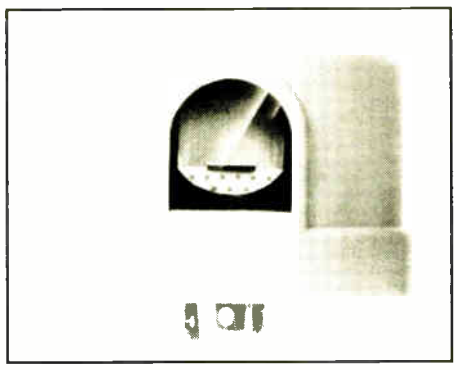
To complete its service offering, Stainless now offers a full spectrum of engineering and maintenance programs. These include analysis, design and tower modifications, tower loading assessments and pattern analysis, electronic trouble shooting and general maintenance and repairs.

For information, contact Dan Ferguson in Georgia at 800-824-7865; fax: 404-475-0247; or circle **Reader Service 137.**

PRECISION

Precision Offers Obstruction Lights

MIDLAND PARK, N.J. For more than 35 years, **Precision Multiple Controls Inc.** has been a leading manufacturer of photocontrols for outdoor lighting. Some of their specialty controls are specifically designed for aviation obstruction lights, beacons and strobe light systems. These models conform to FAA requirements for airway obstruction lighting.



There are two basic styles available—a locking-type model that plugs into a three-prong photocontrol receptacle and a meter base model that installs in a standard four-blade watt hour meter socket. Both series are available in either 120 or 208 to 277 V. Units are available with 35-foot candle turn on and a 58-foot candle turn off or a standard turn-on of 1 to 3 foot candles.

For information, contact Precision Multiple Controls in New Jersey at telephone: 201-444-0600; fax: 201-445-8575; or circle **Reader Service 96.**

LEC

LEC Hybrid Lighting Prevention Device

BOULDER, Colo. The Spline Ball Terminal (SBT) from **Lightning Eliminators & Consultants Inc.** (LEC) is a modular hybrid lightning dissipation/collection device that attaches to air terminal bases. Its primary function is to prevent lighting strikes by inducing a charge on the surfaces of both the earth and structures under the storm cell, collecting the induced charge and transferring it into the atmosphere.

In the event that during severe thunderstorm activity the SBT is struck, lightning is prevented from terminating on the equipment being protected.

Because the SBT has discharge points oriented in every direction, the upward streamer it generates during severe conditions will be on the same axis as the incoming lightning leader, and will offer the preferred termination point. Consequently, the SBT is designed to withstand a lightning strike and must be used with a grounding system designed to do the same. The SBT is UL listed.

For information, contact LEC in Colorado at 303-447-2828; fax: 303-447-8122; or circle **Reader Service 79.**

PHASETEK

Phasetek Manufactures Custom Phasing and Antenna Tuning units

QUAKERTOWN, Pa. **Phasetek Inc.** manufactures custom AM and medium wave directional phasing and branching systems, antenna tuning units (ATUs), diplexers, triplexers, transmitter combiners and a complete line of RF components.

A unique feature of all Phasetek phasors is the custom designed housing, which is based upon circuit design and customer specifications. This allows for proper spacing of components and ease of adjustment and maintenance.

Standard tuning units are enclosed in aluminum weatherproof cabinents with rear and base mounting flanges, hinged locking door, and have a gold allodine/Phasetek gray finish. All units have a 3-foot pigtail of copper strap for connection to station ground.

All phasing systems and ATUs are designed with computer analysis programs, developed by Phasetek, to assure maximum performance.

Customers that require an ATU, new phasing system, or would like to modify an existing system can contact Phasetek for quotes. The information required for phasing system design is: array parameters and geometry, transmission line lengths, and any special requirements of the station engineer or consulting engineer.

Customers can also turn to Phasetek for system installation or modification in conjunction with the station engineer and/or consulting engineer.

For information, contact Kurt Gorman, Dave Gorman or Matt Nelson in Pennsylvania at 215-563-6648; fax: 215-536-7180; or circle **Reader Service 71.**

Cable Reference Guide

The following is a list of companies that produce transmission line, cables, line connectors, RF line filters and cable management devices. It is not an exhaustive list, and other companies listed elsewhere in Buyers Guide may also manufacture cable products.

company:	TL	CB	CN	FL	WM
Andrew Corp. 10500 W. 153rd St. Orland Park, IL 60462 phone : 708-349-3300 fax: 708-349-5943	✓	✓	✓		
Cablewave Systems 60 Dodge Ave. North Haven, CT 06473 contact: Ilene Locke phone : 203-239-3311 fax: 203-234-7718	✓				
Cole Wire & Cable Co. Inc. 6430 N. Hamlin Ave. Lincolnwood, IL 60645 contact: Tim Logan phone : 800-323-1403 fax: 708-673-2243	✓	✓			
Myat Inc. P.O. Box 425 380 Chestnut St., Norwood, NJ 07648 contact: Philip Cindrich phone : 201-767-5380 fax: 201-767-4147	✓		✓		
Belden Wire & Cable 2200 U.S. Highway 27 South Richmond, IN 47374 contact: Kip Coates phone : 317-983-5200 fax: 317-983-5257		✓			
Canare Cable Inc. 511 5th St. #G, San Fernando, CA 91340 contact: Barry Brenner phone : 818-365-2446 fax: 818-365-0479		✓			
Clark Wire & Cable 151 S. Pfingsten, Deerfield, IL 60015 contact: Susan Clark phone : 800-222-5348 fax: 708-272-9564		✓			
GEPCO International Inc. 2225 W. Hubbard St., Chicago, IL 60612 contact: Larry Smith phone : 312-733-9555 fax: 312-733-6416		✓			
Nemal Electronics International 12240 N.E. 14th Ave., North Miami, FL 33161 contact: Benjamin Nemser phone : 305-899-0900 fax: 305-895-8178		✓			
Times Microwave Systems 358 Hall Ave., P.O. Box 5039 Wallingford, CT 06492 contact: Robert Perelman phone : 203-949-8432 fax: 203-949-8423		✓			
Trompeter Electronics 31186 La Baya Dr., P.O. Box 5069 Westlake Village, CA 91362 contact: Mike Shorb phone : 800-217-2020 fax: 818-706-1040		✓			
Lemo USA Inc P.O. Box 11488, Santa Rosa, CA 95405 contact: Karen Beehler phone : 800-578-8811 fax: 707-578-0869			✓		
RF Industries Ltd. 7620 Miramar Rd., San Diego, CA 92126 contact: Les Perlman phone : 800-233-1728 fax: 615-549-2345			✓		
Communications and Energy Corp. 7395 Taft Park Dr., East Syracuse, NY 13057 contact: Steve Shafer phone : 800-882-1587 fax: 315-452-0732				✓	
Microwave Filter Co. 6743 Kinne St., East Syracuse, NY 13057 contact: Tom Parker phone : 800-448-1666 fax: 315-463-1467				✓	
Panduit 1333 Schoolhouse Rd., New Lenox, IL 60451 phone : 800-777-3300, ext. 1709 fax: 708-532-1811					✓
Rip-Tie P.O. Box 77394, San Francisco, CA 94107 contact: Michael Paul Fennell phone : 415-543-0170 fax: 415-777-9868					✓

TL = transmission line CB = cables CN = connectors FL = RF line filters WM = wire management

MARK ANTENNAS

Compact Flat Panel Antenna from Mark

DES PLAINES, Ill. The FP-5509-1 flat panel antenna from the **Mark Antennas** division of Radiation Systems Inc. is about the size and weight of a telephone book.

The antenna is available in a range of frequencies and can be mounted almost anywhere, including on a building or pipe. It operates in the 806-960 MHz range, and features a gain of 5.7 dBd.

The FP-5509-1 is only 2 inches deep, 9 inches wide and weighs only 4 pounds, and is designed to be inconspicuous in every way but its performance.

The antenna is constructed of aluminum and its white ABS plastic housing can be painted to blend with its environment. The FP-5509-1 is designed to withstand extremely adverse weather conditions, including winds up to 150 mph and temperatures from -40 degrees Fahrenheit to 160 degree Fahrenheit.

The FP-5509-1 is versatile and useful for cellular, SCADA, SMR and GSM services and applications.

For information, contact Al Crego in Illinois at 708-298-9420; FAX: 708-635-7946; or circle **Reader Service 92.**

ETI

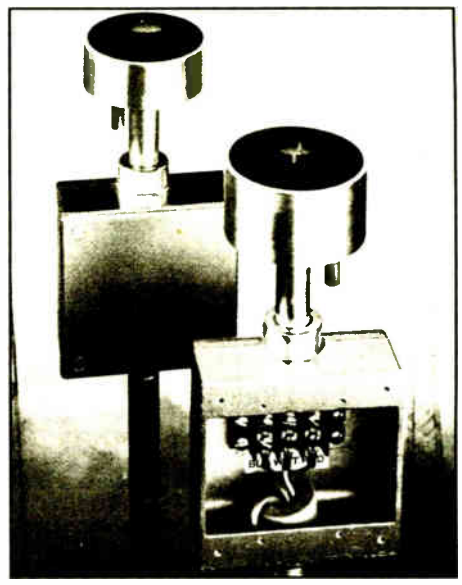
Simple and Efficient Anti-Icing System from ETI Helps Prevent Ice from Forming

SOUTH BEND, Ind. The Antenna Ice Melting Control System from **Environmental Technology Inc.** consists of a CIT-2TV ice sensor located adjacent to the transmitting antenna and an APS-3A control panel. The APS-3A is normally located in the transmitter shelter, within 2,000 feet of the sensor. Sensors and the control panel employ special filters and circuit design techniques to minimize susceptibility to RF interference and lightning damage.

The CIT-2TV sensor operates heaters at temperatures below 40 degrees Fahrenheit in the presence of moisture, and prevents heater operation at temperatures below 0 degrees Fahrenheit to save energy and to prevent partial melting of ice. Heaters operate for the hold-on time as the temperature increases through the lock-out temperature if precipitation occurred during lock-out.

In addition to supplying 24 VAC for sensor operation, the APS-3A control panel provides status indicators, an adjustable heater hold-on timer and a heater cycle switch.

For information, contact Steve Leykauf in Indiana at 800-234-4239; fax: 219-233-2152; or circle **Reader Service 47.**

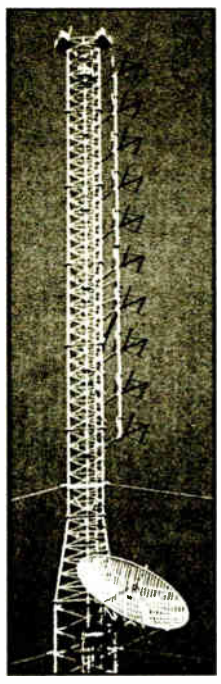


CENTRAL TOWER

Central Tower Provides Full Line of Towers

NEWBURGH, Ind. **Central Tower** has been a primary producer of broadcast antenna support structures for many years. Central has conscientiously kept pace with changing industry needs.

Broadcasting is an essential, growing industry. The experts at Central Tower are ever aware of the timeliness of the information transmission that is supported by their towers. Each Central Tower structure is built to our high standards, as if it was being built for our own use.



Central's product line includes guyed and self supporting towers, monopoles, antenna mounts and tower accessories. And Central Tower offers many services, from design through construction, maintenance and inspection.

In the hundreds of Central towers in service worldwide, there have never been any failures. In the face of Hurricanes Hugo and Andrew, Central's towers continued to provide service without any loss of airtime.

For information, contact Scott Smith in Indiana at 800-264-0595; fax: 812-853-6652; or circle **Reader Service 203.**

FLASH TECHNOLOGY

ElectroFlash Beacon from Flash Technology Marks Obstructions Effectively

BRENTWOOD, Tenn. The **Flash Technology Corp. of America** ElectroFlash FTB 204 beacon provides highly conspicuous flashes of white light and is used to mark obstructions. Using the FTB 204 beacon system 24 hours per day eliminates the need for other markings on structures 500 feet AGL or higher. It provides an easily perceived visual warning signal that is both effective and efficient.

The FTB 204 assures compliance to FAA specifications, includes no high voltage wiring, causes minimal wind loading and includes the capability to be remote monitored.

The flashhead emits 270,000 ±25 percent effective candelas during the day; 20,000 ±25 percent effective candelas at twilight; and 2,000 ±25 percent effective candelas at night or 4,000 ±25 percent effective candelas at night to meet ICAO specifications. It emits 40 flashes per minute with 120 degrees of horizontal coverage and a 3 degree vertical beam. Options include complete installation and electrical kits, mounting brackets, system installation and dual systems with type L-864 red lights for night use and FTB 204 strobes during the day and at twilight.

For information, contact Larry Montuori in Tennessee at 615-377-0600; fax: 615-377-2383; or circle **Reader Service 34.**

TWR LIGHTING

TWR Offers Complete Line Of Aviation Obstruction Lightning Products

HOUSTON **TWR Lighting** provides a complete line of high quality aviation obstruction lighting products for FAA, FCC and ICAO applications.

TWR Lighting offers ETL certified and FAA approved medium intensity white strobes, red code beacons and single and double obstruction lights, as well as complete lighting kits, dual red and white systems, and custom-designed systems.

Each system is tested before leaving the factory and all equipment carries a two-year warranty. Most products are kept in stock and are ready for shipment within 24 hours.

For information, contact TWR Lighting in Texas at 713-973-6904; fax: 713-973-0205; or circle **Reader Service 98.**

ATCI

Simulcast Upgrade from ATCI Allows Greater Use of Full Satellite ARC

MESA, Ariz. Since 1979, **Antenna Technology Communications Inc.** (ATCI) has manufactured the Simulsat multibeam antenna. Because demands have increased upon the industry to view a greater number of satellites, ATCI has striven to stay a step ahead by offering customers continual upgrades to the Simulsat Multibeam Series of satellite earth stations.

Owners of Series I Simulsats currently receiving only 50 degrees of the satellite arc can now view the entire 70 degree arc with the purchase of a retrofit feedbox. This provides current users the same viewable arc as the new Series III Simulsats.

ATCI field engineers can install the retrofit box and at the same time re-align and tune the antenna with minimal service disruption.

Along with the development of the Simulsat Retrofit Feedbox, ATCI offers 2 degree feed assemblies. These high quality feeds enable the Simulsat user to place more feeds closer together.

For information, contact ATCI in Arizona at 602-264-7275; fax: 602-898-7667; or circle **Reader Service 1.**

Radio World

Broadcast Equipment Exchange

"Broadcast Equipment Exchange" accepts no responsibility for the condition of the equipment listed or for the specifics of transactions made between buyers and sellers.

ACOUSTICS

Want To Sell

AMPLIFIERS

Want To Sell

Macintosh 1900 AM/FM stereo rec amp exc cond, works perfect, $400/BO; McIntosh C-8 tube preamp, VGC, $150/BO. W Kremer, Kremer Kraft, 301 SW 16 St, Ft Lauderdale FL 33315. 305-524-5652.

Dynaco ST120 solid state stereo amp 60 W per side, mint, $350. A Levinson, Spruce Hill Studio, 1002 S 49th St, Philadephia PA 19143. 215-729-0941.

Marantz 8, $1450; McIntosh MC240, $1450; MC225, $750; MC40, $750 ea, A11 6/$950 ea; RAC D40 w/mods, $850; Spectral DMA-80, $1950. R Katz, Allegro Sound, 15004 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Dynaco stereo 120 solid state, rack mt $229, Dynaco stereo 70 tube amp all new tubes! Dynaco PAT 4 preamps $59. W Gunn 619-320-0728.

New 10 kW FM amp under $24,000. Call for details. Bill Hoffman, 518-743-1601.

ANTENNAS/ TOWERS/CABLES

Want To Sell

Shively 6813, 2 bay w/radomes, rebuilt and in factory boxes, 95.4 MHz, $2400. B Bailey, WHYR, POB 507, Saco ME 04072. 207-284-9000.

Andrew 40545 transmission line air compressor, 3-8 lbs/sq in, $450. R Chambers, 916-257-2121.

Two bay FM antenna, as is on 99.9, manf 9/11/89, $1700/BO. J BellGerman, WHKX, 345 Office Plaza Dr, Tallahassee FL 32301. 904-942-9459.

ERI FML-3E, 3 bay low power antenna, 2 yrs old, exc cond, on 107.7, $4000, we pay shipping. G Vaile, KYTN, 723 W 14th St, Little Rock AR 72202. 501-433-1077.

Continental 37-CP-3 3 bay FM antenna, 105.5 MHz, $4800. C Fletcher, WLJE, 2755 Sager Rd, Vawaraigo IN 46383. 219-462-8125.

Andrews various 3" & 1 5/8" connectors, 100' of 3 1/8" Andrews line, (2) RF chokes, Continental 814B + manual, BO; Continental ERI Rototiller tuned to 97.7, 3 bay, 1 5/8" lead, 1.5588 gain, BO/trade. B Hill, KALK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9770.

Jampro JMPC-10 10 bay CP FM antenna on 107.1, new cond, stored inside, $9500/BO. B Zellmer, KSIR, Box 2475, Greeley CO 80632. 303-353-6522.

Want To Buy

100' - 150' self supporting tower. B Hurst, WWCH, 725 Wood St, Clarion PA 16214. 814-226-4500.

4 or 5 Bay CP FM antenna, tuned to 92.7, low power pref. S Greeley, 602-855-1051.

AUDIO PRODUCTION

Want To Sell

dbx 3bx dynamic range expander, $300. A Levinson, Spruce Hill Studio, 1002 S 49th St, Philadephia PA 19143. 215-729-0941.

Eventide BD-941 broadcast delay line with 3, 6 or 12 second delay, $975. R Chambers, 916-257-2121.

Shure M-67 mic mixer, $100; Collins 212-S console, stereo, 16 input, $250; Gates Sta-Level compressor, $40; Dayton AF155 SCA receiver, $100. R Place, WPEP, 401-455-7226 or 508-636-6707.

dbx 157 NR units (2), simul type-1 encode/decode, indiv level controls ea chan to match -10 thru +8, manual, 1 unit needs repair; Ampex 620 amp/-speaker pair, 10 W tube amps, portable in original Samsonite cases (dark orange), gd cond. J Mehne, Clearwater Audio Recorders, 607-277-0540.

Modulation Sciences Stereo Maxx, $1000; CBS dyn EQ 4500, $50, Orban 526A mono sib cntrlr, $150; (3) Logitek AIA-200 phono preamps, $50, Gorman Redlich EBS, $250. D Matyis, KVET/KASE, 705 N Lamar, Austin TX 78703. 512-495-1300.

ART 2001, stereo compressor, limiter, gate, de-esser, exciter, like new, $300. K Thomas, Rebel Recording, 5555 Radio Lane, Jacksonville FL 32205. 904-388-7711.

Gentner GT300 teleconference unit, new in box, $750; SpectraSonics 610, as new, $350; Shure AMS 4000 new, no manual, $900; Dyaxis I, system sync, DSP card, 320 HD, Mac Portrait display & Mac II driver card, very good condition, $2750, plus shipping. Klay 801-272-1814.

Demeter 4 channel rack mount tube direct box NEW $795. W Gunn 619-320-0728.

ADC 96 & 144 Pr TT patchbays, excel cond, 1 rack space, 3 rows of 48, top 2 rows normalled, $149, 96 is 2 row normalled, $129 (you remove old wiring) or we totally refurbish w/new front panel, ready to install, $199-229. TT cords up to 10 per bay at $9 ea, reg $13.95, also 1/4" bays. Audio Village, 619-320-0728, or Fax 619-320-2454.

Want To Buy

Fairchild 600 conac or 602 Conex high freq limiters. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

AUTOMATION EQUIPMENT

Want To Sell

BE Econo Sat 16 automation w/Carousels (3), IGM Go Cart, on-air, $4000/BO. C Ashworth, WMJR WBZA, POB 928, Glensfalls NY 12801. 518-792-2151.

SMC RP1000 automation controller, Otari R/R (5), carousels (3), cart liner drawer (2), sell complete unit all working, $2000. C Maley, KSIB KITR, Hwy 34 West, Creston IA 50801. 712-542-4858 after 3:30 pm CST.

Authenticity RA-1 digital radio automation system complete w/Pioneer PC-TM2 18 pack & Sony CDP-C910 CD players, Pioneer 6 pack cassette player, 2 Sony Mini Disc, computer, software, hardware & more, $7777.77, M Lund-Vallance, WAPN, 1508 State Ave, Holly Hill FL 32117. 904-672-3333.

Schafer 800T control unit, Carousels (2), Gates 55 cart units (2), Ampex R-R (3), will consider selling separately L Nelson, WSRS, POB 1327, Russell Springs KY 42642. 502-866-5969

Schafer Series 7000 1-Cetec system brain; ITC 770 stereo R-R tape PB units (4); Gates ATC P/B cart units (3); Cetec Audiofiles (6); Ctr terminal, racks, spare parts, B/O. P Berger, WROE, POB 1035, Neenah WI 54957. 414-725-4447.

SMC RP1000 automation controller, Otari R/R (5), carousels (3), cart liner drawer (2), all working, $2000. C Maley, KSIB KITR, Hwy 34 West, Creston IA 50801. 712-542-4858 after 3:30 pm CST.

IGM EC system, switcher 4 carts, 3 Carousels, computer, monitor, printer w/latest software, used 6 mos on Unistar, $5000. D Igou, KCHL, 8435 Twisted Oaks, San Antonio TX 78266, 210-651-9049.

Century 21 Autosegue, 3 multi-disc CD players, brain and disc magazines, $400 as is. J BellGerman, WHKX, 345 Office Plaza Dr, Tallahassee FL 32301. 904-942-9459.

Audiofile II, single column, 10 slots, 3 Audiofile I, various shape, 903 boards. B Bailey, WHYR, POB 507, Saco ME 04072. 207-284-9000.

Schafer 902, 1/2 automation system, inc 901 switch w/lots of I/O cards, audiofile I unit, Audiofile II unit, spare parts inc Schafer decks (4), grt for satellite format, BO. S Winkey, KXIC/KKRQ, Box 2388, Iowa City IA 52240. 319-254-9500.

Schafer Cetec 7000, Level II software, Audiofiles (2), ITC R/R (2), monitors (2), in operation, $2500 firm. S Yates, KRBA/KUEZ 121 Calder Sq, Lufkin TX. 409-634-6661.

Smartcaster 8K mono, will interface w/satellite, (2) 60 MEG hard drives, $3900 B Hill, KALK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9770

IGM-SW automation controller w/9 USC source cards, IGM Go-cart 24 w/GSI (3), IGM-EN FSK encoder w/television 905, IBM PS/2, manuals & cables, $3500. L Collins, WJYY/WRCI, POB 1923, Concord NH 03302. 603-228-9036.

SMC DP-1 CPU, 24 deck Carousel, 5.5' 19" racks (6), Revox PR99 R-R tape, you freight it, $3000. T Wetzel, KEXO, 715 Horizon Dr, Grand Jct CO 81506.

Want To Buy

NBC and Mutual detector boards to decode network automation signals. P Bjornstad, KDBS, 2100 W 11th, Eugene OR 97402. 503-686-6165.

CART MACHINES

Want To Sell

ITC PDII R/P mono, mint cond, clean, $650 incl shipping. E Finley, Genesis 200 Studio, 4101 W Union Hills Dr, Glendale AZ 85308. 602-978-8092.

BE 2100C mono R/P mint, $500. (5) Ampro mono play, gd cond, $100 ea; Ampro mono R/P gd cond, $200. G Kornbluth, A&J Recording Studios, 225 W 57th St, New York NY 10019. 212-247-4087.

SMC 590, cart recorder in gd cond, mono R/P, newer style head gasket w/many spare parts, $150 B Bailey, WHYR, POB 507, Saco ME 04072. 207-284-9000

Fidelipac CTR-12 stereo PB w/ all tones, never on air, manual incl, $850. D Igou, KCHL, 8435 Twisted Oaks, San Antonio TX 78266, 210-651-9049.

CART MACHINES...WTS

ITC R/P mono, R/P, SP stereo playback, WRA stereo record amp, w/3 tones. D Matyis, KVET/KASE, 705 N Lamar, Austin TX 78703. 512-495-1300.

ITC Delta players, mono, vgc, $675; Harris triple deck stereo, gd cond, $600. K O'Malley, 804-446-1328.

BE 5300C tripledeck, stereo, PB, mint less than 50 hrs, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Want To Buy

Ethnic community stn, in need of low cost mono cart machs w/tones, need R/P & P/B machs, minor repairable units ok. P Ryan, KYMC, 2122 Marconi Ave, St Louis MO 63110. 314-664-7080.

ITC, BE, Fidelipac cart machines: single, triple, mono, stereo, play & record/play. Call M O'Drobinak @ 619-758-0888.

CASSETTE & REEL-TO-REEL RECORDERS

Want To Sell

Telex 1022, gd cond, needs heads, portable case, many parts & boards. B Bailey, WHYR, POB 507, Saco ME 04072. 207-284-9000.

Scully 280 1/2 inch 4 track, very good cond, 7 1/2 /15ips, $650; also 4 more 280 electronics, $100 ea. M Gore, 54 Ney St, San Francisco CA 94112. 415-469-0136 noon to 5 pm West Coast time.

Revox 77A (2), 1/4" 2 trk 7.5/15, port case, very fine cond, $500 ea; (5) Scully 280A 1/4" 2-trk 7.5/15, Russ Lang console cabinets, $500 ea. G Kornbluth, A&J Recording Studios, 225 W 57th St, New York NY 10019. 212-247-4860.

Telex 235 exc cond, records 3 cass at once, no notches in hds, like new, $650. S Russell, Russell Studios, 60410 Klett Drive, Decatur MI 49045. 616-782-9258.

Scully 280 4 trk, 1/2 inch, in roll around cabinet, gd cond, $1200 or trade for Tascam model 15 console; Scully 280 2 trk recorder, 1/4", gd cond, rack mount, $800/BO. F Bardeaux, The Music Faktory, 1812 Procter St, Port Arthur TX 77640. 409-982-7121.

Otari MK-III, 8 trk w/snake, exc cond, $1900; roll-about stand, $100. S St John, St John Productions, POB 641448, Kenner LA. 504-464-8881.

Revox A-77 quarter trk w/spkr cab, 7 1/2 - 3 3/4 ips. Wolf, Ealing Recording, 312-784-1558.

Ampex 350/440 parts transport & electronic parts, some new most used in super cond, motors, headstacks, guides, etc, also parts for Scully 280s & complete Inovonics electronics for 250s & 440s, all reasonably priced. M Gore, 54 Ney St, San Francisco CA 94112. 415-469-0136 noon to 5 pm West Coast time.

Tascam MSR16 low hours, mint cond, dbx NR $3200; Alesis ADAT. M Schackow, 307 4th Ave E, Lemmon SD 57638. 605-374-3424.

Studer C270/2 2 trk analog mastering, $295/BO; Studer/Revox HS77 Mk IV FT mono, $750/BO/trade; portable case for A77 w/mon spkrs & pwr amps, exc cond, $375. R Katz, Allegro Sound, 15004 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Ampex MM 1100 16 trk 15/30ips in superb cond, has seen very little use, heads gd, all elects have been checked, has updates, counter, MDA fans, AC stabilizer card, mods, B/O. M Gore, 54 Ney St, San Francisco CA 94112. 415-469-0136 noon to 5 pm West Coast time.

Recordex 6 cass rewinder $100; Tascam 40-4 4 trk 10" in flight case w/free dbx $750; MRL new short lest tapes $39 for 1/4' to $199 for 2". W Gunn 619-320-0728.

Nakamichi 480 pristine single well tape deck, black face, superb sound, $250; Teac 3340S, as new cond, 10 1/2 in syncrosyn 4 trk, 1/4" tape deck w/sev reels of tape, $350. R Schweppe, WTMO, 7155 Clark Rd, Sarasota FL 34241. 814-925-7215.

Ampex AG-440B, 2 trk, 7.5/15, add'l 1/4 tr PB hd w/both scrape flutter idlers, synchronous capstan, spare hold-downs and pinchroller, in Ampex roll-around, mnl, exc cond; Sony 770-2 portable, 2 trk, 7.5/15, add'l 1/4 trk PB hd, variable spd DC servo capstan, mnl, nds some wk; Pioneer RT-1050, 2 tr & 1/4 tr hdblocks, 15/7.5, balanced mic inputs, edit/cue lever mod, mnl, nds rewind switch. J Mehne, Clearwater Audio Recorders, 607-277-0540.

Ampex 440 recorder & parts, RCA, EV, Presto, UTC and other misc electronic gear, call for 4 page list, B/O, close out. B Lindahl, 503-644-9643.

Otari Pro+4, 16tk MX70, gd cond, w/text tapes & remote, BO; Fostex D20 time code DAT w/Sony control 9 pin, $4500. 412-281-4470.

Otari ARS 1000 (2) gd cond, w/25 Hz, $400/ea. B Hill, KALK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9770.

Revox A-77 10.5" open reel recorder, 3.75, 7.5 ips, 4 trk, needs minor work, would consider trade. D Fields, POB 194, Avoca AR 72711 501-451-8803.

Sony/MCI JH-24 24 trk, 2" multitrk master rcdr w/add'l 16 trk hd stack, full locator, very gd cond, all mnls, one owner, lots of life, $15500 FOB Austin TX. J Block, Production Block Stds, 906 E 5th St, Austin TX 78702, 512-472-8975.

Sony PCM-F1 digital recording system modified with Apogee input filters and external sync input, system capable of locking to external video house sync, incl 2 SL-2000 protable Beta recorders, AC power supplies, NiCad batteries, tuner-timer module, cables, road case, complete system $1500; F1 processor only $1000. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Sony F1, digital PCM for 2 ch link, or recording on VCR (2), $1800/both. T Markham, The Warehouse Studio, 2071 Emersor St, Jacksonville FL 32207. 904-399-0424

Tascam 688 MIDI studio, 8 track recorder/mixer, mint condition, $1800. N Hersh, UN Radio, 212-353-3410.

Teac AH010S like new w/box, $150; Teac A1500U, like new, low hrs, $200; Pioneer RT701, new heads, $300; Viking Telex RD84, record amps (3), $80 ea. J Parsons, 2781 Fayson Circle, Deltona FL 32738. 904-532-0192.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 4646 Houndshaven Way, San Jose CA 95111. 408-363-1646.

EMPLOYMENT

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

POSITIONS WANTED

Former radio GM fluent in Spanish and semi-fluent in French seeks pos in int'l bdct equip sales or consultation, exp'd in programming, technical & sales aspects of bdcting, willing to travel often, very familiar w/most areas of Mexico, currently a senior at UGA. Tyler, 706-354-6109.

European MassComm student w/exc study record & bdct exp in the Netherlands seeks internship in programming/promotions at AC/CHR for 1995. D Kokkelink, POB 85833, 2508 CM, The Hague, Netherlands.

Former CE National Black Network, college radio exp, seeks FT/PT radio or TV position, ISCET cert, FCC licensed, ham radio OPCET. M Rakoo, 95-60 Queens Blvd Ste 513, Rego Park NY 11374. 718-591-3659.

Account Exec w/20 years media sales, ad and promo exp seeks position in Tucson, Phoenix or San Diego market. B Lukas, 602-750-9211.

Soon to be college grad, skg emp in early May, sales, on-air, prod, will travel. RR 2 Box 21A, Center Point IN 47840.

Recent graduate w/experience seeks mid to major market news, superlative writing, delivery and vocal skills to elevate or keep your ratings. Dan, 918-742-1227.

Bdcting school grad, at end of road, aspiring to be top of the heap. Dallas, 405-848-5334.

Rockin Rick Allen, aka Rick Savage, from Akron OH is avail, great tape. 216-773-1549.

Hard working guy willing to work in country or contemporary Christian stn, can handle on-air, production or news. S Weller, 918-258-5154.

Sportscaster w/pro & college exp seeks stn commited to PBP, if you do lots of sports, call me 302-436-5631.

Combo Chief Engineer, PD, anncr, sales, prod. Tampa Bay area or other gd coastal FL locatn. Bill, 813-844-3823.

Exp Radio Personality seeks prgm dir/prod for CHR or A/C fmt stn, med or large mkt pref. John, 904-683-9050.

Talented, energetic, AAS grad seeks FT announcing/talk, chr PD potential, ready to settle, 6A only, for T/R: Brian, 1104 Park Circle, Conyers GA 30207.

Seeking GM/GSM position, recently GM/GSM with eastern NC station built from CP, can wear many hats to reduce your overhead. B Bolton, 919-249-1893.

HELP WANTED

Inspirational Christian FM network in upstate NY is seeking morning-drive co-host that is creative, positive, personable, team-oriented, and ministry-minded. Competitive salary and benefits. Send resume & demo tape to: Family Life Network, POB 506, Bath, NY 14810.

Broadcast Engineer Wanted!! Young, aggressive broadcast group looking for chief engineer for our Washington, DC facility. Must possess good eor for audio processing, be willing to build out new studios and have experience. Resumes only. WOL/WMMJ, 400 H St NE, Washington, DC 20002, Attn: General Manager.

HELP WANTED

CHIEF ENGINEER: Immediate opening for Chief Engineer for 4 Class B FM radio stations in one of the most attractive cities in the Midwest. Minimum of 5 years experience and S.B.E. certification required. Knowledge of high power Continental and Harris FM transmitters is essential, along with the ability to troubleshoot audio and RF equipment to the component level. Stations are currently upgrading from analog to digital in both production and on-air environments. Salary $35,000+. Full medical package, car, 401(k) plan. EOE, M/F/H Please send resume with at least 3 professional references to:

Mr. Charles Stone
Broadcast Services
1650 Tysons Blvd.
Suite 790
McLean, VA 22102

CHIEF ENGINEER

Virginia broadcast group seeking FM broadcast engineer with several years experience Requirements: Technical school graduate, SBE certified, proficient at troubleshooting audio quality, radio station RF and studio systems, strong PC and digital system knowledge. Send resume and salary requirements to:

Radio World, Box 1214

Falls Church, VA 22041

Attn: Box #94-04 20-01RW EOE, M/F

CHIEF ENGINEER - Colorado Mtn Radio Group needs all around engineer to construct & maintain studio, transmitter, computer automation. Applicant needs to be able to deal with high altitude remote sites. We are an EOE Employer. Contact Marty Hijmans: 303-949-0140.

ABOUT OUR EMPLOYMENT SECTION

HELP WANTED: Any company or station can run "Help Wanted" ads for $1.50/word or buy a display box for $60/column inch. Payment must accompany insert, use your MasterCard or VISA; **there will be no invoicing.** Blind box numbers will be provided at an extra charge of $10. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for details.

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

Mail to: BROADCAST EQUIPMENT EXCHANGE
PO Box 1214, Falls Church, VA 22041 Attn: Simone Mullins

CASSETTES/R-R...WTS

Ampex 440C, 4 trks, 4 & 2 trk, headsets, roll-around, nds work, pick up only, $400. 212-219-3670.

Revox A7, (6) 1/2 trk, 3 high speeds, 3 low speeds, $100/ea; B77 (2) 1/2 trk, low speed, $300/ea. D Matyis, KVET/KASE, 705 N Lamar, Austin TX 78703. 512-495-1300.

Crown SX-722 stereo R-R 1/2 trk recoder, $300. G Hultman, Hultman Media, 300 Limpy Creek Rd, Grants Pass OR 97527. 503-474-6466.

16 track 2" $3450, MCI JH110C-8 $2800, 110C-8 play only $500, ATR800 mono or Tascam 7300 or 2502 $600 ea, MCI Locator III $1195, Tascam 52 2 trk $1200, Ampex AG350 electr $50/ch. W Gunn 619-320-0728.

Otari Mark III-2 two tracks (4) modified to full track, good condition, $1000 ea, changed to two track, $1750; Revox A77 2 track low speed, good condition, 2 at $500 ea, plus shipping. Klay 801-272-1814.

Otari 5050 MK III-8 track, heads excellent, $2450. Wayne Gunn 619-320-0728.

Otari Mark II-IV 1/2" 4-track, multitrack, mint, less than 50 hours, Best Offer. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Want To Buy

Portable R/R recorder w/built-in spkr, must accomodate 1/4" mono tapes on 5" & 7" reels, must play at 7.5 & 15 ips, gd working cond. S Vainrib, Vainrib Audio Productions, 764 Dividing Ridge Dr, Birmingham AL 35244. 205-987-5198.

Tascam 58 1/2" 8 trk wanted to buy or trade for Otari 5050 MK III-8 or...? Wayne Gunn 619-320-0728.

Ampex tube recorders and mixers. W Gunn, 619-320-0728.

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

CD PLAYERS

Want To Sell

Revox B225 built like tank, $350. Wolf, Ealing Recording, 312-784-1558.

Denon DN950FA (2), perf cond, in use until 2-25-94, $750 ea. J Leutzinger, KFSB Radio, 2629 Dogwood, Joplin MO 64804. 417-624-1310.

Denon 950 FA, perf cond, $1650. K Thomas, Rebel Recording, 5555 Radio Lane, Jacksonville FL 32205. 904-388-7711.

Audiometrics AMCDS-1000A 100 disk CD Jukebox w/RS232 computer interface, $1000/BO. J Stromquist, WNCB, 2828 Piedmont Ave, Duluth MN 55811. 218-722-3017.

Denon 950FA, CD players (2), gd cond, rebuilt, $750 ea. J Leutzinger, KIXQ FM, 2620 Dogwood Rd, Joplin MO 64801. 417-624-1310.

COMPUTERS

Want To Sell

Tektronix 4662 interactive digital plotter, complete w/ 3 complete sets RGBB colored pens and IBM compatible software, pens fresh, very gd cond, $950. C Stuart, POB 1236, Susanville CA 96130. 916-257-2702.

EFI UPS, 500 watt new in box, $350. Klay 801-272-1814.

Want To Buy

Tandy 6000HD w/at least 1 floppy drive. Mel Crosby, 408-363-1646, FAX 408-363-0957.

CONSOLES

Want To Sell

Tascam 5B mixer, 8x4, 2-band EQ, 2 sends; talkback module, spare master module, spare pan, wood shipping crate, documentation; PB-64 patchbay w/cables, nice shape, kept clean, used on classical music. J Mehne, Clearwater Audio Recorders, 607-277-0540.

Ward Beck, NBC Radio Network master control, collectors item. H Norman, NDXE, 747 Wire Rd, Auburn AL 36930. 205-826-0393.

Russco Mono 505, rack mount (1), table top (1), $250 ea. J Parsons, 2781 Fayson Circle, Deltona FL 32738. 904-532-0192.

Auditronics Grandson 110, 12 mono chnls w/faders, 2 stereo chnls, 3 remote starts, incl Auditronics PS-30 & very nice custom console fumiture w/space for 2 deck mounted R/R recorders, $850. Bill, 806-359-4000.

BE 10S350A 10 chl stereo slide fader mint, complete doc, $2300. G Kombluth, A&J Recording Studios, 225 W 57th St, New York NY 10019. 212-247-4860.

Soundcraft 200B—Like New! 8 chnl w/EQ, 4 subs, 4 auxs, stereo master, tape return. $1500 +S/H. Anvil roadcase included. Call Leo 310-207-3600 from 0900-1830 PST (M-F).

Shure M67 original condition mic mixer with meter, with schematic, $150; Shure M68 original condition, with schematic, $150; Altec 1567A modified for stereo output, Peerless mic & line transformers, 2 band EQ section tubes all around, 5 input mic line amplifier (as is), $300/BO. A Levinson, Spruce Hill Studio, 1002 S 49th St, Philadephia PA 19143. 215-729-0941.

Tapco 6 chnl, like new, many hook ups in back, great tone, $200. S Russell, Russell Studios, 60410 Klett Drive, Decatur MI 49045. 616-782-9258.

Reconditioned Howe 12 channel stereo. Mid '80s VCA design, 22 inputs, 5 line amplifiers and VU meters. All inputs and outputs tested. New molex connectors included, $1300. Ron Krob, 303-484-2704.

Soundcraft Spirit 163 mixing console, 16 inputs, sep assignable stereo and mono outputs plus 4 aux busses, modification incl pre/post fader switches for Aux-2, tape return to monitor, line level monitor outputs, mono-sum to monitor, exc cond, $1550. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Arrakis 500SC exc cond, 8 chnl stereo, will trade for studio or on air processing, $1750. B Hill, KALK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9770.

Quantum 12A mixing console, highly modified for live concert recording applications, incl ATA road case, $1300; Fostex 2050 line mixer, ten (8+2) line level inputs, stereo outputs, incl rack mount adaptors, $100. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Gately Prokit mixer, reverb & equalizer, rough, $75. 212-219-3670.

Collins 212S-1 stereo broadcast console and 260S-1 expansion unit for 8 chnls, w/shop manual and extra parts/cards, in working cond, $395 + shipping. M Masters, 312-777-1700.

Ramko DC5AR 5 channel mixers, vgc, $225 each. 916-725-2434.

Want To Buy

Ampro AC Series, any cond. M Crosby, 408-363-1646.

RCA BC-7 in nice condition, Inovonics MAP II. G Goldsmith Consulting Engineers, POB 5786, Beverly Hills CA 90209. 310-696-0177.

WE 23C 5 channel console. B Davies, Virgo Productions, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Soundcraft 200B or Delta 24 chnls w/dbx modules. M Schackow, 307 4th Ave E, Lemmon SD 57638. 605-374-3424.

DISCO-PRO SOUND EQUIP

Want To Sell

Complete 8 trk, analog recording studio, demos, too many brands to list, no shipping, bring cash and come and get it, no reasonable offer refused. T Houston, Custom Audio, 929 California Ave, Bakersfield CA 93304. 805-324-0736.

JBL 2425H-2402H compression drivers, new in boxes, never used, 2402-H bullets, exc cond, $200; JBL 2426-H, $300/pr/BO, dbx 118 compressor/expander, exc cond, in box, $125; SAE 5000, inpulse noise reduction sys, remove clicks & pops, exc cond, $125. R Glenn, WIGR, 1718 Shannan Dr, Wimauma FL 33598, 813-634-1940.

EV Eliminator Twos, 2 way PA/mon spkrs, recovered, sounds great, $350/pr. W Kremer, Kremer Kraft, 301 SW 16 St, Ft Lauderdale FL 33315. 305-524-5652.

AudioWorks DataLink, AES/EBU digital cables; Studio Sound S305, vintage passive filter sets, rackmount, $175 ea. R Katz, Allegro Sound, 15004 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Yamaha DX100 synthesizer, works extremely well as FM digital tone module, 192 sounds on board, full MIDI, $150 + shipping; Roland Alpha June 2, 5 octave velocity sensitive keyboard synthesizer w/road case, great analog/digital sounds, also makes great MIDI master keyboard, $550 + shipping. J Bartus, Radio Active Productions, POB 2523, Marathon Shores FL 33052. 305-743-4248.

SAE click & pop impulse noise reduction unit, $185/BO. D Elliot, 25 San Raphael, Monarch Beach CA 92629. 714-489-5787.

Want To Buy

Roland DEP-5. S Russell, Russell Studios, 60410 Klett Drive, Decatur MI 49045. 616-782-9258.

UREI filter set. D Elliot, 25 San Raphael, Monarch Beach CA 92629. 714-489-5787.

FINANCIAL SERVICES

LIMITERS

Want To Sell

Collins 260-1 classic tube limiter, excellent original condition (1); Gates 5767 classic tube limiter/comp, BO/trade. W Kremer, Kremer Kraft, 301 SW 16 St, Ft Lauderdale FL 33315. 305-524-5652.

Orban Optimod XT-2, six band limiter for 8100A1, $1000 firm. R Wolfe, WDFM, 118 Clinton St, Defiance OH 43512, 419-782-9336

UREI BL-40 modulimiter mono compressor limiter SN632, $250. R Chambers, 916-257-2121.

Optimod 8100, $2500; 8000, $1000. K Leiw, KIAI, 341 S Yorktown Pike, Mason City IA 50401. 515-423-1300.

Want To Buy

Modulation Sciences CP-803 clipper, rack mount not necessary, must be in working condition. T Backer, Contract Engineer, WXHC FM, Box 386, Homer NY 13077. 317-472-9797.

903 (looking for 4) and 905 (looking for 2), just the modules, not the frame. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Fairchild 670 or 660 tube compressor/limiter, Teletronics LA-2A tube compressor/limiter or UREI LA-3A solid state compressor/limiter, call after 3PM CST. 214-271-7625.

MICROPHONES

Want To Sell

AKG C422EB large diaphragm stereo mic, incl remote pattern selector, 20 meter cable, windscreen and shockmount, exc cond, $1850. AKG D-140 dynamic cardioid mics, $225/pair. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Cooper CSPA-1 2 channel mic preamp with 48 V, m/s decoder & high pan filters, mint with power supply. Wolf, Ealing Recording, 312-784-1558.

Electro-Voice BK-1, condenser mic (cardioid) for vocals & instruments. live remotes, etc, battery or phantom power (3), $125 ea or all for $275 + shipping; Peavey PS-4AC, 4 chnl phantom power supply, AC powered, perfect for remotes and boards w/o on board phantom, $250 + shipping. J Bartus, Radio Active Productions, POB 2523, Marathon Shores FL 33052. 305-743-4248.

Telefunken/Schoeps CM61 tube mic, ext rare, uses std 6AU6 plug in tube, orig ps, new cable, mint cond, $2500. R Katz, Allegro Sound, 15004 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

RCA 74-B (Baby 44), Ampex 350-2 with tube amps & other quality equipment, closing up shop, for list, SASE to: C Fuller, 241 Douglass Way, Bolingbrook IL 60440. 708-739-0044.

RCA 77DX (1), RCA 44BX (1), both in exc cond, BO over $800 for either. R Burns, RF Studios, 1326 Highmeadow Drive, Garland TX 75040. 214-271-4386.

TEAC ME-120 matched pair, electret, slim, both omni & cardioid elements, windscreens, batteries, original cases, mike stand adaptors, $99 for both. J Sunier, Sunier Productions, 21 Stetson Ave, Kentfield CA 94904. 415-457-2741.

Electro Voice EV20, like new, only slightly used. $275. D Bohanan, Bohanan Broadcasting, POB 21829, St Simons Island GA 31522. 912-638-9502.

EV RE-15 in mint cond (2), $200. M Harrington. 501-223-9056

Telefunken, Sheops, Neaumann, AKG tube mics. Telefunken, Siemens. Tab tube mic pre's. RCA, WE, mics sale or trade. Tracy 615-821-6099, no calls after 10PM EST.

Manley Labs CR3A, new, $795 w/shockmount, windscreen & case, no risk trial in your studio. Also have used mics & everything else. Get our catalog! Liberal trade policy too. Audio Village, 619-320-0728.

Want To Buy

RCA 91-A; desk stand for model 44 mic. E Kovach, 1409 Oak St, Wyandotte MI 48192. 313-285-9710.

Ethnic community stn. in need of gd low cost mics and mic preamps. P Ryan, KYMC, 2122 Marconi Ave, St Louis MO 63110. 314-664-7080

CBS or NBC call letter plate for RCA 44 mic. M Harrington, 501-223-9056.

RCA 77DXs/44BXs ribbon, chrome/TV grey, good cond, BO. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Neumann U87s, KM84s, AKG 451s, EV RE20s, Sennheiser 421s. W Gunn 619-320-0728.

Select from these categories for best ad positioning:

Acoustics	Consoles	Software
Amplifiers	Disco-Pro Sound Equip.	Stations
Antennas & Towers & Cables	Financial Services	Stereo Generators
Audio Production (Other)	Leasing	Tapes, Carts & Reels
Brokers	Limiters	Tax Deductable Equipment
Business Opportunities	Microphones	Test Equipment
Cart Machines	Miscellaneous	Transmitter/Exciters
Cassette & R-R Recorders	Monitors	Tubes
CD Players	Receivers & Transceivers	Turntables
Computers	Remote & Microwave Equip.	Positions Wanted
	Satellite Equipment	Help Wanted

Classified Advertising Rates Effective January 1, 1994

	1x	3x	6x	12x
1-9 col inch (per inch)	$60	58	54	49
10-19 col inch (per inch)	55	52	49	44
Distributor Directory	100	95	90	85
Professional Card	65	60	55	50
Classified Line Ad		$1.50 per word		
Blind Box Ad		$10 additional		

To compute ad costs: Multiply the number of ad inches (columns x inches) by the desired rate schedule for your per unit cost. Example: a 3" ad at the 1x rate is $180, at the 3x rate $174, at the 6x rate $162, at the 12x rate $147, etc.

DISTRIBUTOR DIRECTORY

The following distributors serving the broadcast industry would be glad to help you with any of your requirements.

MICROPHONES...WTB

77-DX's, 44-BX's, WE KU-3A's On-Air lights, recording lights & audition lights. Top price paid. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131, FAX: 615-292-3434.

MISCELLANEOUS

Want To Sell

Apple A9M0305 wide carriage computer printer, 9 pin dot matrix, friction or tractor feed, gd cond, $45. D Howard, KBAS/KWAZ, 2636 Hwy 95, Bullhead City AZ 86442. 602-763-5227.

Snake, 16 phantom-pwrd inputs w/ext ps, 250' Belden 19 pr cable/mil connectors/ss strain reliefs, 10' Neumann XLR snake mates w/box or Belden snake, top qual, exc cond, $750/BO/trade. R Katz, Allegro Sound, 15004 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Aline 150-cart capacity wall mount style cart racks, qty (2), $100 ea; rack mount for Fidelipac CTR-10, $25. J BeliGerman, WHKX, 345 Office Plaza Dr, Tallahassee FL 32301. 904-942-9459.

27" Neon Hula Hoops w/sound packed 36/cs, $.90 ea. R Suraci, Fine Art Productions, 67 Maple St, Newburgh NY 12350. 914-561-5866.

Furman PB-40 Patch Bay, 1/4" plugs on front, RCA jacks on back, $50. G Hultman, Hultman Media, 300 Limpy Creek Rd, Grants Pass OR 97527. 503-474-6466.

JVC HR-S10U portable VHS recorder w/companion tuner/timer unit, $300 complete. R Streicher, Pacific Audio-Visual Enterprises, 545 Cloverleaf Way, Monrovia, CA 91016. 818-359-8012.

Want To Buy

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

Radio transformers by Chicago, UTC, Triad, Peerless, Freed, Sola, send list. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

MONITORS

Want To Buy

McMartin (buy & sell) any model. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886 or fax 402-493-6821.

RECEIVERS & TRANSCEIVERS

Want To Sell

Motorola SP3113171, multi-X XFL, 2 freq repeater, carrier squelch, & PL100.0 Hz, 10 w, RX158 mHz, TX152 mHz, $500. B Dickerson, WEAG AM/FM, 1421 S Water St, Starke FL, 904-964-5001.

SCA RECEIVERS—ALL TYPES

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DAYTON INDUSTRIAL CORP.
(Manufacturer)
2237 Industrial Boulevard
Sarasota, FL 34234
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MacIntosh M-1700 tube receiver, beaut cond w/wood case, one owner, factory serviced, $375. R Schweppe, WTMO, 7155 Clark Rd, Sarasota FL 34241. 814-925-7215.

McMartin EBS system, w/TG-2, EBS-2, AMR-1, worked when removed from service, $300/BO. C Ashworth, WMJR WBZA, POB 928, Glensfalls NY 12801. 518-792-2151.

Denon DRA-95VR 65 w/CH, pre-main loop, wireless remote, manual, black, like new in the box, will consider trade. D Fields, POB 194, Avoca AR 72711. 501-451-8803.

REMOTE & MICROWAVE EQUIP

Want To Sell

Marti RMC-15, 16 chnl remote control system, exc cond, w/manuals, $400. D Igou, KCHL, 8435 Twisted Oaks, San Antonio TX 78266, 210-651-9049.

Anixter Mark SH272GN/SH872GN set (2) STL dish antennas w/940-960 MHz dipole, like new cond, $1500. D Howard, KBAS/KWAZ, 2636 Hwy 95, Bullhead City AZ 86442. 602-763-5227.

Burk TC 8 w/relay panel, 110/92 kHz subcarrier & SCA rcvr, $2000/BO. C Ashworth, WMJR WBZA, POB 928, Glensfalls NY 12801. 518-792-2151.

Marti RMC-15, 16 chnl remote ctrl syst, complete in exc cond, w/manuals, $400. D Igou, KCHL, 8435 Twisted Oaks, San Antonio TX 78266, 210-651-9049.

Burk TC 8 incl relay panel, 110/92 kHz subcarrier & SCA reciever, $2000/BO. C Ashworth, WMJR WBZA, POB 928, Glensfalls NY 12801. 518-792-2151.

Moseley Digital Remote Control Systs, DRS-1 cntrl termnl, DRS-1 rem termnl, DRS-1 selection unit(2), DRS-1 station panel(2), DLS-1 sampling termnl, DLS-1 smplg interface, DLS-1 printing termnl, TAU-3 tolerance alarm unit, $400. B Lacy, WAVG, 806-359-4000.

Broadcast Products super roving radio, 28' self contained trailer, lks like giant boom box, complete w/air, elec heat & 6500 W Honda built-in gen, $25000. D Brown, CHYM/CKGL, 305 King St W, Kitzhonor, Ontario N2G 4E4. 519-743-2611.

Mobile Remote Unit, boombox, fully self contained, great attn getter, exc cond. W Grant, WZBQ, Drawer 4, Tuscaloosa AL 35402. 205-339-3700.

32 Foot Self Contained (w/generator) radio/TV mobile studio, equipped w/mic mounts, 75 GMC HC body style, price neg. WPTM, POB 910, Roanoke Rapids NC 27870. 919-536-3050 9-5 EST.

Marti M30 BT transmitter in the 160 band, used but working, w/cord & manual, $500. K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055, 405-658-2556.

Hilo Mast NK-9, 32 ft collapsible mast for remote vehicle, 25 lb air pressure to raise, locking collars, $1300/BO. W Borneman, WBYN, 280 Mill St, Boyertown PA 19512. 610-369-7777.

Marti M30 BT xmtr in 160 band, used but working, w/cord & manual, $500. K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055. 405-658-2556.

Burk TC-8, 5 yrs old, exc cond, in use, w/manuals & interface, $1100. J Murphy, WMXO/WMNS, 118 W Henley St, Olean NY 14760. 716-223-3591.

Moseley 505 xmtr & rcvr, type approved, upgrade complete, in perf cond, will sell as pair only, $3750. J Leutzinger, KFSB Radio, 2629 Dogwood, Joplin MO 64804. 417-624-1310

Want To Buy

Marti, TFT, or equiv 450 MHz receiver, pref dual freq. P Bjornstad, KDBS, 2100 W 11th, Eugene OR 97402. 503-686-6165.

SATELLITE EQUIPMENT

Want To Sell

Telesystems TCS-900 satellite telephone, INMARSAT, A-class, voice, data, anytime, anywhere, exc cond. H Norman, NDXE, 747 Wire Rd, Auburn AL 36930. 205-826-0390.

Scientific Atlanta 7450 receiver w/AD 7007 down converter, AD 7010 demod & AD 6305 block converter, w/manual, 2 years old. $1500. K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055. 405-658-2556.

Universal 100 SPCP satellite receiver, $300, Zephyrus 400 series satellite receiver configured for Satellite Music Network with LNB $850; complete KU band receive system; PICO HR-100 ereicevr, Panasonic LNB, 1.8 meter dish with mount, RG6 feed line, $500. R Place, WPEP, 401-455-7226 or 508-636-6707.

Wegener 1600 system receiver setup for Unistar, AM only, w/all cards for stereo, printer, sateve 400, TZM, w/manuals, like new, $3500. D Igou, KCHL, 8435 Twisted Oaks, San Antonio TX 78266. 210-651-9049.

SERVICES

CONSULTANTS

SATELLITE EQUIP...WTS

Scientific Atlanta 7450 receiver w/AD7007 down converter, AD7010 demod & AD6305 block converter, w/manual, 2 yrs old, $1500.K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055, 405-658-2556.

Avcom 7550 SAT rcvr, taken out of service, on Unistar AC II format, exc cond, w/manuals, $3000. J Leutzinger, KIXQ FM, 2620 Dogwood Rd, Joplin MO 64801. 417-624-1310.

Adcom 7550 exc cond, BO or trade. B Hill, KALK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9770.

Scientific Atlanta 7300/7325 DAT 32 terminal system w/all crystals, 7.5 kHz and Sedat decoder card. Exc cond, $3250. Call Richard at 404-482-9706

Wegener main frame and mini main-frame for Unistar. Paul, 612-222-5555.

Want To Buy

Fairchild or SA digital receiver. W Thomas, WIRO/WMLV/ POB 292, Ironton OH 45638. 614-532-1922.

SOFTWARE/ DATABASES

Want To Sell

STATIONS

Person to lease/purchase FM stn for small beach town in W coast of FL, monthly payments as low as $4000. Bill, 806-359-4000.

AM Station in lake reion of SE Kentucky, on 1590 w/night pwr, w/2000 sq ft brick bldg, tower, 5 acres on major hwy, all equipment, priced to sell. J Kesler, 606-843-9999.

Investors for new FM stn to be built in Rocky Mountain area, 25 kW, good university town, serious investors only, no job seekers. Hawkeye Radio, 5546-3 Century Ave, Middleton WI 53562.

CP-25 kW in Rockies, 2 hrs from Denver, serious inquiries only. Hawkeye Radio, 5546-3 Century Ave, Middleton WI 53562

CGA SG-1E composite stereo generator for vintage CCA model FM-40E exciter. Working or serviceable cond, documentation required. C Dunnam, Linear Research Assoc, 5244 Perry City Rd, Trumansburg, NY 14886, John Douglass, call back. 607-387-3411.

TAPES/CARTS/REELS & CD's

Want To Sell

County Music Library (70s & 80s), 10" reels, most w/play lists (38), must take them all at $5 per reel, $190. D Howard, KBAS/KWAZ, 2636 Hwy 95, Bullhead City AZ 86442. 602-763-5227.

ITC, Audiopak, Scotchcart carts, various lengths from :20-10.5, $1.50 ea, as is. J BellGerman, WHKX, 345 Office Plaza Dr, Tallahassee FL 32301. 904-942-9459.

ABCO wire carousel cart racks (3), 500 cart cap, lk new stnless steel, list at $628/will sell for $350 ea/BO. B Kohtz, KBAY-FM, POB 6616, San Jose CA 95150. 408-370-7377.

10" reels (450), Bonneville Ultra format for production use. $5/ea or $2000/all. B Hill, KALK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9770

250 Asst'd artists pre-recorded cassette tapes, $.50 ea + shipping; 100 ass't CDs, various artists, $275. R Suraci, Fine Art Productions, 67 Maple St, Newburgh NY 12350. 914-561-5866.

Audiopak A-2 country music library on cart, 1925 A-2 country carts 1970-1992, recorded in stereo, $3 ea. P Berger, WROE, POB 1035, Neenah WI 54957. 414-725-4447.

Audiopak AA-4 music length carts w/stereo oldies fmt (500), $2 ea + shipping. S Winkey, KXIC/KKRQ, Box 2388, Iowa City IA 52240. 319-254-9500.

TM Century 10.5" reels, Christian praise & worship w/some contemporary APX 85 reels, $350/BO would consider trade: southern gospel CD library, etc. D Fields, POB 194, Avoca AR 72711. 501-451-8803.

Used & new carts 40s, 70s, 2 min, 2 1/2 min, 3 min, 3 1/2 min, 4 min, 4 1/2 min, 5 min & longer lengths, several hundred, $1 ea, you take all. M Taylor, KNEO Radio, POB 845, Neosho MO 64850. 417-451-5636.

Sony L-500 Beta videotape, high qual (no dropouts), 2 hrs at Beta II, 1 hr at Beta I, used once only for digital audio, 500 tapes left, $1 ea any quantity. J Sunier, Sunier Productions, 21 Stetson Ave, Kentfield CA 94904. 415-457-2741.

Scotchcart II's, 1000 btwn :40 & 7:00, most are btwn 2:30 & 5:00, all in exc cond, $1.89 ea. R Burns, RF Studios, 1326 Highmeadow Drive, Garland TX 75040. 214-271-4386.

3M/ITC, Scotchcart II's, like new 4.5 & 5.5 min carts, $1.50 ea for 100, smaller qtys $1.70 ea. D Nuechterlein, WUCM, University Center MI 48710. 517-652-6863.

Audiopak AA-3, more than 300, from :40 to 7:30, $2 ea. M Siegel, 800-560-6670.

Pams Jingles ref tapes, 1951-1976, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625.

Karsky's rewind loop carts. Also sell reconditioned carts. Service guaranteed. Call 605-348-9928.

Want To Buy

45s, LPs of 50s, 60s, pop, C&W, radio transcript of Beatles, Elvis, etc, must be in very gd cond, for personal library

D Fields, POB 194, Avoca AR 72711. 501-451-8803.

Robert Hall production music discs from the 60s & 70s, particularly interested in news sounders, etc. D Bohanan, Bohanan Broadcasting, POB 21829, St Simons Island GA 31522. 912-638-9502

Fidelipac/Audiopak Mastercart II gold or AA-4 light blue in 2:30 through 4:00 lengths, must be in vgc, call after 3PM CST. 214-271-7625.

TAX DEDUCTIBLE

Want To Sell

High School Educational FM station in San Jose, CA desperately needs donation of FM modulation monitor & cart machines. J LoBue, 89.3 KLEL-FM, 6677 Camden Ave, San Jose CA 95120. $08-268-6343.

School accepting working TV/Radio studio equip, PA/remote gear, computers, etc, receipt provided. M Adelman, 3400 SW 17th Place, Cape Coral FL 33914. 813-549-2726

Non-commercial college station needs mono cart machines, 1/3 rack width size, ITC, BE, etc, will pay shipping and documentation confirming deductable donation. E Ford, KBPK, 321 E Chapman Ave, Fullerton CA 92634. 714-992-7418.

TEST EQUIPMENT

Want To Sell

Delta OIB3, operating impedance bridge, exc cond, in padded container, $1150. C Stuart, POB 1236, Susanville CA 96130. 916-257-2702.

General Radio 916 AL Impedance bridge, 100 kHz - 5 mHz, w/manuals, cables, fresh calibration, $325 firm. C Scott, WKYU-FM, Western KY University, Bowling Green KY 42101. 502-745-5489.

General Electric ST-2A bench type oscilloscope works good, $50 or will trade for working Heath 10-12 oscilloscope S Gardner, 3-G Enterprises, POB 387, Hillsville VA 24343 703-728-9114.

Oscilloscopes, Tektronix 130BR, $150; Tektronix T921 (15 MHz), $200; Telequipment 4 MHz portable, $100; Boonton 202H RF signal generator, $100; HP 330B distortion analyzer, $100; Lambda 71 (AC 0-500 V DC 0-200 V @200 mA), $100; Lambda LYD5-152 (+/-12 V DC & +/-15 V DC), $75. R Place, WPEP, 401-455-7226 or 508-636-6707.

Anaconda #9300 sweep spectrum analyzer, $1950/BO/trade; Philips PM6507 curve tracer, $1450/BO/trade. R Katz, Allegro Sound, 15004 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

General Radio 916AL impedance bridge, 100 kHz - 5 MHz, w/manuals, cables, fresh calibration, $325 firm. C Scott, WKYU-FM, Western KY University, Bowling Green KY 42101. 503-745-5489.

TRANSMITTERS

Want To Sell

LPB AM25 low pwr AM carrier current xmtr & matching network, $450. G Wise, 102 Perkins Bldg, Richmond KY 40475.

RCA BTA-1R AM on 1230 kHz, needs work, as is, $1000. C Ashworth, WMJR WBZA, POB 928, Glensfalls NY 12801. 518-792-2151.

Collins 830F-1A, 250 W power amplifier, excellent condition, complete w/ spare tube & manual, $1500. K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055. 405-658-2556.

Raytheon 1944 250 watt, original stn xmtr, works well, tuned to 1490 kHz, rare find, $1500. W Histed, 813-294-4111.

TRANSMITTERS...WTS

Gates FM1B, 100 watt FM xmtr, 104.9, removed from full-time service in 1991. L Nelson, WSRS, POB 1327, Russell Springs KY 42642. 502-866-5969.

Spare parts for CCA AM50,000D, including, HV transformer, mod. transformer, mod. reactor, HV filter choke, tube sockets and more. Call Transcom Corporation 800-441-8454 or 215-884-0888.

ITA 1000, 1 kW FM xmtr, new finger stock & tuning assembly w/manual & harmonic filter, $1500; Collins 830-F-1A 250 W pwr amplifier, exc cond, w/spare tube & manual, $1500. K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055, 405-658-2556.

Rotron CXH 33433A xmtr blower, gd working cond, used as standby, $200; Eimac 3CX3000 A7, new, tested but not used, $475; Eimac 3CX3000A7, rebuilt by Econco, tested but not used, $375; Eimac 3CX3000A7, used 3 years, still good when removed, $75. B Murphy, KVRH AM/FM, 7600 C.R. 120, Salida CO 81201. 719-539-2575.

McMartin BA-1 K, excellent condition, tuned to 1450 kHz, kept in AC'd room. R Vega, WOCN, 350 NE 71st St, Miami FL 33138. 305-759-7280.

Gates BC1J recently taken out of service, gd cond, $2000. J Yinger, WLQV, 29200 Vasser Rd Ste 650, Livonia MI 48150. 810-477-4600.

Want To Buy

Tepco/Hones J317 or J317-2, single or dual 10 watt translator; Gates TE-3 exciter pref in working order w/stereo generator. J Stromquist, WNCB, 2828 Piedmont Ave, Duluth MN 55811. 218-722-3017.

Late Model 10 kW, prefer low power, single phase, will consider package w/exciter tuned to 100.7; low power 4 bay antenna tuned to 100.7; 40 foot Rohn 25G tower. A Harle, 503-265-5000.

Collins 20-V, 20-T or RCA BTA-1M(X). Pref CA, NV, AR area. G Goldsmith, Consulting Eng, POB 5786, Beverly Hills CA 90209. 310-696-0177.

50/25 kW AM, older okay if in gd cond & spare parts included; phasor, LTUs, etc also needed for 2 twr single pattern. B Zellmer, KSIR, Box 2475, Greeley CO 80632. 303-353-6522.

McMartin AM/FM xmtr, any model, exciter or stereo modules. Goodrich Ent., 11435 Manderson, Omaha NE 68164. 402-493-1886.

TUBES

Want To Sell

Gates BC-1-T gd shp, spare tubes incl w/tuning unit tuned to 1230 kHz, price neg. M Hendee, KLWT, Rt 2 Box 29, Lebanon MO 65536. 417-532-2962.

4CX250B, 4-400, 833, 813, 5CX1500, 4-1000, all types, full warranty EIMAC, Amperex, RCA. Westgate 800-213-4563.

Want To Buy

New US/British 6550 vacuum tubes, no China or USSR please. R Glenn, WIGR, 1718 Shannan Dr, Wimauma FL 33598, 813-634-1940.

TURNTABLES

Technics SH15B3 tumtable base, new in box, $250, plus shipping. Klay 801-272-1814.

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