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AES Show  
Product Review, p. 18

# Radio World®

Vol 15, No 19

Radio's Best Read Newspaper

October 9, 1991

## EIA Looks Into DAB

by John Gatski

**WASHINGTON** Getting a jump on the NAB and other broadcast-related organizations, the Electronic Industries Association (EIA) has formed a subcommittee to "direct development of a unified digital audio radio (DAR) technical system."

According to EIA's Consumer Electronics Group VP Gary Shapiro, the subcommittee will centralize DAR (EIA's acronym for DAB) technical analysis, conduct testing of DAB systems now being proposed and select a system for standardization. The subcommittee was scheduled to have its first meeting Oct. 18 in Washington.

"We do have expertise" in standards setting, Shapiro said, referring to the MTS stereo standard that was adopted for television in the mid-1980s, and many other audio standards developed over the years by EIA.

Shapiro said the subcommittee will have a budget and a timetable for testing digital broadcasting systems.

Shapiro speculated that the subcommittee would also take into consideration satellite and cable broadcasting of digital audio, but he said the details have yet to be worked out.

Systems testing could be similar to MTS stereo with the EIA setting the guidelines, but contracting to an outside laboratory. That has not been decided yet, according to Shapiro.

In terms of input from other organizations that are interested in DAB, Shapiro said "the NAB has been contacted."

Subcommittee Chairman Randall Bruns of Delco said, "there is a need to centralize DAR (DAB) activities under a common, objective umbrella. I hope that other industry segments will support the subcommittee's work."

The NAB has been an early proponent of over-the-air DAB, initially pushing for the out-of-band European Eureka 147 system. Recently, however, the NAB has softened its stance on in-band FM systems.

Because of the newness of the technology and the rapidly increasing number of digital audio broadcasting systems being proposed, Shapiro said selection of a system will take some time, but he does not believe it will take as long as the high definition television broadcasting system selection process that has been underway since the late 1980s.

## WCBS Embroiled in EBS Furor

by Frank Beacham

**NEW YORK** WCBS AM and FM, the CBS network's flagship stations in Manhattan, are embroiled in a controversy over their failure to relay emergency information about Hurricane Bob to other stations participating in the Emergency Broadcast System (EBS).

The network has admitted that its

AM used pre-recorded attention signal tones during EBS announcements on Aug. 19—the day the hurricane moved toward Long Island. WCBS-FM chose not to participate in the emergency network at all that day, but did not notify other stations dependent upon its emergency signal.

The controversy, which has resulted in the resignation of the vice chairman

of New York's EBS oversight committee, once again bolstered criticism that the traditional broadcast emergency warning system is prone to failure during an actual emergency.

WCBS AM and FM are both CPCS-1 stations (Common Program Control Station #1) under New York's EBS plan. This means both stations have accepted responsibility to relay emergency information along a chain to other stations, which monitor their signals and await their transmission of an emergency activation tone, according to EBS guidelines.

The controversy began to unfold in late August when New York's Newsday newspaper reported that New York State Emergency Communications Committee Vice Chairman John W. Nelson, had dropped WCBS-AM from the state's EBS system as a result of the Aug. 19 incident.

### Dropped, then reinstated

At the time, Nelson said he also would recommend to the FCC that WCBS be dropped from the national EBS plan.

Following the Newsday article, Nelson said he was told to stop making public statements about the WCBS incident by

(continued on page 7)



**Here Comes the Sun:**  
Construction begins on KTAO, a solar-powered station in New Mexico. For details, see page 30.

## Firms Start Talks on Digital I/Os

by Alex Zavistovich

**SAN FRANCISCO** Broadcast equipment manufacturers have taken the first step in developing a broadcast-specific standard for interconnection of digital equipment.

A quickly-convened meeting of manufacturers was held at the King George Hotel Friday, Sept. 13, during the NAB's Radio 1991 convention here.

Spearheaded by Harris' Bob Weirather, the meeting also included representatives from QEI, TFT, MacroMedia, Orban, Greg Labs, BE, Gentner, AKG, Otari, Dolby, Prophet Systems, 360 Systems, Antex and C&C Systems.

While a variety of concerns were raised during this first meeting, by the end, two main areas of standardization were decided—file interchange for studio-oriented gear and composite baseband RF. A second meeting was tentatively scheduled to

(continued on page 9)

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## NEWS BRIEFS

### EEPA Seminar Slated

**NEW BRUNSWICK, N.J.** The Electromagnetic Energy Policy Alliance (EEPA), in conjunction with Rutgers University, will conduct its fourth annual short course, Oct. 16-18, on management of electromagnetic energy hazards.

The course will be held on

Rutgers' Cook College Campus and will instruct attendees on what scientific research has found about the effects of electromagnetic energy, including RF radiation, on humans.

Speakers will include consultant Richard Tell, president of Richard Tell Associates; Ronald Peterson, AT&T Bell Laboratories; David McCallum, Colum-

bia University; and noted RF researcher Eleanor Adair, John B. Pierce Foundation Laboratory.

For more information, call 908-932-9271.

### ESPN Radio Network to Debut

**NEW YORK** The ESPN Radio Network will make its on-air debut in January. The joint ABC-ESPN venture will feature weekend broadcasts of sports news and commentaries.

The ventures hopes to garner

200 station affiliates by early 1992. ESPN will produce the programming; ABC plans to sell the service. The network is not planning to carry live or taped sports events.

### "Hot Country" via SEDAT

**ATLANTA** Unistar Radio Network is the first IDB Communications Group customer to convert to Scientific Atlanta's SEDAT digital audio transmission system.

On Jan. 1, Unistar will trans-

mit its 24-hour live satellite broadcast of the "Hot Country" format to subscriber stations via the SEDAT system. Unistar has been using Scientific Atlanta's DATS system.

The major radio networks converted to SEDAT from Scientific Atlanta's DATS system last summer.

### New VOA Director Named

**WASHINGTON** Charles "Chase" Graves Untermeyer has been named new associate director of broadcasting for the United States Information Agency and director of the Voice of America (VOA).

Untermeyer, 45, succeeds Richard Carlson. He will oversee Radio Marti, TV Marti, and USIA's Film and TV Service (WORLDNET). Previously, Untermeyer served as President Bush's White House director of personnel and as assistant to the president.

### NAB Urges Relaxation Of Ownership Rules

**WASHINGTON** The NAB continues to urge the FCC to ease ownership rules for group ownership of radio stations in order to "give greater clarity to time brokerage and joint venture rules."

The association's statements echo earlier support for an FCC proposal to relax the ownership rules. "Easing the restrictions would likely provide better diversity and not impede minority ownership," the NAB said.

Opponents of relaxing the ownership rules believe such a move would have the opposite effect because it would create a monopoly by group owners and would stymie diversified programming.

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## INDEX

<b>Mixes Lead to Spurious Signals</b>	13
by Cris Alexander	
<b>Understanding the FCC Self-Inspection Report</b>	14
by Harold Hallikainen	
<b>What to Do Once You're Hit</b>	15
by John "Q" Shepler	
<b>Making the Transition to Digital</b>	16
by Mel Lambert	
<b>Planning for Security On Station Property</b>	26
by Barry Mishkind	
<b>The Amazing Multiple-D Mic</b>	27
by Bruce Bartlett	
<b>Life and Times of Major Armstrong</b>	28
by George Riggins	
<b>KTAO-FM Lets the Sun Shine In</b>	30
by Dee McVicker	
<b>Workbench</b>	32

Wheatstone Corporation

Circle 60 On Reader Service Card

# RBDS Group Tackles Codes, AM

by Judith Gross

**SAN FRANCISCO** A group trying to standardize codes for a U.S. Radio Broadcast Data System (RBDS) needs more input from the industry on how to identify stations.

In addition, the RBDS subcommittee of the NRSC wants to begin efforts toward a system for AM stations as well as FM.

NRSC Chairman Charlie Morgan said that at the group's meeting during the Radio 1991 show here, members voted to get input and proposals on an AM system.

To date, the RBDS (it is called RDS in Europe) system has been proposed only for FM. It uses a station's 57 kHz subcarrier to identify stations and help listeners tune to their desired format. It can also switch automatically to alternate frequencies and can be employed for emergency alerting.

A system for AM has not been developed, and there are concerns that it may not be compatible with AM stereo systems, according to questions raised during a session on RBDS at Radio 1991.

But in seeking AM proposals, Morgan emphasized that the work toward a system for FM would continue. "I do not believe we should hold up an FM system for AM," he said.

The committee is also tackling the thorny issue of format codes. While station calls have been identified through a

numerical formula, a station has the chance to identify its music programming by selecting a PTY code.

### Three coding options

Originally 29 codes, with titles like "country," "classic rock," "jazz" and "light" had been identified. Now the NRSC is proposing three options.

Option A is a shorter list consisting of nine PTY codes. Option B would break it down further into 20 codes, while Option C would delete the feature from the U.S. standard entirely.

Morgan said more information was needed. "We want to look at the effects of the PTY codes, the switching between them, and get more input, especially from station managers," Morgan said.

He added that the problem with choosing PTY codes was that stations would feel them to be either too narrow in more diverse formats or too broad in highly competitive markets where there are only slight nuances between formats.

Another question remaining before an RBDS standard can become final is how compatible an already installed paging network operated by Cue Paging is with the RBDS standard.

### First tests work

Cue Paging originally proposed a modification to the European standard that would accommodate its network, but

a group of receiver manufacturers was concerned about compatibility.

Cue Paging President Gordon Kaiser reported that tests done this summer showed that the paging system would be compatible with RBDS. "We were confident all along that it would work," Kaiser said.

Terry Beale, representing Delco, confirmed that the paging system had functioned well when it came to the program service feature which identifies call letters. "Our tests showed that it would work on some radios," Beale noted, but he said more tests would

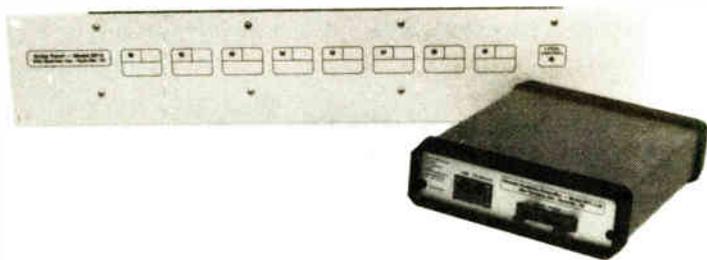
have to be done.

"We still need to test the PTY code and AF (alternate frequency) switching functions," Beale said. He noted that the tests should be done this fall and the results presented at the committee's meeting during the winter CES show.

Kaiser said Cue was confident about the next round of tests. "In theory, all features should be the same. If one works, the others should. The radio doesn't distinguish between features," he noted.

Morgan said that the committee hopes to have a draft standard for RBDS ready by next April.

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# Sights and Sounds of Radio '91

by Judith Gross

**SAN FRANCISCO** I'm not going to tell you where I left my heart . . . you know that already. Not a bad Radio 1991 show, all in all, despite some of the heavy feeling in the air due to the economy. No doubt about it, the stations are feeling it. But staying alive nonetheless.

Some of the digital gizmos we saw peeking their heads out at the spring show: processors from Cutting Edge and Gentner, store and play from ITC and Fidelipac, and workstations-with-a-radio-bent from Wheatstone and Arrakis were ready for prime time.

Too bad that some of the technical and non-technical scheduling presented



dilemmas for conventioners. For instance . . . why did they have to schedule the heavy-duty session on HLTs (highly leveraged transactions) right across the hall from and at the same time as the one on RBDS (Radio Broadcast Data System)?

Then there was the AMAX campaign. Finally, something for those concerned about AM improvement to get excited over, but whoops! It followed too closely on Mario's fireside chat. The Governor of New York is a tough act to follow (ask former NYC mayor Ed Koch) even if he isn't running for President.

But enough grousing for now. On the high side, the DAB bus demo of Eureka 147 was a marked improvement on the over-scripted dog-and-pony show we got treated to in Vegas.

There were more A-B comparisons, thank you, and darned if the (unprocessed) digital signal didn't sound fuller

and cleaner than the FM, which, because of the lay of the land, was usually multipath-ridden and suffered from receiver blending.

Course, it still wasn't up at L-band frequencies. That should come later. Maybe at next spring's NAB show. Or will it? We'll have to see if the Air Force parts with any L-band for DAB first, no doubt.

And this time, on the bus route, the gap filler was more than just window-dressing. It was actually needed for one block of the ride. But I wish we'd gone higher up some of those wonderful San Francisco hills.

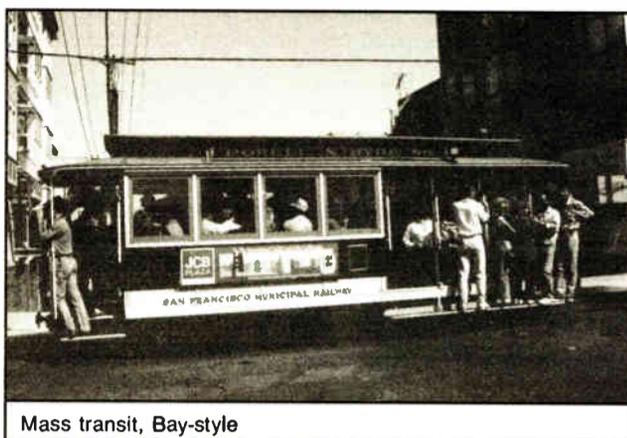
Not just because it would have made the multipath reduction more dramatic, mind you. I would have loved to see how the big cruiser negotiates those nose-bleed inducing streets.

Controversies flared up over the NAB's desire to have Eureka work on a "narrow-band" if not actual "in-band" system. Entercom's Joe Field said NAB's continued negotiations with the Europeans still looked a lot like a conflict of interest.

Joe's DAB session, by the way, was interrupted by a live radio chat from President Bush. He and NAB's Eddie Fritts exchanged some pleasantries from the session room.

And we've got a few new acronyms for you as a result of these DAB sessions. How about: IBOC, for in-band, on-channel, which a lot of broadcasters like Odeon favor because it won't disrupt things so much. The Acorn folks said they've found a way to do it, but will show no DAB before its time. Expect it in the spring.

Then, may I suggest, IBAC, for in-band, adjacent channel? Which several broadcasters and the NAB's John Abel point out carries many of the same problems as NB, or new band, also known as



Mass transit, Bay-style

extended-band or new spectrum DAB.

Can't seem to come up with a catchy acronym for that last one. How 'bout NEB, for "new-expanded-band?" If you can do me one better on that one, fax it to me.

Well, the Eureka folks seem to be saying that in-band, or even narrow band is a formidable challenge, and who wouldn't agree? You got your basic capture problem, adjacent channel interference and multipath mitigation to solve.

The IRTX's Dr. Georg Plenge called for a cooperative group of all in-band proponents, under the direction of the NAB, to work together to solve these problems.

Whoa, now. Isn't NAB still negotiating a royalty/licensing arrangement with Eureka 147? And didn't they just ask Eureka to develop a narrow-band DAB on the FM band, effectively placing them squarely in competition with U.S. companies (USA Digital, ADR, Mercury Digital, DATA et. al) attempting to do the same thing?

Might this be a case of "You show me yours and I'll show you mine?" OK, but you first, right?

I would think a U.S. developer of DAB would not be too anxious to rush into such a cooperative arrangement. First let's figure out who has the most to gain from whom.

Then there was Ted Schober's emotional plea to engineers attending the Digital Radio Seminar to oppose the quest for L-band and the attempts by NAB to get too closely aligned (I believe his exact words

were "in bed with") one particular system.

Ted's point, unfortunately lost in the fact that a technical session may not have been the most receptive environment for such a far-reaching exhortation, was that some smaller private developers trying to fund and gather support for their systems are perhaps being hurt by the impression that NAB's endorsement of Eureka has pre-decided the outcome of the DAB horse race.

Oh well, it was Friday the 13th. And would whomever made off with my Jason mask please return it? I don't want to wake up some night and see a knife hovering over my bed. Then again, maybe it was that DAB fiend from the "Fiend or Foe" session in Vegas.

OK, in case you didn't make it to the show . . . or even if you did and spent too much time inside the convention center . . . here's my favorite street ride (yeah, they do go halfway to the stars).

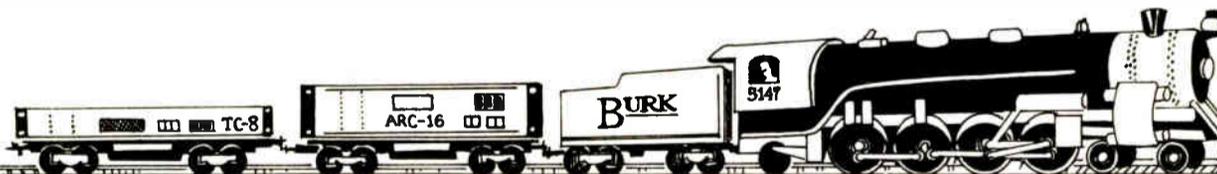
And here's a few furry friends out on the wharf expressing their points of view



The San Francisco Pier 39ers

on DAB. Their exact quote is "Ark, ark, ark, ark, ark."

And about my heart . . . I believe you'll find it somewhere between North Beach and the Bay. Maybe Vesuvius, near Jack Kerouac Alley. Or try Mel's Diner. Have a juicy tidbit, wisecrack, rumor, innuendo or something silly to say? Spill those guts out to Earwaves by faxing JG at 703-998-2966, writing to PO Box 1214, Falls Church VA 22041, calling 703-998-7600, or whispering to the wind. Maybe there's an RW mug in your future.



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A buss is a bus

Dear RW,

It's annoying to see a trade publication consistently perpetuating a common misspelling of a technical term.

The electrical/electronic circuit serving as a common source or common destination is a *bus*, not a *buss*. Check IEEE references.

A "buss" is a kiss; "buss" is a registered trademark of the Bussmann Manufacturing Co. for some of their fuse products.

Like a street bus, an electrical bus is a facility that accepts "riders" (signals) from a variety of possible sources and carries them to a variety of possible destinations. It has nothing to do with kisses and is not a fuse. It's a bus. Let's not encourage a whole generation of radio technicians to believe otherwise.

R.H. Coddington  
Richmond, Va.

*Editor's note: Actually, the term describing a point in a circuit where a number of connections come together is written as "buss" in a variety of reference books (most notably "The Mechanics of Sound Record-*

*ing," by Tony Zaza).*

*Mr. Coddington is correct, however. "Bus" with a single "s" is the only accepted spelling of the word as listed in the IEEE's "Standard Dictionary of Electrical and Electronics Terms," 4th edition. (By the way, "bus" is also the spelling preferred in the Radio Shack dictionary—another electronics heavy-weight.)*

*Because it must be conceded that the IEEE's spelling of English terms relating to electronics is the definitive one, RW will henceforth also adopt the spelling "bus." We will, however, continue to use "busses" in the plural, in accordance with grammatical conventions. Apologies to all who might have been led astray by us in this matter.*

Importance of labeling tape

Dear RW,

Bruce Bartlett's tips on audio recording are good, and they remind me of a problem that has probably happened to everybody—the erasure of a master tape.

That happened to me once, and I vowed it would never happen to me again. Now I am in a position of coaching production room personnel and I always direct them to label the tapes immediately. The tapes without labels all look alike, so a label can make a big difference.

We also recycle tape that has been

Amid the excitement of the NAB's Radio show, one moment of clear thinking shone through—a first step toward a national broadcast-specific digital interconnection standard.

Equipment manufacturers are to be commended for taking this step, which will put digital technology for radio on more solid ground.

Some may say that a de facto standard for pro audio digital I/Os already exists—the AES/EBU standard is widely accepted the world over for connecting one piece of studio gear to another. There are, however, numerous others in the running (such as the Sony-Philips format and even proprietary interfaces) that serve to complicate the issue.

What's more, none of these pro audio "standards" really addresses the problems on the RF side of the issue. As more companies take the plunge into digital, broadcasters need to be assured that the system components they are piecing together will be able to speak to each other without having to convert back to analog several times along the way.

Digital I/O Meeting Is Good Idea

From the attendance at this first meeting, it was clear that the problem is taken seriously by all facets of the equipment industry. Comments from those in attendance

supported a solution that would be quick in coming and would mean an improvement for the industry rather than merely a status quo.

What was left undecided, however, was whether the industry should seek the endorsement of the NAB or some other trade association once a standard has been framed.

Such an endorsement would be worthwhile to pursue. Even though the equipment manufacturers are clearly well-intentioned, there are legalities involved in the writing and implementation of a standard that may be handled more ably by a group with a track record of such work. Whether it is the NAB, EIA or other association, affiliation with a professional group could add credibility to the standard—and ensure the necessary legalities are followed in its creation.

A broadcast-specific digital interface standard has been a long time in coming, and represents a positive step for radio in general; it indicates a willingness to cooperate for the greater good of the industry.

Manufacturers who heard about this meeting too late to attend should contact Bob Weirather of Harris Corporation to learn more. It is in everyone's best interest to contribute to the effort, and help guide us all into the new era of digital technology.

—RW

did not fall away as expected. I had to do some fancy editing to get around that one!

We seem to have to learn things the hard way. I guess it started way back with Adam and Eve.

Ronald R. Cone, chief operator  
WGN  
Chicago, Ill.

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Next Issue  
**Radio World**  
October 23, 1991

L-Band Dream Could Be NAB's Curse

by William K. Keane

**WASHINGTON** For over 20 years the aerospace industry has utilized L-band radio spectrum (1.5 GHz) for flight testing aircraft and missiles. Industry and government have invested over a billion dollars in facilities designed to carry out this test function. Thus, the Aerospace and Flight Test Radio Coordinating Council (AFTRCC), an aerospace industry association, has participated actively in the policy debate regarding a spectrum allocation for digital audio broadcasting (DAB).

While AFTRCC's interests in preserving the L-band for flight testing are not the same as broadcasters', one cannot help but be struck by the convergence in the positions of the two groups. It is no exaggeration to say that the aerospace industry and much of the broadcast industry—for separate reasons—now share a common position in opposition to L-band reallocation for DAB. By contrast, the position of the National Association of Broadcasters (NAB) in favor of the L-band seems increasingly shaky and in need of review.

NAB has said that it adopted its L-band position in order to preserve broadcaster options for a transition to digital transmission, and to preempt or delay the advent of satellite-fed

DAB. Recent developments, however, have thoroughly undermined this view.

NAB's chosen technology—the European Eureka 147 system—was not designed for operation at L-band, but rather at lower frequencies. A recent report by the European Broadcasting Union Technical Committee concludes that the frequency range between 60 MHz and 250 MHz is most suitable for terrestrial DAB transmission, with the latter representing the upper limit for unimpaired reception in moving vehicles.

GUEST EDITORIAL

In addition, development of an L-band system would be disruptive to the structure of the industry. Implementation of L-band systems could entail radical changes in the coverage areas of existing stations: Broadcast owners who paid the premium to acquire wide coverage Class C FM stations could find themselves facing much expanded coverage from Class IV AM operators, for example.

Lastly, in-band system proponents have shown encouraging progress in developing DAB systems to accom-

modate existing broadcasters. To be sure, much work remains to be done in order to validate these early returns. However, enough is already known to suggest that an in-band approach—one which allows broadcasters to add digital transmission to their existing analog systems when, as and if they determine to do so—offers the smoothest, most economical and least disruptive transition to the brave new world of DAB.

All of which brings us back to NAB. In light of the above, should not NAB reconsider its position? L-band represents one of the least attractive of all the possible homes for terrestrial DAB, nor is it in any way a "stopper" relative to satellite competition; on the contrary, by arguing for the L-band, NAB gives aid and comfort to the very adversary it set out to defeat.

All in all, NAB's position reminds one of the ancient Chinese curse: "May all your dreams come true." Broadcasters—and NAB itself—should hope that its L-band dream does not come true.

William K. (Ken) Keane, a partner in the law firm of Winston & Strawn, Washington, D.C., represents the Aerospace and Flight Test Radio Coordinating Council.



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# WCBS Caught Up in EBS Furor

(continued from page 1)

John F. Kelly, chairman of the committee. Nelsen said that Kelly also asked him to apologize to WCBS.

Nelsen told RW he has resigned his unsalaried position due to "a lack of trust" in his judgment by his EBS superior.

Kelly subsequently reinstated WCBS AM and FM to the New York EBS system and said he is conducting his own investigation of the matter.

Browning said they are waiting for a report from New York officials before deciding what action the FCC might take in the WCBS case.

## FM declines to participate

While the snafu at WCBS-AM caused New York-area broadcasters to miss EBS warnings, WCBS-FM chose not to participate in the EBS program even though it is a designated CPCS-1 station and EBS

tion and we just say, 'you know what, we're in the middle of a music set and we're not going to do it,' then somebody gets killed by a tornado. Are we liable? I think so."

Although a lot of people blame DJs for EBS problems, Caracciola said, "this is a case of dropping the ball at the management level."

In a letter he wrote to the New York EBS Committee, Caracciola said he was considering monitoring an EBS station other than WCBS.

George Drake, vice president of WLIM, Patchogue, Long Island, wrote the New York EBS committee that its EBS receiver also was not activated by WCBS-AM. "My own personal view is that the present EBS system is antiquated and cumbersome, at least for the relaying of emergency messages," he said.

**"State activation and participation is voluntary. There are no guidelines that indicate that you have to make a position known at the time."**

— Helene Blieberg, CBS Radio

Asked to re-state his charges against WCBS, Nelsen said, "I've been told to disavow those quotes. Read my lips. I am not permitted to discuss anything that relates to this."

Although initial New York media quoted WCBS officials as saying the stations complied with their EBS responsibilities on Aug. 19, WCBS officials declined to directly comment to RW.

Two network-level CBS officials, however, later described to RW what happened. "The on-air news people did receive activation," said Tony Masiello, vice president of technical operations at CBS Radio. "Unfortunately they assumed they were just tests like everything else they had been getting. They did not listen to the message. They were quite busy dealing with the hurricane news story on their own."

## Played-back tones

"When they finally realized it was not a test but an activation," Masiello continued, "they recorded the whole message on reel-to-reel and that's how they played it back. They thought they could just cue it up from the top and play tone and all."

Masiello said the tone was off-speed when played back on an analog tape recorder, and that is why WCBS-AM failed to trigger other stations' EBS receivers. He contended, however, that no FCC rule actually prohibits playing a tone off a tape.

"The only thing the rule indicates is you have to issue specific frequencies," he said.

Frank Lucia of the FCC's EBS office said the use of pre-recorded EBS tones "is an FCC violation, and stations found using such tones could be subject to substantial fines." He said stations must use FCC type-accepted EBS tone-generating equipment and no tape recorder of any kind has ever been approved by the FCC for that purpose.

The use of pre-recorded tones by stations has been the subject of several FCC public notices. A warning was issued May 15 following KSHE-FM's broadcasting of taped EBS tones during a skit portraying a nuclear attack. The public notice also warned that only the EBS encoder is authorized to generate the EBS tones.

In 1974, the Commission released an order (FCC No. 74-1285) which found tape playback not sufficiently reliable to produce the two-tone EBS signal within required tolerances.

Lucia and FCC EBS Director William

monitors were tuned to its frequency.

"WCBS-FM did not participate," said Helene Blieberg, director of communications for CBS Radio. "State activation and participation is voluntary. There are no guidelines that indicate that you have to make a position known at the time."

The FCC's Lucia said that participation by a CPCS-1 is voluntary. But, he said, "there is an unwritten obligation that they (CPCS-1 stations) will serve the community with the EBS half-tone. The broadcasters on Long Island, where many of the stations were supposed to monitor WCBS, have got to take the initiative and say alright, either CBS is going to have to prove this is not going to happen again or they should change it."

Some New York-area broadcasters, who depended on WCBS AM and FM for emergency information, criticized the stations' handling of EBS Aug. 19.

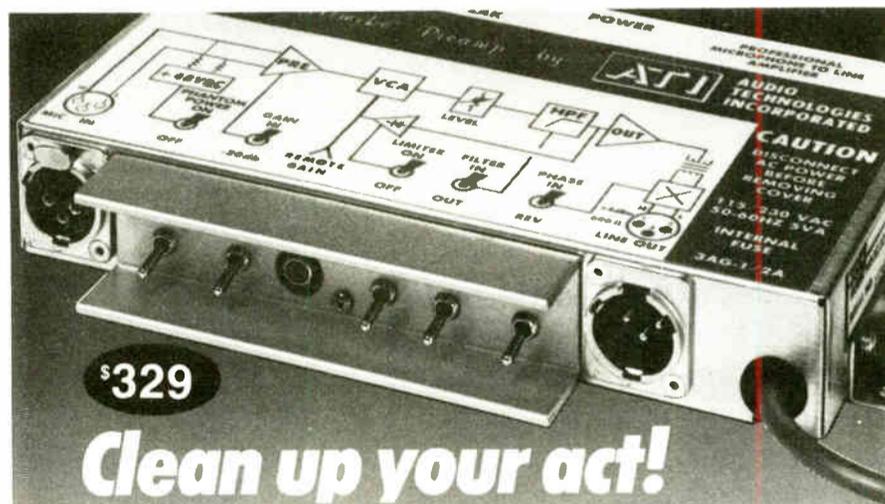
"It's an ethical obligation," said John W. Caracciola, chief engineer at WDRE-FM, Westbury, N.Y., whose station monitored WCBS-FM. "What if somebody depends on our station for emergency informa-

## EBS still a high priority

Although its FM declined to participate in the recent EBS alert, WCBS apparently still considers EBS a high priority at both stations—based on a grant request pending before the Federal Emergency Management Agency (FEMA). Both stations have submitted a grant request for a new power generator and 6,000 gallon fuel tank for EBS use. The exact amount of the grant has not yet been filed but is estimated to be about \$250,000.

Masiello said the FEMA request was made to help upgrade the existing government-owned equipment to meet new federal environmental standards regarding underground fuel tanks.

Lucia said FEMA should be made aware of WCBS's recent EBS performance. "The FEMA people should be made aware of what happened so they can make a correct decision. If the station (WCBS-FM) is not going to participate in EBS at the state and local level, I think FEMA should know because the generators are intended to provide backup to stations that will participate in state and local EBS."



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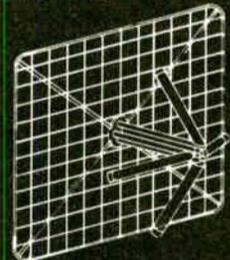
Lucia said broadcasters may make changes to New York's EBS system as a result of the WCBS incident.

"I know WCBS is pretty embarrassed by this," he added. "They are one of the big stations in New York City. It's kind of funny because for the past 30 years the CBS Radio Network has participated in our national level tests on a voluntary basis. They have committed air time, announcers, travel and personnel. They've done a lot of good."

All was not bad news concerning the EBS during Hurricane Bob, according to broadcasters. New York broadcasters were pleased that a new satellite-delivered, state EBS system, now being implemented, did get the word out to some stations. WALK-FM, Long Island, reportedly became a de facto control station as it received its EBS information straight from Albany.

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# DAB Session Critical of NAB's Stand

by Judith Gross

**SAN FRANCISCO** Criticism of NAB's DAB position and calls for support for on-channel, in-band DAB systems dominated a Radio 1991 session titled, "DAB: How Will It Affect You?"

In a lengthy session interrupted by a ten-minute live radio address from President Bush in the White House, previous "foes" of the NAB's policies were given a chance to air their views.

Among them were moderator Joseph Field, president of Entercom and member of the Radio Operators Caucus; Randy Odeneal, partner in Sconnix Broadcasting and opposition member of the NAB's DAB Task Force; Ron Strother, who has proposed his own DAB solutions as president of Strother Communications Inc.; and Arthur Kern, chairman and CEO of American Media, who has criticized the NAB's DAB policies in other recent conventions.

Defending NAB's DAB positions were Alan Box, president of EZ Communications and chairman of the DAB Task Force; and Michael Rau, senior VP of Science & Technology.

The harshest criticism came from Field, who deviated from the traditional moderator's role by making a presentation that compared a new-band DAB system scenario against one in which an in-band system was chosen.

The previous day, NAB Executive Director of Operations John Abel had

said that despite NAB's recent encouragement of in-band systems, including a possible one to be developed by Eureka 147, NAB would continue to pursue a royalty/licensing arrangement with the European consortium.

Abel also said that interested broadcasters could join in and share in the royalties as well.

Field said that NAB should protect the industry's interests by adopting an in-band, on-channel DAB approach, similar to one suggested by USA Digital (Gannett-CBS-Group W), which would "save the industry from massive internal division."

## Too alluring?

He also said that while he hated to ask this question, he had to ask "could it be that the allure of perpetual royalties from Eureka is so alluring that it eclipses all other considerations?"

"Shouldn't the NAB policy be to terminate negotiations with Eureka, adopt an in-band on-channel policy and seek impartially to pick the best system to achieve that goal?" he asked.

The promise to let broadcasters share in the royalties does not mitigate the situation, Field added. "The NAB should not be in a conflict of interest with its membership to any degree whatsoever."

Field noted in his presentation that a new-band DAB system brought with it the threat of unfavorable regulatory action from the FCC, including a "use it or lose it" approach to commencement of DAB

operations and the threat of new program channels and increased competition.

Like Abel the day before, Field noted that this would be true even if an in-band off-channel (Mercury Digital, ADR, and others) were selected.

He also criticized the NAB's quest for L-

casters and listeners.

Kern noted that even today, many markets are "over-radioed" and many stations are financially strapped. He said consumers want as little confusion as possible and the lowest cost for receivers.

"The fact is, we have a damn good system . . . The listener can't really distinguish between DAB and a well-processed FM station today," Kern maintained. He said the right decisions would be made "if



NAB's Radio 1991 DAB session included a discussion of new-band versus in-band options.

band spectrum for Eureka, a part of the spectrum also sought by satellite broadcasters.

"If we get co-primary status in L-band, we will be providing the launching pad for satellite by pushing the development of DAB (receivers) and carrying satellites on our back until critical mass," Field said.

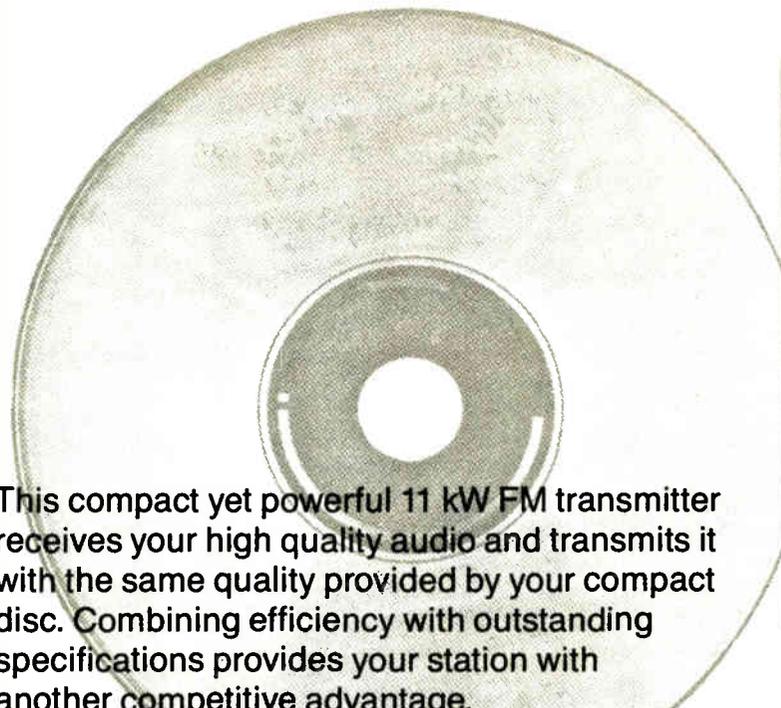
Odeneal and Kern agreed that in-band, on-channel DAB made the most sense from the point of view of both broad-

the consumer made the call."

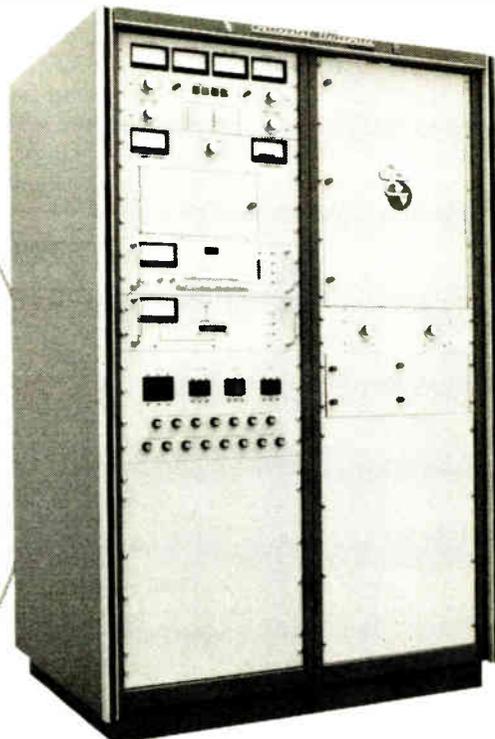
Odeneal said the list of "plusses is extensive" in an in-band, on-channel DAB system. "Better to build a new house on our own lot. The receivers should parallel today's FM receivers in their handling of stereo. If present, it is received; otherwise the reception is mono."

Strother, who has been investigating first adjacent in-band DAB systems, (continued on next page)

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# Manufacturers Discuss Digital Interconnection

(continued from page 1)

coincide with the Consumer Electronics Show (CES) in Las Vegas this coming January.

At the outset of the interconnection meeting, Weirather touched on topics to consider in drafting a standard. These topics included data rate selection, parallel or serial technology, and problems of bit reduction or data compression algorithms. He pointed out that it is likely that no single standard could solve all the problems of interconnection.

Weirather's framework for a standard included making it voluntary. He also stressed that it should be "nothing proprietary." If the standard is something everyone can share, "it makes the playing field level, then we can all compete on the quality of our products," Weirather said.

He also commented that any standard should be decided upon quickly. "This is not going to be a three-year program," Weirather commented, adding that the group should recognize that "engineering is a compromise" and that there may not be a perfect solution.

Manufacturers then raised their own concerns about a digital standard. QEI's Bill Hoelzel maintained that sample rates should relate to an existing stereo standard—that is, either 19 or 38 kHz. He added that for simplicity's sake, equipment should use serial rather than parallel design and be capable of accepting some timing or clock. Others present commented on the problems of clock slippage.

TFT's Joe McMurphy raised a point that was subsequently echoed by others in attendance—that any interface agreed upon should mean a real improvement in quality, not just a status quo.

Orban's Bob Orban noted that it would

be "desirable to examine existing standards for the economies of scale provided by them." Commenting that a sample rate of 38 kHz is an "oddball standard," he suggested that a sample rate of 32 kHz might be appropriate. Orban also agreed with serial rather than parallel system design.

Another concern brought to light during the meeting involved "headers" for digital storage systems, such as those made by MacroMedia, 360 Systems, Prophet Systems and Otari, which provide information about compression algorithms employed in the storage of data. Problems of "cascading" of compression schemes also were raised, as were audio and speed tradeoffs in editing of compressed data.

In the end, Otari's John Carey divided the issue along the lines of file storage and transmission. Regarding pro audio equipment, he said, "let's not reinvent something that already exists," and recommended the adoption of the AES/EBU standard as the "digital spigot."

Carey also noted that a joint AES/SMPTE working group is examining a standard for connection of digital audio equipment such as workstations and storage products, and suggested that manufacturers of such equipment take part in future AES/SMPTE meetings.

As for the issue of composite baseband RF, BE's Ed Anthony volunteered to lead an industry subgroup to investigate the interconnection options possible for transmission equipment.

During the meeting, Harris' Weirather stressed that while he did not try to contact every maker of digital equipment, the meeting was not intended to be exclusionary. He said he hoped the "media will help spread the word" about the existence of the group and any future meetings.

## NAB Takes Heat on DAB

(continued from previous page)

agreed that L-band efforts should be minimized. But he noted that the development of an acceptable in-channel DAB system was a challenging task.

He said a separate system for AM on the current AM band "will push the envelope on the laws of physics" and could result in a "major disruption of the AM band."

Strother called for establishment of "an independent, unbiased group to objectively test and evaluate DAB systems."

### Too early to predict

Neither Box nor Rau answered the criticisms leveled at NAB's DAB policies directly.

Box said that "DAB is an evolving and therefore constantly changing technology" and noted that there is still a "void of knowledge" on in-band systems.

He also said that WARC allocations for DAB, as well as the regulatory approach to be taken by the FCC were "impossible to predict."

Box also said that a problem such as a possible "use it or lose it" regulation would be a negotiable point with the Commission, and that "it shouldn't be overburdensome to broadcasters." He added that "we are making too many assumptions to be accurate in our predictions."

Rau noted that a new-band DAB solution

may offer broadcasters some options not available with an in-band approach. He said one possibility to offset the threat of competition from new program channels would be to require broadcasters to turn in current AM and FM spectrum once critical mass with DAB receivers was reached.

He said another approach would be to sell DAB receivers that do not receive current AM and FM channels. "If in-band development goes along with out-of-band, we would shoot ourselves in the foot by creating a whole scenario of new services competing with each other," Rau noted.

He added that "if an out-of-band DAB service is implemented, I would encourage the industry to continue to improve AM and FM service perhaps by developing and standardizing a digital broadcasting technology that is not for audio, but for data."

Rau said that instead of broadcasters fearing the demand for new program channels and narrow-casting which appears to be the wave of the future, they should become the providers of such services, the way Pepsi developed products like Diet Pepsi and caffeine-free Pepsi.

He encouraged broadcasters to take charge of their own destinies and future, and noted that "to the lions of the jungle, the jungle appears to be a promised land."

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# Chickens, Eggs and AM Radio

by John Gatski

**WASHINGTON** Which came first—the chicken or the egg? Or more aptly, which will come first: the production of AMAX-certified radios or the demand for those radios?

The NAB seems to be trying to influence both with its AMAX radio receiver promotion that kicked off Oct. 1. AMAX is the voluntary AM receiver certification mark that the NAB and Electronics Industries Association (EIA) agreed to push last summer so better

AM radios would be developed.

To meet the standard, radios must have an improved frequency response over the

the features. There also is an AMAX Stereo certification for AM stereo radios with the aforementioned features.

**... According to the Sanyo spokesman, consumers do not buy auto receivers on the basis of tuner features ...**

current telephone receiver-like quality now available, external antenna connection, noise blanking, wide-narrow bandwidths and the expanded band among

In light of the EIA/NAB agreement, NAB has enthusiastically kicked off an ambitious, nationwide promotion program to create consumer demand for better quality AM radios. This will be accomplished by getting hundreds of AM stations to donate free air time (up to 30 spots per week) to promote AMAX radios, as well as joint promotions with local electronics outlets.

Judging from receiver manufacturer reaction, AMAX will experience the "chicken or the egg" dilemma—just like AM stereo.

Realizing this, the NAB is trying to walk a fine line by "offering a little chicken and a little egg" to create consumer demand and get manufacturer assurance with its AMAX promotion program, according to the NAB's AM Receiver Manufacturer Liaison Committee Chairman Ted Snider.

But NAB has to be careful with this program because there are very few radios out there right now that meet AMAX criteria. The association has wisely decided to space out its promotion effort over the next year to lessen the chance of creating too much demand for the radios. The NAB will just push hard enough to whet consumer appetites for receivers with better specs.

Snider said the promotion will be kicked off for two months in October and November with a break until spring

when promotions will be resumed.

Another break will follow until late summer, when stage three of the campaign will begin to highlight the 1993 AMAX products. By then, companies should see that demand is growing, and they will be willing to make more AMAX radios, or so the thinking goes.

Based on receiver manufacturer reaction to AMAX, it seems that to launch an all-out promotions blitz right now would definitely create expectations that could not be met.

They are correct. At press time, the AMAX radio availability score sheet reads this way: Delco offers five units as factory or dealer-installed options for GM cars. They are the UX1, U1A, U1B, U1G and U1H (for those of you who want to order them on your next car). And yes, they all are stereo.

With regard to home units, Denon said the NAB "super tuner" will be produced by spring, and engineers are checking to see whether the company's

## CUE and REVIEW

existing mobile receivers meet or could meet the standard with little modification.

Carver's TX11B home tuner reportedly is nearly AMAX certifiable, but does not have bonafide AM noise blanking. GE also has a radio that is nearly ready, according to Snider.

Receiver manufacturers I have talked with said late 1992 or early 1993 would be the earliest a large number of AMAX units could be produced.

However, company officials cautioned that they are going to be watching NAB's promotion effort very carefully to see how the market responds.

While there is enthusiasm for NAB's and EIA's AM efforts, a Sanyo spokesman said companies remember the recent track record of AM products—including AM stereo's sluggish consumer market and station penetration.

According to the Sanyo spokesman, recent market trends show that consumers do not buy auto receivers on the basis of tuner features, but on tape player and power considerations. AM tuner features are even less of a priority.

Additionally, he said, even if AMAX takes hold, there may be a reluctance to go beyond the AMAX mono to AMAX stereo radios—unless the demand is solid.

A Sony representative agreed. He noted that Sony "got burned" in the early 1980s when it introduced its AM stereo home tuner that received several stereo broadcast formats.

Sony applauds the efforts to clean up the AM band, including AMAX. But receiver production still will be based on market conditions and demand, the spokesman explained.

Let's hope the NAB's AMAX campaign will stimulate both the chicken and egg a little so these radios can be produced. AM deserves it. Cluck, cluck.

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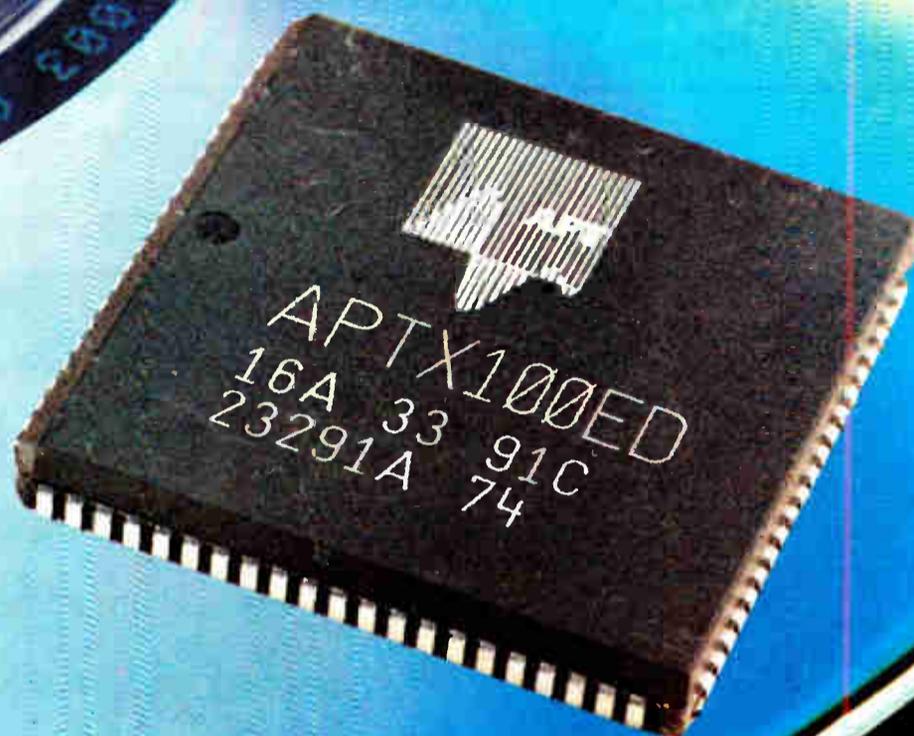
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WorldRadioHistory

# Florida FM Faces Tower Move

by Paul Rebmann

**ORLANDO, Fla.** A recent federal court decision could force the FAA to require a Florida station to move its existing broadcast tower array, according to an attorney representing the station.

In a federal court case brought by the Greater Orlando Aviation Authority (GOAA) against WWNZ in Orlando, the Eleventh Circuit U.S. Court of Appeals found that a 1989 FAA decision not to consider a proposed airport near the station's tower site was "arbitrary and capricious."

The court has ordered the FAA to reevaluate the WWNZ tower construction while considering the proposed airport, which could mean the tower may have to be moved.

Edward Hummers, of Fletcher, Heald & Hildreth, representing WWNZ in the federal case, warned that the federal court's decision could set a dangerous precedent, "affecting the erection of communications towers throughout the United States."

Hummers said that WWNZ plans to appeal for a rehearing before the full circuit court. In the GOAA appeal, the case was heard by a three-judge panel of the court.

## FAA policy not applicable?

WWNZ had sought and eventually received FAA approval in 1989 to construct its tower array, allowing a power increase from 5 kW day/1 kW night to 50 kW day and night. The towers were completed in early 1990.

In deciding the appeal of the FAA decision, however, the U.S. Circuit Court in Washington found that the FAA's long-held "first come, first served policy," used in allowing WWNZ's tower construction, "does not meet the FAA's congressional mandate of promoting safe and efficient use, and preservation of navigable airspace."

The court also cited a previous court ruling that found as long as the FAA receives notice of "the second structure before the end of the time allocated to receive comments on the proposed hazard," it must be considered.

In the WWNZ case, the airport already was under construction before the FAA received notice of either the proposed tower or airport. The GOAA, however, did file formal notice of the proposed airport before the deadline for comments on the WWNZ towers.

Even though the FAA had been involved in planning for the proposed reliever airport, it did not receive formal notice of the exact location and coordinates of the airport site until after WWNZ had filed notice of proposed construction of its towers, according to filing records.

## New airport

The new Orlando airport is required to handle the increased air traffic caused by the rapid growth of the Orlando-Disney World area, according to a Florida Department of Transportation study.

An area 1.5 miles from the station's towers is preferred by GOAA over several other identified sites where an airport could be built in the west Orange County, planners said.

The GOAA succeeded in halting construction of the WWNZ towers for a short time in late 1989 (RW Dec. 13, 1989)

through a local injunction, which was lifted after a Lake County Planning Board upheld the building and zoning permits for the tower construction (RW

Dave Murray.

After failing at the local level, GOAA appealed the FAA decision in the federal courts, while simultaneously appealing

## The court has ordered the FAA to reevaluate the WWNZ tower construction while considering the proposed airport . . .

Jan. 10, 1990).

The tower array was erected and the station began broadcasting from the site in early 1990, according to WWNZ CE

the county board finding in the state courts.

In commenting on GOAA's opposition to the towers, Murray said that WWNZ

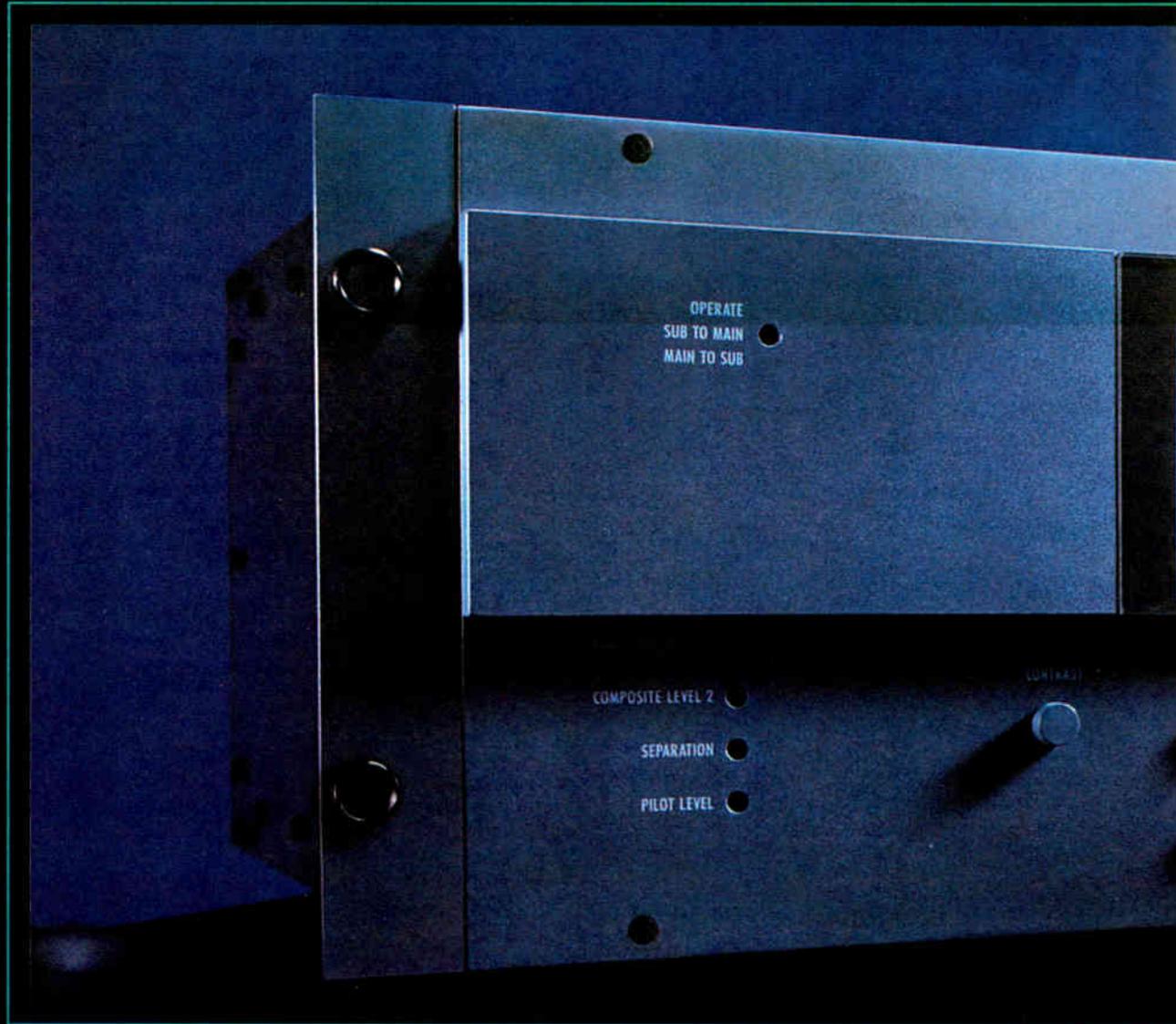
"did everything we were supposed to do" in getting approval for the towers and that they "did not hear about the airport until they got ready to build."

The airport authority also has appealed the original zoning case in local courts, which found in the radio station's favor on a jurisdictional matter, according to Jerri Blair, the attorney representing WWNZ in that case.

If the federal ruling is upheld, Hummers said the "FAA could in the future be unlikely to find that any tower is an efficient use of airspace." He also cited the problem of no published standards for determining when a structure is a hazard to navigation.

Blair also commented on the federal case in that it "impacts on any person or entity seeking to build a tower, in not knowing when it is clear to go ahead."

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# Mixes Lead to Spurious Signals

*Editor's note: This month, RW introduces a new column, Feed Line, by Cris Alexander, director of engineering for Crawford Broadcasting Co., in Dallas. The monthly feature will focus on aspects of broadcast transmission.*

by W.C. "Cris" Alexander

**DALLAS** Recently, I had the opportunity to examine a midwestern FM station with a frustrating signal problem. The Class C2 station, with its transmitter site in a suburban location, was being wiped out in a large portion of the urban area

by a spurious signal. The spurious signal was the result of a mix between two other stations.

There are situations nationwide in which the frequencies of different FM stations in an area can be multiplied, added and subtracted to produce unwanted products. Many times these products wind up on unused channels and no one notices them.

### Another station's frequency

In a few cases, however, the resulting undesirable product lands squarely on top of another local station's frequency.

In the case described above, the problem was created as a result of a 2A-B multiplication and mix. Doubling station

tion's signal. How can mixes like this occur and what can be done about them? Such mixes can occur in any non-

## Master antenna users are less likely to cause problems than are discrete antenna users . . .

A's frequency and subtracting station B's resulted in a product that appeared as co-channel interference to the third sta-

linear device. This includes just about every conductor or semiconductor in one situation or another.

A classic example would involve a galvanized downspout connected to the horizontal rain gutter, which often becomes rusted at the joint. If the downspout or the gutter is in an area of strong signals from two or more stations, the rusty joint often will mix the signals and the metal gutter/downspout can radiate the resulting signals. This situation, although troublesome, usually causes trouble only in the immediate vicinity of the offending rain gutter.

Perhaps worse is a situation involving a guy wire on a tower. A corroded joint in the wire can act as a non-linear device. With the guy wire in a very high field from a couple of stations, a mix can occur. With a lot of punch because of the

## FEED LINE

high RF fields and a pretty good re-radiating antenna (the guy wire itself) high in the air, such a mix can cause trouble over a wide area.

Other mixes can occur in the power amplifier stage of one of the stations' transmitters. This is particularly troublesome in cases where two stations share the same tower and their antennas are located adjacent to one another. RF energy from one station's antenna can induce a voltage in the other station's antenna, travel down the feedline into the transmitter and mix with that station's signal.

The result is often an undesirable product not very many dB below the level of either station's carrier.

### Benefits of measurement

The first two examples above involve elements that often are beyond the control of the broadcaster. Fortunately, such mixes are not impossible to track down. Normal direction-finding techniques often will lead right to the source of the trouble.

A third example, where the mix occurs right in the transmission system of one of the stations, is within the control of the broadcaster. If you think that the spurious measurements that the FCC requires you to make every year are unnecessary, think again.

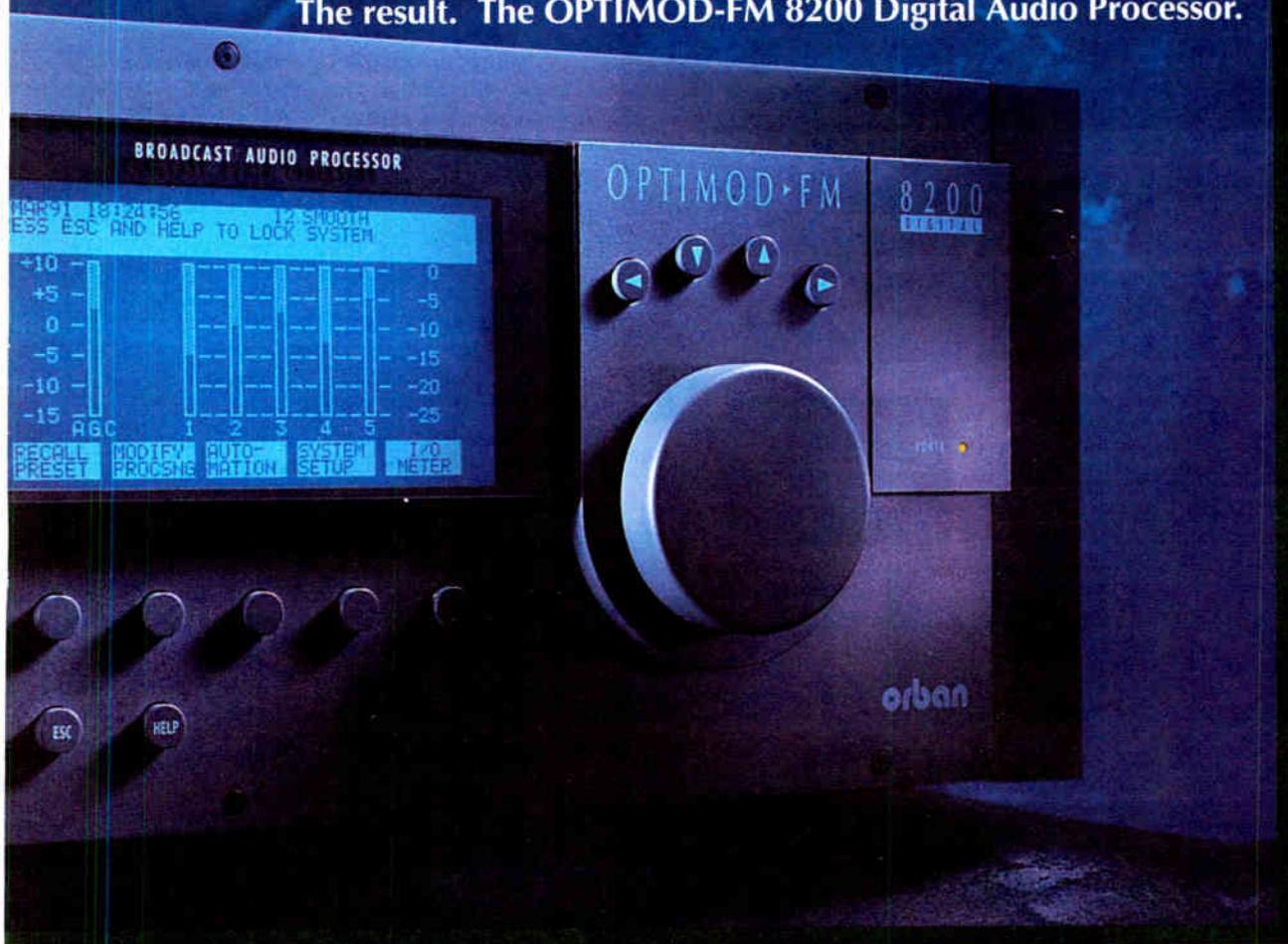
Yes, it's true that your transmitter's spurious and harmonic output is probably more than 90 dB below carrier, but what about in-band products generated in the final amplifier stage as a result of mixes? Those aren't going to show up while operating into a dummy load.

An annual check of such spurious (continued on page 25)

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# Understanding the FCC Self-Inspection Report

by Harold Hallikainen

**SAN LUIS OBISPO, Calif.** The FCC's Self-Inspection Report is a pilot project, currently being tested by the Commission.

The "mail order inspection" reminds me somewhat of the old station license renewal forms. Those forms required fairly detailed reporting of station parameters. They also required submission of a "composite week" of

logs. The composite week consisted of individual days randomly chosen through the license period.

The new station inspection report is more detailed than the old renewal form. It may be compared with inspection checklists the FCC uses in its own inspection of stations.

This month, we'll review this form question by question. This should be a good way to check compliance of your station, whether or not the

FCC has asked you to submit a report.

## Where are your current station authorizations posted?

73.1230(a) requires station licenses and other authorizations to be "posted" at the licensee's principal transmitter control point. At all other control points, ATS alarm monitoring points, etc., a photocopy of the current authorizations is to be posted. Since the transmitter can be controlled from the transmitter site, it is suggested that a copy of the current authorization (license, CP, renewal card, etc.) also be posted there.

73.1230(c) allows licenses to be posted on a wall at the control point or placed in a binder readily available at the control point.

Remember also that 73.1400(c) and 73.1500(d) require the FCC to be notified within three days of the initial use of a control or ATS point other than the main studio or transmitter site, unless "responsible station personnel" can be reached at the studio or transmitter when the remote

## INSIGHT ON RULES

control operator is elsewhere. The FCC should be able to always phone the operator (or knock on the door) and say "shut this thing off, you're causing interference to airplanes."

## Are you operating under a construction permit or a station license?

If you're operating under a station license, everything on the license is correct and current, right? Perhaps your license authorizes 10 W while you're running 10 kW. Perhaps your license says the transmitter is (based on latitude and longitude) in the middle of Lake Michigan, but it is not. Are the monitor point descriptions accurate?

When a new license shows up, don't treat it as junk mail. Before posting it, read it and make sure it is accurate.

If operating under a CP (program test authorization) as outlined by 73.1620, you are authorized to run an "automatic program test"—unless you happen to be a directional AM station.

Directional AMs must submit an application demonstrating proper operation of the directional array at least 10 days prior to the desired program test start date. Stations operating under the "automatic program test" must submit an application for station license within 10 days of starting operation.

Also, if construction involves replacement of the main transmitter or the installation of stereo or subcarrier equipment, 73.1590 requires equipment performance measurements (EPMs) to be completed.

These EPMs demonstrate compliance with the occupied bandwidth specifications and are *not* an "audio proof," as was required years ago. AM stations that are just beginning operation and have installed an NRSC-1 audio filter are exempt from making the measurements until June 30, 1994, by 73.44(e).

Other stations doing transmitter replacement or subcarrier or stereo equipment replacement must complete the EPM. In addition, "Please provide the file number of the construction permit or station license." If your records are current, this should be easy.

## Are your station authorization(s) posted or immediately available at all control point(s)?

As mentioned above, this is required by 73.1230(a).

73.1400(c) and 73.1500(d) require the FCC be notified of the addresses and phone numbers of all control points within three days of their initial use, unless an operator can be reached at the transmitter or studio. I don't know if the FCC will compare what you put on the form to what they've been "notified" of, but I'd suggest the FCC be notified of all control points, no matter what.

## Are your auxiliary broadcast (FCC Part 74) licenses posted or immediately available? (if applicable) (74.432(j)).

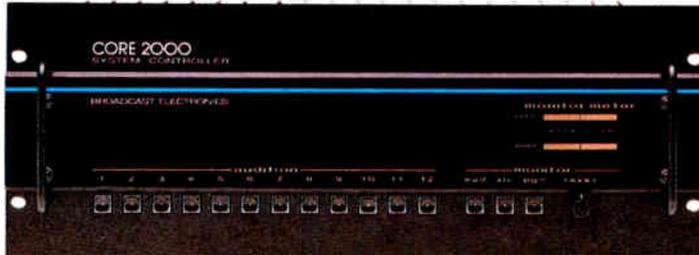
This section requires STL, RPL, TRL (continued on page 25)

# REVOLUTIONARY,

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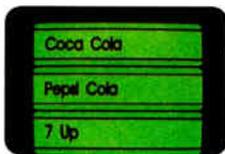


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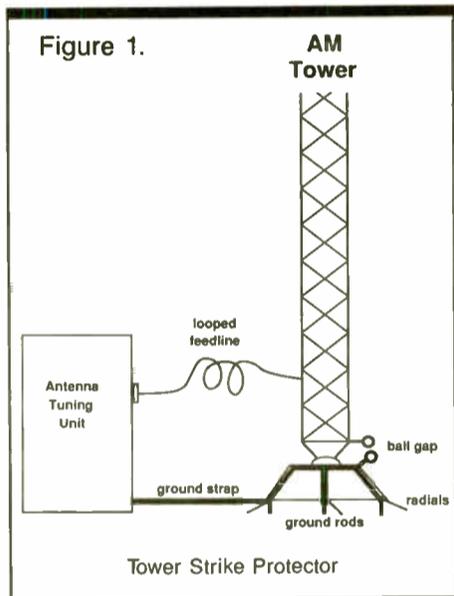
# What to Do Once You're Hit

by John "Q" Shepler

**Part IV**

**ROCKFORD, Ill.** Now you're standing in the transmitter room, gazing at the black clouds swirling above the tower beacon. It's warm and dry in here. There are flashes of lightning in the background, much like camera strobes going off a couple of times a minute. It doesn't look too bad through the window, but how will the tower fare this time? Will the charge be dissipated? Or . . .

All of a sudden the tower itself is lit in a bluish glow. There are white bolts of electricity jumping across the insulators and down the guy wires. For a second, you don't hear anything. You stand staring at the eerie scene outside.



In another second, the sound hits. First, you hear the transmitters dump. Both of them. Then the shock wave of thunder rocks the building. You've been hit—and hard.

**Smart guy**

The afternoon drive announcer impulsively punches the remote Plate On buttons from inside the studio. The FM transmitter comes back immediately. The AM doesn't respond. Next, you hear the blower of the auxiliary AM transmitter. "Smart guy," you think. "He's going for the other transmitter."

In a minute, the Aux is on and normal programming is resumed. That other transmitter has you bothered, though. What's wrong? Why didn't it come back? Hmm. Something doesn't smell so good, either.

Your first impulse is to pop the cabinet back and see what's going on in there. Don't do it. Get out of that room and stay out until you see blue sky again. You can assess the damage when it's safe.

The way to keep your transmitters from being damaged by lightning is to make sure the lightning never gets to them. Think also about this: The same measures that keep lightning from getting into your transmitters also prevent lightning from getting to you. Make sure the lightning currents get dissipated outdoors.

There is only one sink with enough capacity to absorb a lightning strike and that's the earth itself. Your first defense is an excellent ground system. The tower, ground rods, radials, ground screen and studio ground strap all tie together to create a low impedance connection with the earth.

FM towers are easier to deal with than AM towers. The tower itself is not being used as a radiator, so there is no reason not to connect it to an excellent ground. I've seen some stations depend on a single three-foot copper rod or even a reinforcing rod in the base concrete, to provide a ground.

**Conductivity**

Not good enough. You need at least several 10-foot galvanized steel or copper rods to get enough conductivity. Some companies sell a chemically treated rod to improve the soil conductivity. In really rocky or dry areas, even more extreme measures may be needed.

Connect the tower to the ground rods with three- or four-inch copper strap. Run that strap underground into the transmitter room and bond the transmitter cabinets to it. The studio ground strap, which might be only one- or two-inch copper, is soldered to the larger transmitter/tower strap.

AM antenna fields get some extra grounding from the radials and ground screen that are part of an AM array. These definitely help, but unless your tower is sitting in a marsh, the radials may be bone dry and not that conductive to the earth. You may still need the grounding rods to get down

to moist soil.

The big problem with AM towers is that most of them are insulated. True, you do have the static drain choke to provide a DC path to ground. For a direct hit though, you need a path for much larger currents.

ungrounded towers. Some stations have two-way or RPU antennas also hanging on their towers. If the tower is not grounded, say on an AM tower, you need a high voltage isolator for each feedline. The higher the voltage you can get, the better.

## Q-TIPS

The nice thing about lightning is that it's lazy. It takes the least impedance path to ground. You can create a short jump path with a ball gap. One steel ball is connected to the tower, the other to the base and ground strap. Adjust the gap between them so there are no sparks at full modulation on a moist night. Don't forget to cut the power before you touch anything.

To further encourage lightning to jump the gap rather than go into the tuning unit, put a couple of big turns in your AM feed wire before it connects to the tower. This forms an inductor that won't upset your tuning, but has an increasing impedance to higher lightning frequencies. Lightning energy can be significant at even 10 MHz or 100 MHz.

Figure 1 shows these various lightning protection schemes. FM antennas and feedlines should be securely bonded to the tower every few feet for grounded or

**Lightning surges**

One more item. Make sure your AM coaxial feedline is large enough to handle normal power requirements plus lightning surges. One station put in line that was too small in diameter. The line isn't destroyed by the strikes, but the bullet connectors get fried every year.

If you can't afford to replace your line right now, your best defense is to lower power when the storms approach. Lower powers are effective because the lightning seldom destroys the connectors directly. Instead, lightning sets up an arc from the center conductor to the shield. The transmitter power feeds the arc until the connector burns up. Lower power levels often don't have the energy to sustain an arc.

The next technical topic for this column is how to protect your transmitters from whatever lightning artifacts get into them. Next month, though, I want to cover a more important topic: how to protect *you* in dealing with transmitters.

John Shepler is an engineering manager, writer and longtime RW columnist.

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# Making the Transition to Digital

by Mel Lambert

**STUDIO CITY, Calif.** As more and more stations begin the inevitable transition from analog to digital-based replay formats and our industry starts its long journey toward DAB, all of us are faced with some critical decisions.

For example, is 1991 the best year to move toward hard-disk retrieval and playback of commercials and music selections? Or would it make more sense to put off that particular decision for a year or so, and in the meantime upgrade to a hybrid CD- and/or DAT-based automation system that can be expanded and

reprogrammed in-house?

Or maybe integrate a current satellite delivery service with a combination of floppy disk, CD and DAT replay transports, under microprocessor control?

## A holistic approach

As I've outlined in a variety of recent columns, to take full advantage of digital, a holistic approach makes more sense—but there are viable hybrid alternatives.

Consider the typical production studio. What about considering, for example, the combination of an eight-track analog multitrack upon which to build

the various music, voice and sound-effects elements for station IDs, jingles, PSA, commercials, plus other routine tasks, and then master to DAT?

In that way, first-generation stereo masters can be laid to a high-quality digital medium, and be cloned to cartridge, or ported via a digital I/O into a future disk-based workstation or replay system.

And if analog eight-track is outside your current budget, the combination of a multiplay CD player, a couple of DAT machines and some outboard digital effects units might provide a cost-effective solution. And you might consider an entry-level hard-disk recording system based upon a plug-in two-channel card for a PC, plus relatively simple cut-and-paste editing software, and mastering directly to NAB cart.

That way, first-generation source material can be held on hard disk—maybe using a non-invasive data-compression format—and then compiled into the finished sequence each time a new version is required.

The point of the exercise is that analog and digital can happily co-exist within the air and production studio, each technology being exploited for its specific sonic and operational advantages. Analog recording formats are inexpensive, reasonably reliable and familiar to most engineers; they suffer, in the main, from restricted frequency response (particularly at elevated record levels), cumulative noise buildup over a small number of generations and indistinct distortion performance.

Digital, on the other hand, is moderately expensive (but becoming less so as hard drives and controlling computers drop in price), relatively complex to initiate, and sometimes intimidating at first contact for the non-technical user.

## Up to speed in half a day

I'm convinced, however, that most operators can be confidently up to speed and using a hard-disk recording and

editing system within half a day of first sitting in front of the screen and keyboard; if they can use a word processor or spreadsheet program, then most people can master a workstation or digital editor.

In fact, I would immediately reject any device that doesn't provide a reasonably intuitive user interface. There are so many good systems around these days that it make very little sense to put up with confusing or excessively complex screen displays, or incomprehensible operator's manuals.

The key to the successful integration of digital technology within an existing analog-based facility, and the gradual replacement of various recording, replay and processing components, is to consider each function within its own merits.

As many stations are discovering, adding a couple of DAT machines can dramatically improve the quality of a master production and allow multiple copies or overdubs to be produced without additional noise and distortion.

## DIGITAL DOMAIN

I also suspect that the new generation of CD-R machines and floppy-disk recorders will have a major impact on the integration of digital within a primarily analog-based facility, simply because of the familiar role they can play as an adjunct to existing technology.

And, of course, as each new element is added to the air and production chain, it represents an ideal opportunity to closely examine new developments in state-of-the-air digital hardware, without getting locked into one design solution.

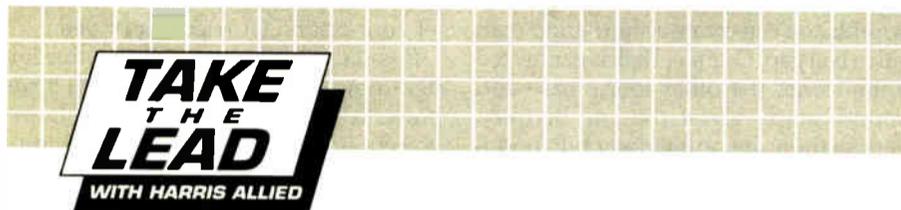
## Predicting the future

For example, I suspect that within two to three years, magneto-optical drives will become *the* removable storage format for workstations and editing systems. So, if a decision has been made to specify a design that doesn't readily support such media, or for which there is no successful upgrade path, then it might not represent the best nor most cost-effective solution.

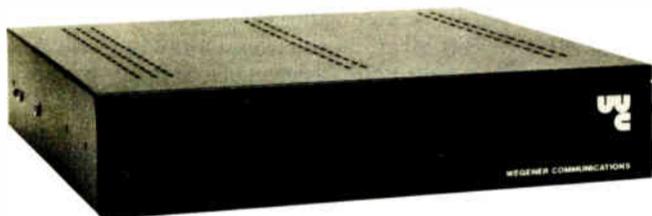
In the same way, I suspect that as we begin to upgrade some of the key backhaul links and STLs with digital pathways, the thorny subject of data compression is going to become much more important. As I've also mentioned in previous columns, it still is unclear how many encode/decode generations will be acceptable before a noticeable quality loss, and specifically how different coding techniques interact with one another.

In this instance, the advent of digital heralds an era of re-education, as we come to terms with some new operational and technical considerations that are central to the successful implementation of microprocessor-based workstations, recorders and processors within the broadcasting environment.

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



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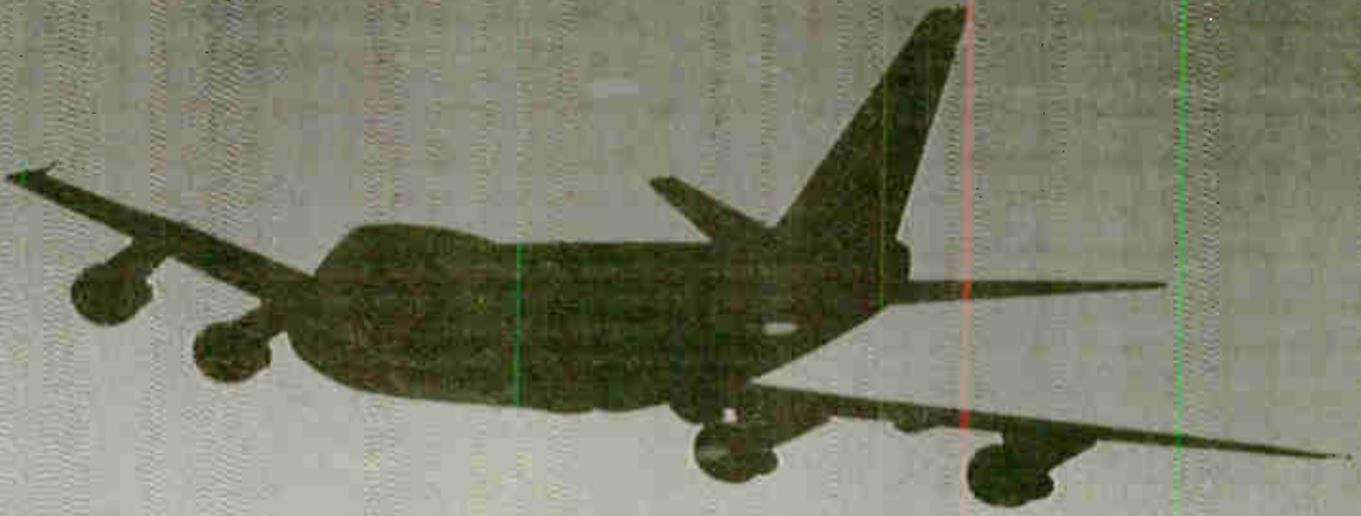
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# The future of entertainment was changed 43,000 feet over Greenland.

Garry Greth, chief engineer of radio station KLON, was on a flight from L.A. to Frankfurt. He didn't know it at the time, but he was about to make history.

Somewhere over Greenland, he was going through the SV-3900 Pro-DAT manual, when he first realized what he could do with this new technology from Panasonic. The SV-3900 was the system he had chosen to link KLON and the Eurojazz network for the first American produced continuous jazz programming ever heard on the Continent. Only then did it dawn on him how endless the possibilities were. And that they were to take him far beyond the applications he was used to.

What Garry did was create an automated network of SV-3900s which broadcast 22 hours of jazz every day for Eurojazz. Custom programming, recorded at KLON, was sent to Germany daily for automated transmission. Commercials, features and music were programmed on the SV-3900s to start and stop at precise times day and night, with no operator intervention. There was no room for error.

The SV-3900 provides *bidirectional serial remote control* via industry standard protocols. To Garry, this meant an unparalleled opportunity to excel in a game where you can make up your own rules, simply because there are none.

That's why the SV-3900 represents such an unprecedented array of endless applications for broadcast, recording, and installed sound. Like automated replay for radio. Or programmable, random access playback of satellite network broadcasts.

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And with the *Software Developer's ToolKit* available for Macintosh® and DOS-based systems, you can customize your SV-3900 to your needs, whether it's making history somewhere over Greenland or somewhere closer to home.

For more information on the SV-3900, contact Panasonic, 6550 Katella Ave., Cypress, California 90632. Or call (714) 373-7278.



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# AES SHOW PRODUCT REVIEW

**Editor's note:** The following listing describes some of the new and established products introduced by manufacturers during the recently concluded AES show in New York. Additional information can be obtained from the firms directly, or by circling Reader Service numbers as provided.

## Dolby Source Coding

Dolby showed the model DP501/DP502 audio coding units, two channel encoder/decoder units to provide professional quality audio at 129 kbits/sec per channel. It is designed for transmission systems requiring both high audio signal transparency and low, spectrum-efficient data rates.

For information, contact Allen Whitman at Dolby: 415-558-0200, fax: 415-863-1373, or circle Reader Service 23.

## TASCAM CDs, Recorders

TASCAM displayed its CD-601 CD player and RC-601 remote control, as well as the M-1500 series mixers. Also on hand from the company were the CD-301, CD-401 and CD-701 CD players, the BR-20 two-track broadcast recorder and the DA-30 R-DAT recorder.

For information from TASCAM, contact Ken Hirata at: 213-726-0303; fax: 213-727-7656, or circle Reader Service 79.

## Hybrid Arts ADAP II

The ADAP II digital audio recorder and editor from Hybrid Arts can handle a variety of tasks including DAT editing, CD pre-mastering, sound effects design and spotting, dialog editing and conforming, ADR and music editing.

The ADAP II also comes in a portable version, the ADAP II Portable. The portable unit includes all the features of the turnkey system.

Also available from Hybrid Arts is the ADAP IV, a digital recorder/editor with four discrete inputs and outputs, and a minimum of 32 track files.

For information from Hybrid Arts, contact Christopher Pelzar at 213-841-0340; fax: 213-841-0348; or circle Reader Service 84.

## Klark-Teknik Processors

The DN500 dual channel compressor/limiter/expander/peak limiter from Klark-Teknik is switchable between dual mono or stereo operation. Functions are controllable via front panel knobs.

Also available from Klark-Teknik is the DN300 series of graphic equalizers, the DN400 series of parametric equalizers and the DN500 series dynamic processors.

For information from Klark-Teknik contact Sam Spennacchio at 516-249-3660; fax: 516-420-1863; or circle Reader Service 116.

## Lexicon Products

The Lexicon LFI-10 digital audio format interface converts between AES/EBU, SPDIF and SDIF-2 digital standards. It allows viewing and editing of all auxiliary data. The Lexicon 300 digital effects processor also was exhibited.

LARES, Lexicon Acoustic Reverberance Enhancement System, is an electro-acoustic system that augments the natural direct and reflected energy in spaces, providing flexible acoustical character. Software increases gain before feedback, and decreases coloration.

For information from Lexicon, contact Dan Roberts at 617-891-6790; fax: 617-891-0340; or circle Reader Service 41.

## Symetrix Audio Processors

The model 511A from Symetrix is a two-channel or true stereo single-ended noise reduction system. Its dynamic high-frequency filter and downward expander reduce hum, hiss, RF buzz and other noise by up to 30 dB, anywhere in the signal chain.

The Symetrix 528 voice processor enhances both mic and line level signals. The unit includes a pre-amp, de-esser, compressor/limiter, downward expander, three-band parametric EQ and +48V phantom power for condenser mics.

The Symetrix model SX206 multi-dynamics processor can operate in compressor/limiter, gate, downward expander, ducker or slave modes. Active integrators allow manual attack and release controls to be dynamically sensitive.

For information from Symetrix, contact Dane Butcher at 206-282-2555; fax: 206-283-5504; or circle Reader Service 152.

nectible audio cabling components, ranging between 3-50 channels.

The components group offers genuine Jensen transformer isolated microphone splitters and microphone and sound cable assemblies in more than 10 colors. Also available is the "Bandits" cable marking system for permanent identification of cables.

For information from Wireworks, contact Angela Kelly at 908-686-7400; fax: 908-686-0483; or circle Reader Service 141.



Studer's D740 Compact Disc Recorder

## DIC Digital DAT Cassette

DIC Digital's MQ series of professional DAT cassettes are designed with a new shell and new tape formulation that ensures durability in today's broadcasting environment.

The longer length cassettes also have two minutes of additional tape so broadcasters can lay down test tones or pre-roll IDs without using valuable program time on the cassette.

For information from DIC Digital, contact Kevin Kennedy at 201-224-9344; fax: 201-224-9693; or circle Reader Service 133.

## Gotham Condenser Microphone

The UM 70 three pattern switchable condenser microphone shown by Gotham features the original M7 capsule designed by Georg Neumann, of Neumann & Co.

The backplate is a single brass piece, and each of the 153 holes is hand drilled for precision. The gold sputtered membrane is fixed to the backplate with lacquer, not screws.

The capsule membrane is made of PVC, cast by hand on a glass plate. The UM 70 amplifier system (MV 692) features phantom powering.

For information from Gotham Technology Group, contact Russell O. Hamm at 212-765-3410; or circle Reader Service 97.

## Ellason E250 Color Radar

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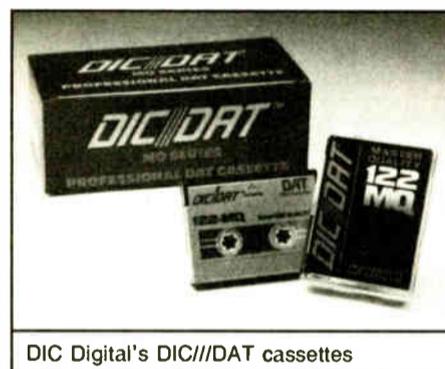
For complete information, call 314/532-3031, or write Ellason Weather Radar, 747 Spirit of St. Louis Blvd. Chesterfield, MO 63005.

1-800-727-2327



### ELLASON WEATHER RADAR

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DIC Digital's DIC//DAT cassettes

## Ramsa Series Products

The Ramsa series from Panasonic features the WR-S4400 four-bus mixers for sound re-inforcement and remote broadcast and the WP-1000 series power amplifiers.

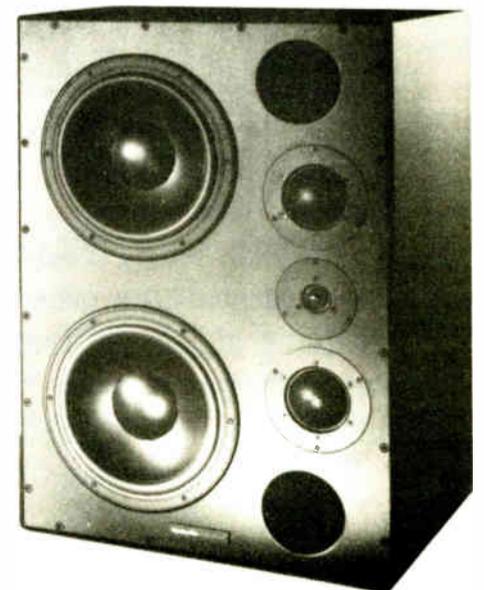
The Ramsa line also includes recording and production mixing consoles and monitor loudspeakers.

Other available Panasonic products include the SDT-390 software developer's toolkit for the SV-3900 DAT recorder. The SV-3700, SV-3900 with RS-422 control and SV-255 portable DAT recorder are all available.

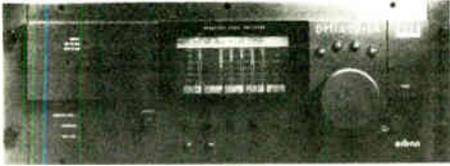
For information from Panasonic, contact Chris Foreman at 714-373-7277; fax: 714-373-7903; or circle Reader Service 35.

## Wireworks Cable Gear

Over 25 new literature sheets are available to provide complete descriptions of Wireworks audio cabling products. The Wireworks microphone multicable components group offers multipin discon-



Dynaudio Acoustics' studio monitor



The Optimod-FM 8200 digital audio processor

**Ampex Tape Products**

The 499 Grand Master gold analog recording tape from Ampex gives digital quality recording performance. The Grand Master series also includes the 456 audio tape, 406 analog recording tape and 467 DAT tape with the exclusive DATpak tape storage system.

For information from Ampex, contact Steve Smith at 415-367-2288; fax: 415-367-4132; or circle Reader Service 110.



Sonex acoustical foam (mounted on wall)

**Dorrrough Meters**

Dorrrough's Model 380 is a dual channel loudness meter. Dorrough loudness meters have a combination of peak and average on a single LED display. The stereo signal test set, Model 1200, is for testing balance, crosstalk, phase and signal-to-noise.

For information from Dorrough, contact Kay Dorrough at 818-999-1132; fax: 818-998-1507; or circle Reader Service 13.



Symetrix SX206 multi-dynamics processor

**Neutrik Accessories**

Neutrik manufactures a complete line of audio XLR connectors.

Other Neutrik products include phone plugs and jacks, goosenecks, XLR adaptors and speaker interconnect. Audio transformers, audio test and measurement and digital message repeaters are among the other products in Neutrik's line.

For information, contact William J. Dorman at Neutrik at 908-901-9488; fax: 908-901-9608; or circle Reader Service 145.

**Neve Console Products**

Neve's HRC-1 digital stereo high-resolution A-D/D-A converter is for use between analog audio consoles and 20-bit digital recorders. Stereo analog inputs/outputs, balanced and line levels, AES/EBU digital inputs and outputs are among the HRC-1's features.

The Neve VR stereo module gives control of stereo sources within a single module. Stereo signal path is intended for applications such as effects returns, stereo tape or disc sources or line level outputs from stereo microphones.

The 44 series from Neve is a range of compact audio consoles for broadcast and post-production applications. Stereo

and mono input modules, two main stereo outputs, separate transformer balanced mic and line inputs are on the stereo module.

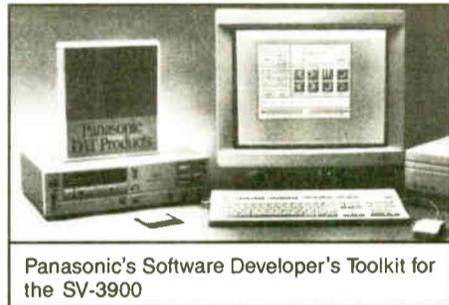
For information from Neve, contact Charles Conte at 203-792-7863; fax: 203-744-6230; or circle Reader Service 67.

**Dynaudio Acoustics Monitors**

Dynaudio Acoustics monitors provide high SPLs in compact enclosures. Hand-built drivers and computer-aided cabinet design and measurement allow optimum frequency response and extended bass.

Monitor models include the 115 dB "M1" desktop nearfield main monitor, the "PPM 1" nearfield, the "C2" classical music reference monitor and the "M2" midfield main monitor.

For information from Dynaudio Acoustics, fax inquiries to: 011-45-86-52-3116.



Panasonic's Software Developer's Toolkit for the SV-3900

**AKG Mics, Headphones**

AKG features a complete line of professional recording mics and headphones. BSS and dbx, divisions of AKG, manufacture signal processors and noise reduction devices.

For information from AKG, dbx or BSS, contact Judy Kuta at 510-351-3500; fax: 510-351-0500; or circle Reader Service 22.

**Sennheiser Microphones**

Sennheiser's Model BF 530 supercardioid dynamic microphone features a moveable inlet basket to reduce proximity effect and internal shock suspension for low handling noise.

The Model HMD 25 headphone and microphone combination features 20 dB of ambient noise attenuation in the headset. The microphone has a balanced 200 ohm super-cardioid microphone capsule. The headset has an earpiece designed to rotate off the ear for single-side operation.

For information from Sennheiser, contact Albert Zang at 203-434-9190; fax: 203-434-1759; or circle Reader Service 64.



Turtle Beach Systems' 56K-D digital interface

**NED Mixers**

New England Digital features the DSP mixer for its PostPro digital audio workstations. The mixer provides 16 channels of digital mixing and signal processing.

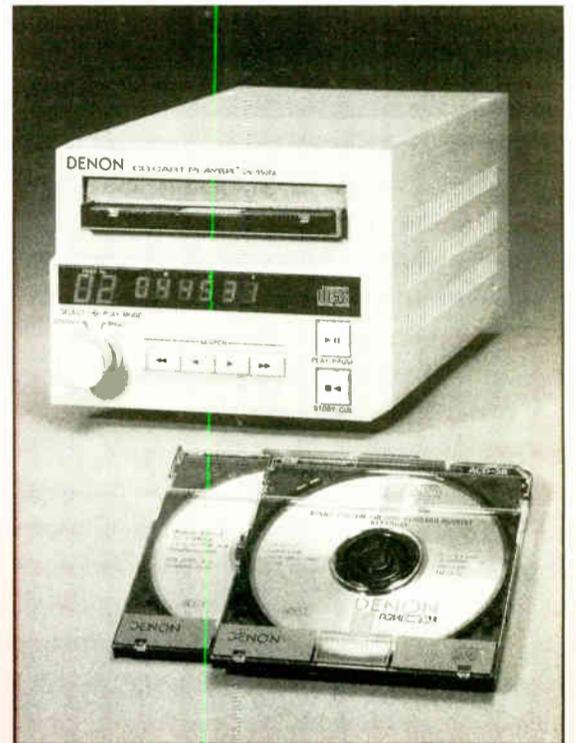
The PostPro is a hard disk-based multitrack recording system with digital audio fidelity, high speed editing and mixing, and SMPTE and VITC synchronization.

For information from New England Digital, contact Ted Pine at 603-448-5870; fax: 603-448-3684; or circle Reader Service 29.

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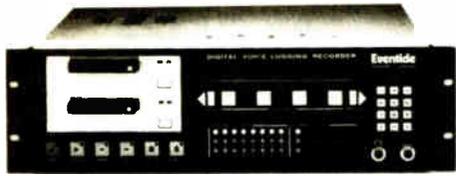


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### Audio Technica Microphones

Audio Technica manufactures the AT4033 studio transformerless condenser microphone and the 40 series of studio microphones.

For information from Audio Technica contact Kenneth Reichel at 216-686-2600; fax: 216-686-0719; or circle Reader Service 107.



Eventide's VR240 logging recorder

### JVC Digital Products

JVC manufactures the DS-DT900NS digital audio tape recorder, which reads and writes SMPTE time code and complies with IEC standards. The DS-LC900 digital parametric controller is among the other products JVC manufactures.

For information from JVC, contact Elin Everson at 201-794-3900; fax: 201-523-2077; or circle Reader Service 111.

### Amek/Tac Consoles

Amek/Tac's Mozart console features MZ15-RN input modules designed by Rupert Neve. The Mozart also features the SuperTrue automated mixing system with SuperLoc and Virtual Dynamics options.

Amek also offers the Hendrix, a multipurpose, multitrack console based on the technology and concepts used in the Mozart system. Virtual Dynamics, screen-based software controlled from the computer, includes advanced compressors, gates, limiters and other devices, and is offered on both the Mozart and Hendrix units.

For information from Amek/Tac, contact Steve Harvey at 818-508-9788; fax: 818-508-8619; or circle Reader Service 32.

### Sound Ideas' Libraries

Sound Ideas manufactures a complete line of sound effects libraries. The General Series 1000 features more than

3,000 original stereo sounds on 28 CDs and the General Series 2000 has more than 2,000 effects on 22 CDs.

Sound Ideas also offers the Ambience Series 3000 with 200 ambience sounds of four minutes each and the Hollywood Series 4000 with 2,200 sounds.

Other libraries include a Production Music Library for visuals, film, industrial, broadcast and commercial presentations.

For information from Sound Ideas, contact Brian Nimens at 416-886-5000; fax: 416-886-6800; or circle Reader Service 136.

### Akai Digital Products

Akai offers a variety of digital units for broadcast use. The DD1000 is a magneto-optical disk recorder.

The DL1000 is the remote control unit that accompanies the DD1000. The DL500 is a "cart machine" trigger remote for the DD1000.

For information from Akai, contact James Martin at 817-336-5114; fax: 817-870-1271; or circle Reader Service 150.

### Telex Headsets, Intercoms

The V-series of professional headsets from Telex Communications, Inc. are ideal for broadcast needs, featuring modular cordsets and mic cartridges.

The model MRT327 intercom user station has two channels, call signal, modular packaging, plug-in gooseneck mic and speaker amplifier. The SAP612 source assignment panel allows selection of six intercom channels or four intercom channels and two audio channels to 12 user station strings.

Other products from Telex include the PS15 intercom power supply with modular packaging and power for 20 headset stations.

For information from Telex, contact Dan Dantzler at 612-884-4051; fax: 612-884-0043; or circle Reader Service 70.

### Sound Technology Pro Gear

Sound Technology manufactures the RTA 4000 E real time spectrum analyzer with one-third octave resolution from 20



The Lexicon 300 digital effects system

Hz to 20 kHz. A comparative mode permits off air comparison with transmitted signal.

The "E" version includes digital signal processing of electrical and acoustical signals. Sound Technology also manufactures the 1510 A professional audio test system, 3100 B programmable generator and the 3200 B programmable analyzer test systems.

For information from Sound Technology, contact Lee White at 408-378-6540; fax: 408-378-6847; or circle Reader Service 26.

### Audio Precision Testing

The FASTest audio channel testing software for the System One, from Audio Precision, can test any audio channel in two seconds or less.

The Portable One audio test set is for remote and studio applications. The System One, System One +DSP and System One dual domain PC-based audio test sets are also all available from Audio Precision.

For information from Audio Precision, contact Tom Mintner at 503-627-0832; fax: 503-641-8906; or circle Reader Service 114.

### RPG Room Treatments

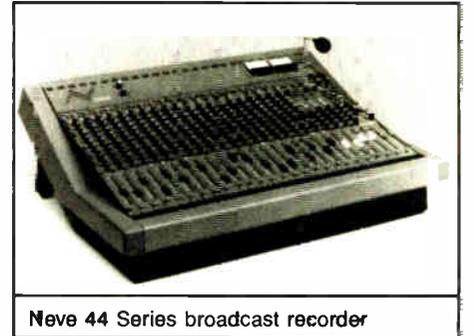
RPG Diffusor Systems, Inc. offers a complete line of diffusors. Among them, the Studio-in-a-Box kit includes a combination of melamine QRD Diffusors, fabric upholstered Absorbors and porous aluminum NDC Almute low-frequency absorbors.

RPG also offers a line of ABS and Class A fire rated Kydex thermoformed QRD diffusors and Omnifusors.

The QRD Diffusor; FlutterFree, an acoustic flutter control hardwood mold-

ing; and Triffusor, a rotatable three-sided variable acoustics module, are among the RPG line.

For information from RPG, contact Dr. Peter D'Antonio at 301-249-5647; fax: 301-249-3912; or circle Reader Service 124.



Neve 44 Series broadcast recorder

### beyerdynamic Microphones

The MCE50 series miniature microphone systems and M833 stereo field production microphone are among the available products from beyerdynamic.

beyerdynamic also offers the M58 dynamic moving coil mic, the MC740 condenser type mic and the MCE86 condenser type microphone. The DT108/109 headsets and HM560 headsets are available as well.

For information from beyerdynamic, contact Mike Solomon at 516-935-8000; fax: 516-935-8018; or circle Reader Service 131.

### Studer Revox CD Products

The Studer A728 CD system controller is designed to control up to three A727 CD players at once. ES bus networking is provided for easy installation, a cue wheel for frame accuracy cueing, and an ergonomically designed keyboard for quick access to all functions.

The Revox C221 professional CD player has 256 times oversampling and 1-bit conversion technology. Other features include improved signal-to-noise ratio technology of the differential mode stereo D-A converters for improved sound quality.

Also, the Revox C115 cassette deck includes XLR inputs/outputs, Dolby B or C and HX Pro, protected fader start function for "on air" broadcasting.

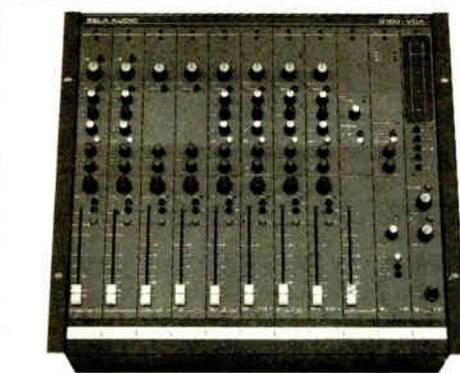
For information from Studer Revox, contact Sandra Hale at 615-254-5651; fax: 615-256-7619; or circle Reader Service 51.

### Soundcraft Consoles

Soundcraft's Europa console is a live reinforcement console with frame sizes ranging up to 40 inputs. Each size is standard with four band parametric EQ, integrated noise gate, eight VCA



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- Fader starts
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**eela audio**

The EELA AUDIO S 120 is a range of modular audio mixers, featuring VCA faders.

Applications can be found in radio production, video editing, OB's and as a general (multi) purpose mixer.

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subgroups and eight mute groups.

The Sapphyre is Soundcraft's in-line and post production console in 20, 28, 36, or 44 input sizes, each with six stereo effect returns. A combined I/O module gives access to dual signal paths with sub-grouping and routing architecture.

The Delta Monitor is Soundcraft's twelve-bus stage monitor mixer with up to 40 inputs. Specific input features include balanced mic and line inputs, four band, two mid-sweep EQs with high pass filter and polarity reverse.

For information from Soundcraft, contact Bill Threlkeld at 818-895-3435; fax: 818-893-3639; or circle Reader Service 80.

**Soundtracs Consoles**

Soundtracs offers a complete line of Megas consoles for a variety of purposes. The Megas Mix is a general purpose console for applications where a maximum of four group busses is sufficient.

The Megas Stage is a dedicated eight-bus sound reinforcement console with VU metering and six mute groups as standard. The Megas Studio consoles are intended for recording use, with either 16 or 24 group busses, MIDI muting and optional patchbay.

The Megas Monitor is a partner to the Megas Stage, providing 24, 32 or 40 inputs into 12 monitor sends for comprehensive stage monitor mixes.

For information from Soundtracs, contact Sue Pym in England at +44-81-399-3392; fax: +44-81-399-6821; or circle Reader Service 38.

**Turtle Beach Computer Editing**

Turtle Beach introduces the Multi-Sound, a professional sound card for use with an IBM computer. Features include two tracks of CD quality audio recording, 32 voices of MIDI playback, a CD-ROM mixer and MPC drivers.

Turtle Beach also offers the 50K digital recording system with an updated version of 1.2, ideal for broadcast editing. Features include time compression/expansion, SMPTE chase/lock, playlist editing and cut and paste editing.

For information from Turtle Beach, contact Jeff Klinedinst at 717-843-6916; fax: 717-854-8319; or circle Reader Service 94.

**Orban Digital Optimod**

Orban's Optimod-FM 8200 digital audio processor provides complete audio processing and transmitter protection for FM broadcasting. The 8200 interfaces with most commonly found transmitters and STLs, and is programmable or expandable via a PC interface.

For information from Orban, contact Judy Kuta at 510-351-3500; fax: 510-351-0500; or circle Reader Service 46.

**Eventide Data Logger, Harmonizer**

The Eventide UR 240 digital audio logger records up to 188 hours of audio on one DAT tape over 24 channels. Searches can be conducted by date, time or channel number. Eventide also manufactures the H3000KS Ultra-Harmonizer featuring Time Squeeze custom broadcast software and 22 second stereo search.

For information from Eventide, contact Gil Griffith at 201-641-1200; fax: 201-641-1640; or circle Reader Service 100.

**Solid State Logic Consoles**

Solid State Logic's Ultimation G series console automation system can operate as a dedicated VCA system, dedicated moving fader system, or a combination of both.

Solid State Logic's SL 4000, SL 5000

and SL 6000 G series consoles are designed for music mixing and tracking and audio-for-video post production. All have Total Recall, G series computer and Ultimation console automation.

For information from Solid State Logic, contact Piers Plaskitt at 212-315-1111; fax: 212-315-0251; or circle Reader Service 1.

**Aphex Systems Modular Products**

Aphex offers the 9000 series modular signal processing unit, and the 9000 R. The 9251 is the Aural Exciter module and the 9301 is the Compellor module with a compressor/leveler.

Aphex also offers the 320 Compellor with dual mono/stereo compressor/leveler, the 720 Dominator multiband peak limiter and 400 Digidocder broadcast

stereo generator.

For information from Aphex, contact Paul Freudenberg at 818-767-2929; fax: 818-767-2641; or circle Reader Service 20.

**Alpha Audio Acoustical Treatments**

Alpha Audio offers its pyramid acoustical foam. The acoustical foam platform has a uniform pyramid platform in two-, three- and four-inch thickness.

Sonex acoustical foam comes in two-, three-, and four-inch thickness; Sonex ceiling tiles are 2'x2'. Soundtex acoustical wall fabric and the Alpha portable isolation booth are also available.

For information from Alpha Audio/Acoustical Solutions, contact Michael Binns at 800-782-5742; fax: 804-358-9496; or circle Reader Service 122.

**Digidesign Broadcast Tools**

Digidesign manufactures the Pro Tools Multitrack digital audio production system, integrating multitrack digital audio recording and editing, DSP, MIDI sequencing and automated digital mixing into a single hard disk recording workstation.

The Pro Tools offers from four to 16 channels of audio and recording playback, including support for the AES/EBU and S/PDIF digital formats. Also, multiple channels of recording/playback and multiple high speed digital signal processing chips provide simultaneous real-time digital effects.

For information from Digidesign, contact Suz Howells at 415-688-0600; fax: 415-327-0777; or circle Reader Service 62.



When you need extra hands mixing audio, Shure's AMS can help.

Until recently, you needed outstanding hand-ear-eye coordination to mix audio in multiple-microphone broadcast situations.

Now there's a system that gives you broadcast-quality audio when you can't cover all the faders at once. It's the Shure Automatic Microphone System (AMS), featuring patented direction-sensitive gating.

The Shure AMS continuously compares audio signal levels from two matched unidirectional condenser microphone cartridges located back-to-back in each AMS microphone. The rear-facing cartridge monitors ambient sound, while the front-facing cartridge handles sound from the desired source. When the front cartridge output exceeds the rear cartridge output by 9 dB, the AMS mic channel gates on automatically in .004 seconds.

Because of this unique gating concept, an AMS microphone channel will only gate on

when addressed from within a 120-degree "window of acceptance" centered at the front of the microphone. AMS mics not addressed from within this angle remain off. So the number of open microphones is kept to a minimum automatically, with no need for manual control.

Since the Shure AMS automatically keeps track of the number of open microphones and adjusts the overall gain to compensate, your broadcast level stays constant as mics open and close, without troublesome gain-riding.

Direction-sensitive gating makes the

Shure AMS the best system to use in multiple-mic situations, from panel talk shows to game shows to hearings on Capitol Hill. More and more broadcast engineers are discovering the advantages of having broadcast-quality multiple-microphone



audio without the headaches of manual mixing or the time-consuming setup of so-called automatic mixers.

With AMS you not only get all the advantages of a truly automatic microphone system, you also get the broadcast-quality audio and reliability of Shure microphones.

For a comprehensive AMS literature packet, call us at 1-800-257-4873. For AMS technical support, call Michael Pettersen at 1-708-866-2512.



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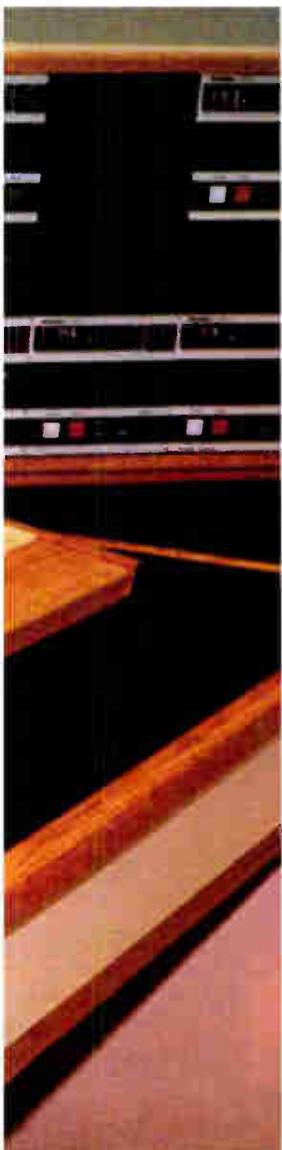
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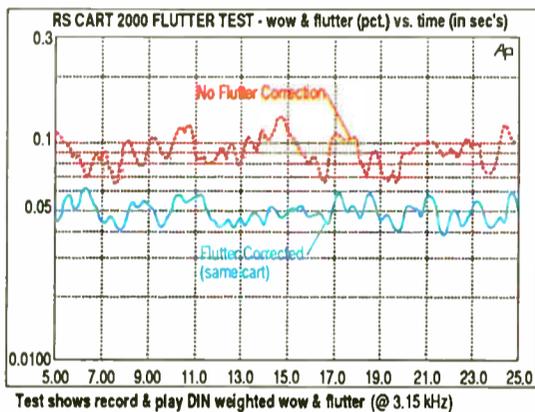
# RS-CART 2000

The RS-CART 2000 is the Finest Cart Machine ever designed and manufactured. From major new features like flutter correction, to important details like improved cart hold downs, nothing has been overlooked.

## The World's First Flutter Correction.

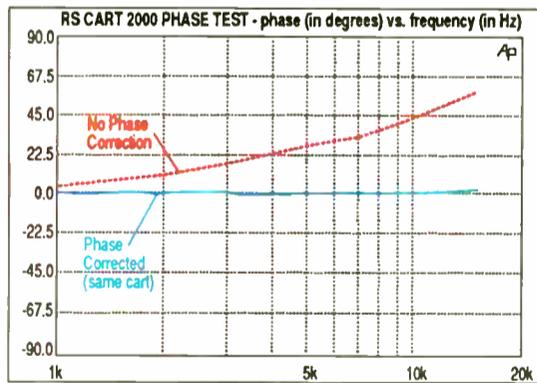
The RS-CART 2000 is the only cart machine to incorporate active flutter correction. This encode-decode system records a pilot tone on the cue track. On playback, the pilot is FM demodulated to drive two dedicated all-pass filter time delay networks to achieve up to a 50% wow and flutter reduction.

For the first time, cart wow and flutter is reduced to levels rivaled only by the finest reel-to-reel recorders.



## Active Phase Error Correction.

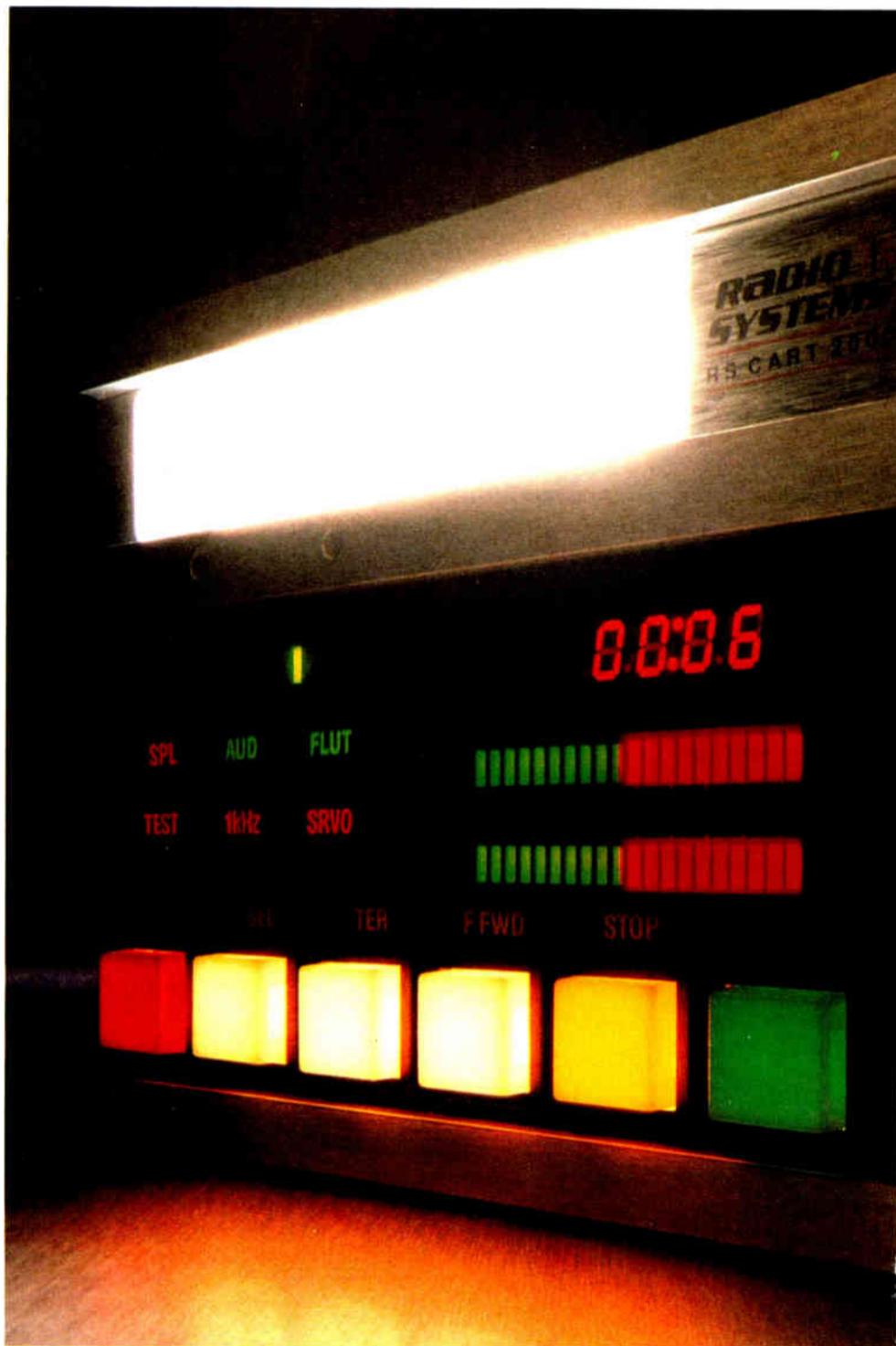
This non-encoding circuitry detects out-of-phase audio by tracking the common left/right audio components of any pre-recorded cart. The RS-CART 2000 is the only cart machine made that uses distortion-free and noise-free, all-pass filter time delay networks to correct phase error. Up to 90° of phase error at 5 kHz is corrected in real time, as the cart plays.



Typical new cart utilized (50 deg's out of phase at 12.5 kHz; within NAB specs)

Listeners will immediately notice the cleaner and brighter sound of any stereo cart reproduced on an RS-CART 2000.

- Splice finder • Timer on all models • LED metering • Front panel azimuth adjust
- 1 kHz defeat mode • Fast forward • 3 speeds • Toroidal power transformers • Test noise generator • Cleaning switch • CMOS logic • Flutter correction • Full remote control • 1/2" thick nickel-plated deck plate • Full size solenoid • Nidec direct-drive motor • Ball bearing mounted pressure roller • Active phase correction • 3 cue tones • Peak LED • Buffered, low-noise input stage • Gas Tight mating connectors • Delrin roller cart hold downs • Injection molded tape guides • User programmable logic states • Long life heads • "Electronic transformer" inputs and outputs • Lamp flash logic • Active Phase Meter • XLR connectors • Bias and cue metering



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# Mixes Lead to Spurious Signals

(continued from page 13)

emissions, as required by FCC Rule 73.1590(b), should be made by connecting a spectrum analyzer or some other suitable measuring instrument to a tap on the station's transmission line. Usually, a pad is inserted between the tap and the instrument.

It may be a good idea to insert a sharp notch filter tuned to the station's frequency in the line. This will reduce the station's signal level into the measurement device's front end, preventing overloads and mixes from occurring there.

If trouble is found, be sure to factor the series notch filter's loss on both the desired and undesired frequencies into the ratio calculation. Finally, remember to do the check under normal modulation with all subcarriers on.

One might think that situations involving stations operating into master antennas along with several others would be ripe for all kinds of mixes. This would be true, were it not for the fact that the combining equipment used for such diplexing provides for sharp filtering at each station's port. As a result, master antenna users are less likely to cause problems than are discrete antenna users.

## Receiver front end mix

The last case—and the one completely beyond the broadcaster's control—occurs when a mix takes place inside the front end of the receiver. In the first case I described, this is the source of the trouble.

The contributing stations are located about three miles apart, and both have

demonstratively clean outputs. But in an area within about 10 miles of either transmitter, the third station's signal is wiped out.

Numerous and extensive tests have been run to both confirm the source of the trouble and to find out what to do about it. It was discovered that by slightly attenuating all signals at the antenna port of a typical mobile receiver (Philco-Ford), the problem would go away.

Similarly, a cavity filter was inserted between the antenna and receiver and again, the problem disappeared. By

reducing the signal levels to place them back into the linear range of the receiver front end, the mix disappeared.

So what can the station being interfered with do about the problem? Provide filters or pads to all its mobile listeners? Get the other stations to reduce power? Both these options will work, but they are not practical.

For now, this station is living with the problem. There is no magical solution, although there may be ways to improve the situation to a degree. We will take a look at some of these techniques in the next column.

■ ■ ■

W.C. "Cris" Alexander is director of broadcasting for Crawford Broadcasting Co., in Dallas. He can be reached at 214-445-1713.

# Self-Inspection Report

(continued from page 14)

and other part 74 licenses to be retained at the address shown on the license, posted at the transmitter or posted at the control point. The form asks for the type of station, the frequencies and call signs.

## Are all operator licenses posted or immediately available at all control points?

73.1230(b) requires all operator licenses to be posted where the operator is on duty (typically a remote control point). If the operator has a "wallet card" restricted permit, that must be posted, not kept in the wallet. If the operator works at more than one station, the license is to be posted at one station and photocopies posted at the others.

Ensure that all operators are properly licensed (including those who may be at some off-premises control point). Recently issued General Radio-Telephone licenses do not permit broadcast station operation. Holders of this restricted license must also hold a restricted permit for broadcast operation. The FCC inspection form asks for the name, date of birth, license type and license number (if applicable) for all licensed operators.

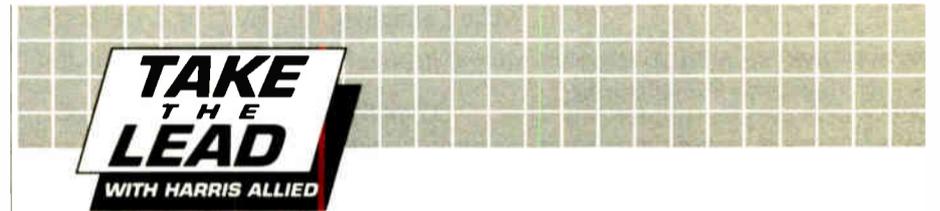
We just finished the first of 20 pages of the FCC Broadcast Self-Inspection Report. Next month, we'll continue the discussion. I look forward to your comments.

Meanwhile, if you'd like a copy of the Self-Inspection Report, send \$2 (for copying) to H&F, 141 Suburban Road, Building E4, San Luis Obispo, Calif. 93401-7590, along with a SASE (52 cents postage). The existing form is aimed at AM stations, especially directional AMs. Many questions, however, are applicable to all radio stations.

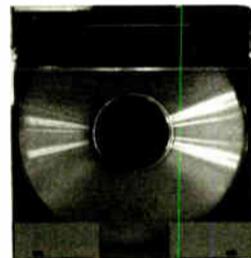
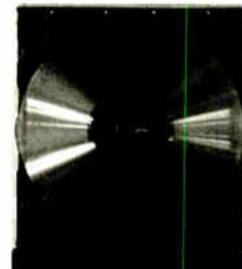
My thanks to Bill Sepmeier of National Supervisory Network, Jeff Young of the FCC FOB in Washington, and Michael Ritter of the Commission's Los Angeles office.

■ ■ ■

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



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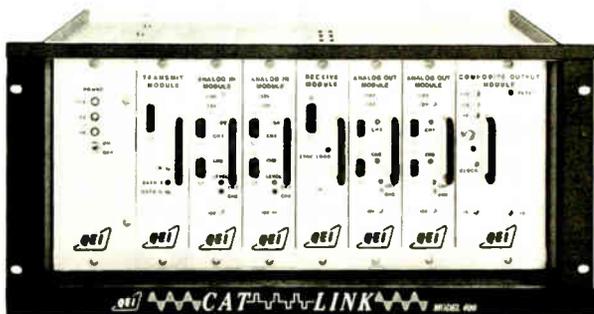
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# Planning for Security On Station Property

by Barry Mishkind

**TUCSON, Ariz.** Over the past few months, we've been talking a lot about safety. It takes a lot of time, effort and, yes, some money to make the station "user friendly."

We've seen that through careful planning, the studio and transmitter sites can be maintained in a condition that will not present dangers to the staff or visitors. Safe sites mean fewer accidents. In the long run, that translates into lower insurance costs, something any station should welcome.

When a station plans out a new facility or prepares to remodel an existing one, safety comes from teamwork. The owner, manager and engineer need to sit down together, to ask and answer a lot of questions. Are you sure everyone can get out safely in the event of a fire? What if the air conditioning fails? How will you ensure the safety of the staff at night?

Asking the right questions is not always easy. Anticipating all the problems that can occur in the future depends not only on the experience but also the attitude of the management team.

To illustrate: A few years ago one station was remodeled to add a new office wing. Although the studios were nearly 30 years old, a very small part of the budget went to upgrade them. The attitude of the owner toward the comfort of the staff was shown by his refusal to allow the new air conditioning system to be set below 85 degrees.

That was merely an inconvenience, not necessarily a danger to the staff. But the lack of concern for the overall welfare of the staff manifested itself in other ways that could be dangerous.

For example, the transmitter was way out in a rural area of the county. When working at the transmitter, the engineer was quite isolated and subject to being accosted or even robbed at gunpoint. Unfortunately, the owner rejected any security measures for the protection of the engineer as too costly.

As a result, the engineer reported that he was somewhat nervous when leaving the building, which he locked while inside. The owner suggested he take a friend to the site, or carry a gun.

What should a station's plan be for the 1990s? How can we properly plan for overall safety before problems occur? We plan to give that some attention over the next few months.

Like many other broadcasters, I've found that my attitude toward personal security while on the job has materially changed over the past 20 years or so.

Many of us remember how in the late 1960s and early 1970s it was possible to walk into virtually any radio station in the state—right into the control room, and sit down and chat with the staff. In fact, that was how we caught the radio bug. I stopped in one afternoon to chat at my favorite station. I've loved radio ever since.

We had a strong bond with our listeners. People would stop by with sandwiches and soda pop. One station I worked was turned on in the patrol cars of the small suburban town. Periodically, the cop would stop in for a cup of coffee and a chat.

One anecdote I love to tell is when one morning, at 3 a.m., I changed my first fi-

nal PA tube. I was (only) a DJ then, but I got the change done. Upon re-entering the control room five minutes later, I saw the cop standing there. He'd heard the station go off the air and came directly over. He was afraid someone might have attacked me.

## ECLECTIC ENGINEER

Now, that's personal security.

Today, it would be very unusual to find anyone who would eat food that someone brought to the station, unless they knew the person bringing it. And when I have to go out to a transmitter alone, I'm a lot more careful about noticing the surroundings. I lock the gate. I lock the transmitter building.

And it's not an irrational fear. Many stations regularly suffer vandalism such as tower lights being shot out or fences being cut. While there often are various wild animals that present danger, there is actually less danger from animals than people. If the engineer comes around, some of these cowboys have been known to attack. In fact, sometimes they will turn off an outside breaker to bring a victim to them.

Stations often may feel that due to the erratic and infrequent presence of personnel at the transmitter, there is little need for security measures.

On the other hand, many stations can give examples of the need for security at the studio rather than at the transmitter. The security guard at KFWB in Hollywood was hit from behind in the parking lot of the studio. Police responded, but it took them 15 minutes after being advised of the situation through 911.

Or, perhaps you remember the protestors that made it into the news studios of at least two national networks. Fortunately, they were unarmed. But then, there was the case of the gunman that invaded the KNBC studios in Burbank.

In Phoenix, a gunman raced past the receptionist and entered the air studio of KOOL-TV late one afternoon in 1979. According to staff, he fired a shot into the ceiling and shouted, "Everyone in this room is a hostage and will be shot if they try to leave. I demand to go on the air." Eventually, "Dallas" (in its heyday) was interrupted to viewers seeing the gunman holding his weapon to the head of the station's news anchor, while he read a rambling letter.

Steps were taken to prevent a reoccurrence at KOOL. Yet, more than a decade later, I was told of a major network station in this country where anyone with enough nerve still could walk from the front door to the air studio in a few seconds. Scary indeed.

Some of the steps taken at KOOL and other stations, as well as other concerns about the security of the physical property of stations, will be discussed in our next installment.

Barry Mishkind, aka RW's "Eclectic Engineer," is a consultant in Tucson. He can be reached at 602-296-3797 or 1:300/11 on Fido-Net, or "barry@coyote.datalog.com" on Internet.

# The Amazing Multiple-D Mic

Reduced Proximity Effect and Lower Handling Noise Are Advantages of This Directional Design

by Bruce Bartlett  
with Jenny Bartlett

**ELKHART, Ind.** Here's a product with an extra hole in its head. A multiple-D microphone is built with several sound entries or holes in the housing at different distances behind the mic capsule.

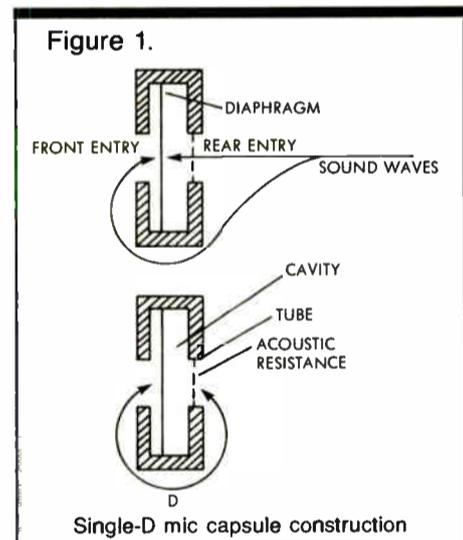
This design provides many sonic benefits to the broadcaster. In fact, it's indispensable.

To explain what "multiple-D" means, first we need to review how a directional microphone works. Every directional microphone, such as a cardioid, has at least two sound entries or ports: one in front of the diaphragm and one behind. The front entry feeds sound to the front of the diaphragm while the rear entry feeds sound to the rear.

That rear entry gives the microphone its directional properties. Here's how it works. Sound waves approaching the mic from the rear enter the rear port first, then they travel to the front of the microphone and enter the front port (Figure 1).

**Acoustic resistance**

Inside the rear port is an acoustic RLC phase-shift network. It consists of an acoustic resistance (fabric) covering a short tube, which leads into a cavity. In



a cardioid microphone, this network delays the sound waves inside the rear port so that they arrive at the diaphragm the same time as the sound waves reaching the front port.

As a result, sound waves push on opposite sides of the diaphragm at the same time (in phase). So the diaphragm doesn't move, and consequently the mic produces little or no signal. That's how the microphone cancels sound from the rear.

This type of construction is referred to as "single-D" because the mic has one rear entry port at a single distance D from the front of the diaphragm.

One unavoidable property of any single-D directional microphone is that it has "proximity effect." This is a progressive rise in bass response as the mic is placed closer to the sound source.

For example, when a single-D microphone is two feet from a sound source, its low frequency response is flat or rolls off. But when the mic is two inches from

the sound source, the low frequency response rises, giving a bassy or boomy effect.

So the tone quality of a single-D mic changes, depending on the working distance. If an announcer talks close to this mic, the voice becomes unnaturally tubby.

To prevent this problem, the multiple-D microphone was invented. It has multiple rear sound entries at varying distances from the front of the diaphragm. Each entry responds to a different frequency band. Because of this construction, the multiple-D mic greatly reduces proximity effect, so that the tone quality of the voice stays natural at any miking distance.

**Looking back**

This development has a long history. In the late 1950s, Electro-Voice (EV) engineers invented the 666 and 664 multiple-D microphones, which had three rear ports—each separately tuned to lows, mids and highs. In the 1960s, EV developed the continuously variable-D microphone (RE-15 and RE-20), which had a slotted tube along the side of the handle. This design greatly improved the performance and ease of manufacture.

The RE-20 is probably the industry-standard DJ announce mic, not only because it's big and looks impressive, but because it sounds natural close up. The mic also has a big diaphragm, which reduces sensitivity to breath pops. EV recently introduced a higher-output version of the RE-20 using an N-Dym magnet, the RE-27 N/D.

EV's Lou Burroughs single-handedly converted the broadcast industry from RCA ribbon mics to EV variable-D mics. Because of this switch, the broadcast tone quality of announcers changed from boomy to natural.

AKG and Shure also produced multiple-D models: the AKG D-200E, D-202E and D-224; and the Shure SM-53 and SM-54.

The AKG models are unique in that they are two-way designs. Each microphone has a low-frequency capsule and high-frequency capsule in a single housing. When you talk very close to one of these AKG mics, the high-frequency unit (the one closest to your mouth) has some proximity effect around 500 Hz, giving a puffy tone quality. So, these mics should not be worked too closely.

**More advantages**

In addition to reducing boominess, the multiple-D design minimizes handling noise. The diaphragm of a multiple-D mic is more highly damped than the diaphragm of a single-D mic; this higher damping reduces susceptibility to mechanical vibrations.

To sum up, the multiple-D microphone gives you a natural tonal balance at almost any distance, so you can use it up close without boominess. It also pops very little and has minimal handling noise, making it a great mic for hand-held interviews.

Just be sure not to cover the rear ports with your hand, or the frequency response and polar pattern will be

degraded. Note that an omnidirectional microphone has the same benefits: no proximity effect, low pop and low handling noise.

The advantage of the multiple-D mic is that it is directional, so it rejects background noise and room acoustics.



Multiple-D mics have saved the day for me a few times. Once I was asked to go into a factory and record several people

describing their political views. The recording was for later broadcast over a local station.

First I tried a single-D cardioid mic placed close to each person's mouth in an attempt to reduce pickup of background noise. The mic did reject the noise, but the bassy voices and pops made the recording unusable. I switched to an EV RE-15 with a foam pop filter. It sounded great: natural bass, no pops, no background noise.

If you use multiple-D mics, you can expect the same results.

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

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



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# Life and Times of Major Armstrong

by George Riggins

**LONG BEACH, Calif.** Edwin H. Armstrong (Dec. 18, 1890, to Feb. 1, 1954) is considered by most of his peers to have contributed as much, if not more to radio as we know it today, than any other single individual.

Fellow RW columnist Harold Hallikainen suggested that a column should be devoted to Armstrong and FM. An attempt will be made to put some comments together that will do justice to the man and his many accomplishments.

Major Armstrong, a title he earned from military service in World War I, received his BSEE degree from Columbia University in 1913 and a Sc.D. in 1929, also from

Columbia. He also received a Sc.D. from Muhlenberg College in 1941. He served on the faculty in various capacities at Columbia from 1913 to the time of his death.

Armstrong started as an assistant in the Department of Electrical Engineering. He became associated with Professor Michael I. Pupin in 1914, and was appointed Professor of Electrical Engineering in 1935. Curiously, during his time on the faculty of Columbia, he never taught a class.

### The regenerative circuit

The first invention credited to Major Armstrong is the regenerative circuit, developed in 1912. This circuit is recognized as making long distance radio communications possible.

The second notable invention, in 1917, was the super-heterodyne circuit. The "superhet" circuit was the outgrowth of original work done by Reginald Fessenden in 1901. The Fessenden circuit, as originally developed, used a second transmitter to furnish the offset signal rather than a local oscillator in the receiver.

The biggest problem with this method of furnishing the heterodyne signal was the lack of precision parts, both mechanical and electronic, needed in the early days of radio to maintain specific frequencies.

The improvement patented by Armstrong used a lower frequency local oscillator to produce the intermediate frequency. Armstrong found that this intermediate frequency was easier to amplify and did not require the accuracy or stability of the oscillator that was needed by the original Fessenden methods. The intermediate frequency needed only to stay within the passband of the amplifier. The developments of Armstrong made weaker signals useable for reliable communications.

According to William E. Denk, W3IGU, in a paper published in the March 1987 Antique Radio Gazette, an early but little-known patent by Michael I. Pupin and Edwin H. Armstrong filed Oct. 1, 1915, and issued April 6, 1920, was an early attempt by Armstrong to reduce the effects of static on radio reception.

This early work with Professor Pupin over a period of eight years was reported to have been a humbling experience to his efforts and delayed further experimentation of static reduction.

### Sarnoff and Armstrong

Perhaps the best motivation for working on a static method of transmitting and receiving was a request by David Sarnoff, head of RCA, for such a system for the fledgling broadcast industry.

The early interaction was telltale of the



many dealings, both as a colleague and as an adversary, that Armstrong had with Sarnoff.

The super-regenerative circuit was developed in 1922. It is said that this circuit development was the most significant factor in the early years of mobile radio. Of course, we know that today almost all mobile/portable/personal radio is based on the principles of Frequency Modulation, also credited to Armstrong in 1933.

One of the overlooked developments by Major Armstrong was a portable super-heterodyne AM receiver in 1923. This first portable superhet was developed and built by Major Armstrong as a wedding present for his new bride, the former Marion MacInnis, who had been the secretary to David Sarnoff at RCA.

The portable receiver, referred to as a "huge mechanism," was taken on the couple's honeymoon and lugged to the Florida beach.

Some may wonder how Major Armstrong developed his wealth. The first invention, the regenerative circuit, was sold to American Marconi and Atlantic Communications for limited use. It is reported that by 1922, there were 24 licenses issued

for use of the regenerative patent.

These early licenses were returning royalties of about \$10,000 each month. In need of money, Major Armstrong soon sold both the regenerative and the superheterodyne patents to Westinghouse for \$335,000.

### A wealthy man

Some of the money received from Westinghouse was used to pay his creditors, and a lot to pay for litigation with Lee DeForest over a claim of prior invention of the regenerative circuit. However, after all the debts were settled, Major Armstrong still was considered to be a wealthy man.

The super-regenerative circuit was sold to RCA for \$200,000 and 60,000 shares of RCA stock. Another 20,000 shares were issued to Armstrong for additional consulting work. The total of 80,000 shares made the Major the largest stockholder in RCA. In 1929, Major Armstrong sold his stock because of a perceived conflict of interest. The sale price was \$114 per share for a total of \$9,120,000.

One prominent episode in the life of Major Armstrong took place in May 1923. The Major climbed the WJZ tower in New York City and had a trailing photographer take a picture of him hanging from a cross-beam.

On the same evening, he returned to the tower and stood on the large iron ball that was on top of the tower. It is said that Sarnoff was less than amused and would have nothing to do with Major Armstrong for quite some time.

### Any Armstrong contacts?

One last Armstrong item: The BBC is researching a 40-minute feature to be broadcast on BBC Radio 4. The feature would examine the events surrounding Armstrong's death.

Jaclyn Parry, a researcher on this project, is looking for people who might have known Armstrong, worked with him, or have some family connection. Contact her at the BBC, Whiteladies Road, Bristol BS8 2LR, England. Phone her at 011-44-272-742160 or fax her at 011-44-272-730793.

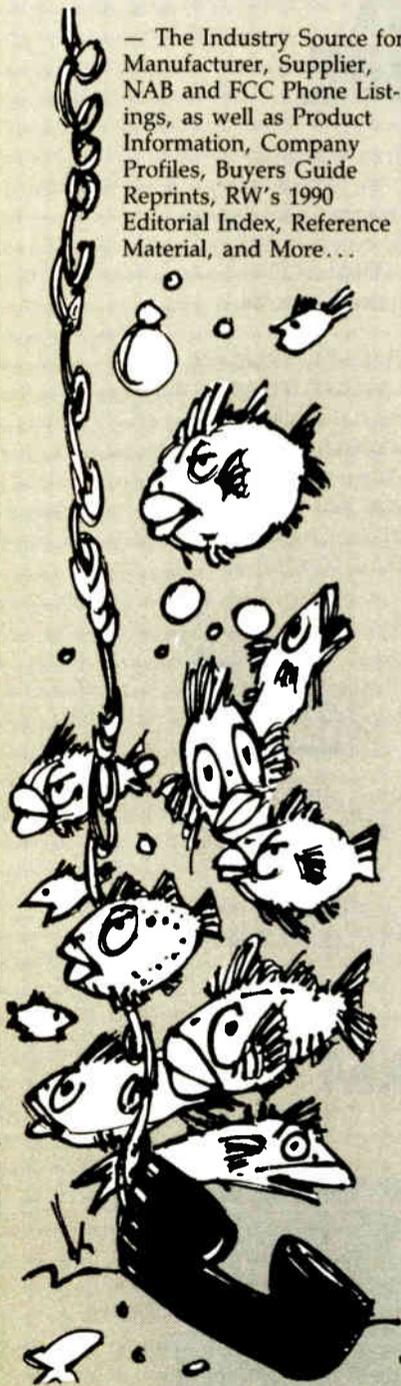
George Riggins has experience in radio and electronics dating back to the 1930s. He can be reached at 213-598-7007.

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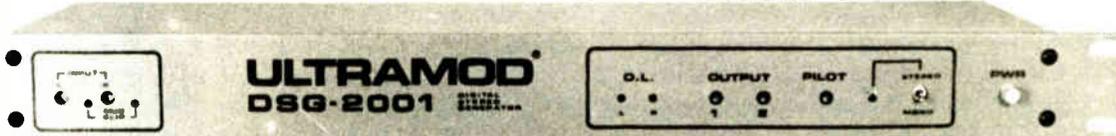
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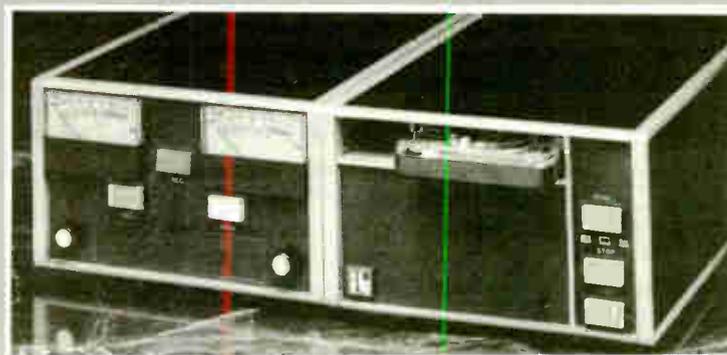
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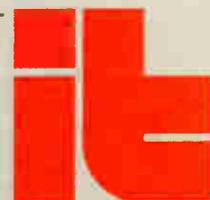
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World Radio History

# KTAO-FM Lets the Sun Shine In

## New Mexico Station Will Be Solar Powered

by Dee McVicker

**TAOS, N.M.** KTAO-FM is about to give new meaning to power rock radio. Located on the nation's sunbelt in Taos, N.M., the FM will be the first 50 kW to rely exclusively on solar energy to power its progressive rock format.

KTAO owner Brad Hockmeyer expects to flip the switch from conventional power to solar power in early October,

when the station's signal will air for the first time from a new transmitter site located at 10,000 feet, on one of the peaks encircling the Taos Valley.

In part, it was the dizzying height of the new tower location that encouraged Hockmeyer to consider solar power. "The best location for our transmitter turns out to be on top of a 10,800-foot mountain with no electricity," he says. "We've been racking our brains for a couple of years now, trying to figure out how we can power this thing."

The mountaintop was KTAO's only realistic hope to hike an FCC-granted

boost from 3 kW to 50 kW and enter larger market Santa Fe, so Hockmeyer ruled out nothing in his quest for power.

## OFFBEAT RADIO

He often was discouraged. "I went to the electric company a few years back," he recalls. "I walked out thinking it was going to be a minimum of \$300,000 and a minimum of three years before anything would happen."

### Conventional power

After eliminating conventional power and then diesel and other transportable power because of transit-hostile mountain terrain, Hockmeyer began to seriously consider solar energy. His early research into solar power uncovered good news: With the mountain-top site requiring one-fifth the wattage of the station's previous site, yet yielding more than 16 times the output, the new tower location was ideal for the low-power requirements of solar energy.

Says Hockmeyer, "Right now we're a 3,000 W station, and because we're 187 feet below average terrain, we have to put 5,000 W into our transmitter to get out 3,000 (ERP). But up there, on the top of this mountain, we have to put in only 1,000 W to get out 50,000 (ERP)."

In all, the move to solar power will have required two years of planning and anticipation—and without the help of enthusiastic environmentalists, would have been cost-prohibitive for the station. Many contractors are donating their services at cost, with funding coming from Guy Spiller of BES Teleproductions, a broadcast production company in Richmond, Va.

Spiller's reason: "Taos is a magical place. I can think of no better site for the largest solar radio station."

Hockmeyer agrees. "It's a very environmentally conscious community," he says, stating that Taos is known for its ancient

Indian ruins, artist colonies, beauty and community spirit.

### Tires and cans

Even Taos architect Mike Reynolds, whose structures made of used tires and beer cans have caught the media attention of "Good Morning America" and "People" magazine, took time out from his environmental-saving ventures elsewhere to help the local station.

KTAO's "Earth Ship," as Reynolds calls his ecologically efficient structures, is built into the mountaintop with layers of Taos adobe, used tires and aluminum cans.

"What he does is dig into as much of the mountain as possible, so basically three walls are rock," Hockmeyer explains. "About half way up he starts building with

**It was the dizzying height of the new tower location that encouraged Hockmeyer to consider solar power.**

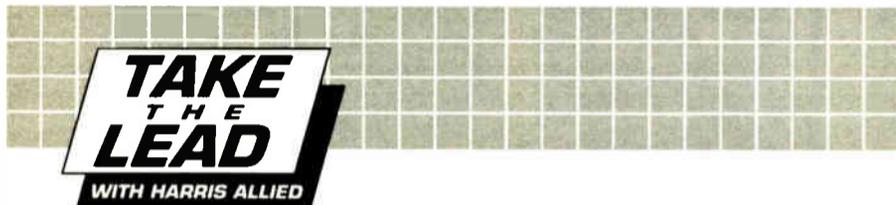
tires, and that forms a lot of mass which certainly helps with the insulation of the building. And the front's all glass panels, which heats the building."

Incredibly, Reynolds began building this latest of his signature structures, which will hold the station's transmitter, with nothing more than solar energy. "He's running a jackhammer off of solar," Hockmeyer says. "He's building solar with solar."

The new transmitter building, near completion, is expected to maintain consistent temperatures even during weather extremes. "It won't go below 50 degrees in the winter and won't go above 90 degrees in the summer," he says.

And for those cool cloudy days when

(continued on page 32)



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Page No.	Advertiser	Reader Service No.	Page No.	Advertiser	Reader Service No.	Page No.	Advertiser	Reader Service No.
22,23	Arrakis Systems	118	18	Elason Weather Radar	39	28	Hnat Hndes	99
7	ATI	117	1	Fidelipac	2	28	Hnat Hndes	7
11	Audio Processing Technology	14	10	First Light Video Publishing	95	29	ITC	4
34	Audiotronics	34	16	FM Technology	65	7	Jampro Antennas	147
14	Broadcast Electronics	73	20	Gentner	40	12,13	Orban/AKG/dbx	30
19	Broadcast Services	96	15	Gentner	18	17	Panasonic/Ramsa	112
4	Burk Technology	57	10	Harris Allied Radio RF Equipment	11	26	QEI	139
32	CCA Electronics	52	6	Harris Allied Broadcast Equipment	—	24	Radio Systems	16
8	Continental Electronics Corp.	47	25	Harris Allied Broadcast Equipment	31,82	21	Shure	56
15	Cortana	89	30	Harris Allied Broadcast Equipment	—	9	Studer Revox	10
3	Crouse-Kimzey	71	16	Harris Allied Broadcast Equipment	15,102	27	Tascam	50
15	Dataworld	24	30	Harris Allied Broadcast Equipment	—	3	Telos Systems	66
31	Delta Electronics	143	2	Wheatstone	60	43	Wheatstone	48
20	Eela	127	44	Wheatstone	45	2	Wheatstone	60
33	Elenos	151						

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# WORKBENCH

## A Short Cut to Redundancy

by John Bisset

**FALLS CHURCH, Va.** A number of unique problems are shared by small market engineers. To begin with, few stations have the budget for a full-time chief.

Budget constraints also extend to equipment—redundancy is usually not a word in the small market vocabulary. Two transmitters is a dream, and making do with one usually is the rule, rather than the exception.

Pete Loewenheim, a contract chief with WQCM in Hagerstown, Md., found a way around the one transmitter problem. He recently installed a four-port transfer switch in the manner shown in Figure 1. The switch provides exciter-power redundancy, should the transmitter fail.

When comparing the price of a four-port switch to a second transmitter, there is no comparison, according to Pete. The beauty of this configuration is that when the station upgrades to a second transmitter, the transfer switch is already in place.

Using the mute control function on the exciter and the normal interlock circuitry of his CCA transmitter, hot switching

and attempting to fire up the CCA transmitter when the exciter is switched into the antenna is eliminated.

Pete adds that as the output power of exciter keeps increasing, it only makes sense to provide a means to feed the exciter directly into the antenna for emergencies. For contract engineers, such a backup does make sense, giving the en-

**When comparing the price of a fourport switch to a second transmitter, there is no comparison.**

gineer a little breathing room to get to the site and make repairs.

\*\*\*

Broadcast Electronics is one manufacturer that has taken this concept a step further. Its transmitters have been designed with 50 ohm inputs and outputs from the exciter to the PA. This permits the use of flexible RF patching around any defective subsystem.

The patching list of materials includes a BNC to BNC cable and a BNC to Type N Adaptor. Using the jumpers, it's possible to bypass the driver, one or both IPAs, even feed the exciter directly into the grid of the PA. Although this flexible RF patching system is not automatic, it gives the engineer the ability to "jumper around" the defective portion of the transmitter, and stay on the air with more than just exciter power.

For information on BE's flexible RF patching system, circle Reader Service 77, or contact Russ Erickson at Broadcast Electronics, 217-224-9600.

\*\*\*

Ronald Pesha with WGFR, the Adirondack Community College station in Queensbury, N.Y., writes of his experience with the seizing of cart machine motors. Ronald's experience has been that the motors seize up in the bearings. To free the bearings, he removes the motor and soaks the bearings overnight in a strong solvent, such as trichloroethylene (obtained from a paint store).

Rather than disassemble the motor, Ron positions the motor in a vessel of the solvent so that the windings remain dry. Use caution with trichloroethylene—this chemical is very toxic, and must be used in a well-ventilated area. Ron's got several machines with motors approaching 20 years of service, which have been maintained in this manner. Ron Pesha can be reached at WGFR, 518-793-4491.

\*\*\*

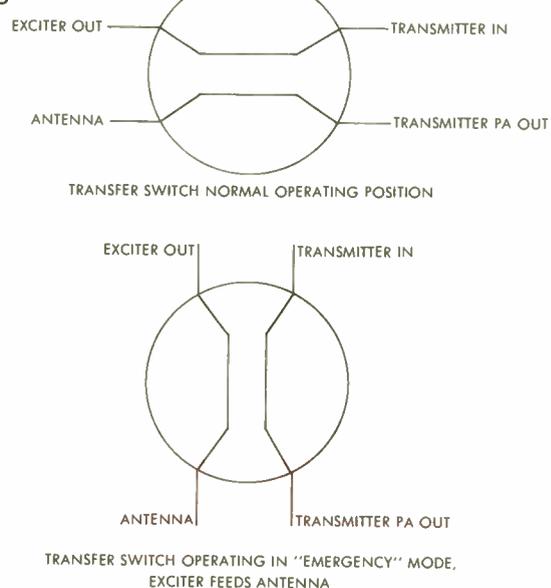
October marks the beginning of the fourth quarter—time for another quar-

terly tower inspection, and the last for the year. If you are a newcomer to broadcasting and wonder what I'm talking about, a good reference is a free Tower Inspection Checklist.

This publication is made available by Stainless Tower and SG Communications. It's an exhaustive checklist—after all, Stainless does build these things. The checklist is a good guide to making sure that all segments of your tower site are in good condition. If you'd like a copy, circle Reader Service Number 49.

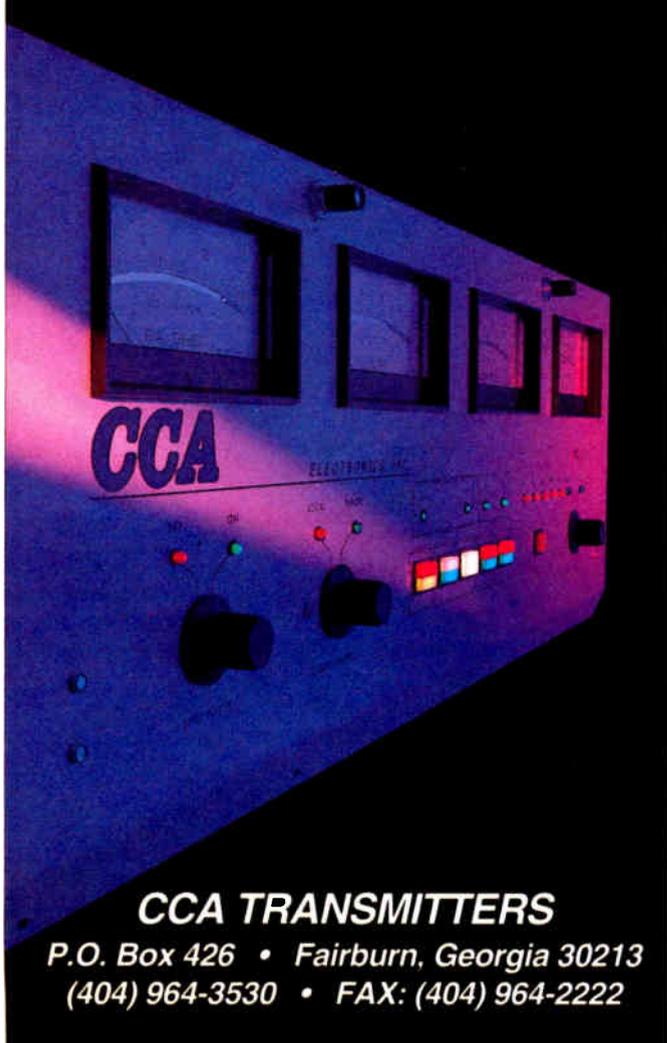
Stainless also offers a really slick calendar for your office or transmitter

Figure 1.



Transfer switch operating in "emergency" mode, exciter feeds antenna.

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## KTAO Lets the Sun Shine

(continued from page 30)

the structure's solar panels do not get enough sun, the earth itself will heat the building, says Hockmeyer.

For the solar system that will soon power the station's 50 kW ERP, an equally ecologically efficient design is planned—with an emphasis in collecting and storing as much sunlight as structurally possible.

### Downtime to a minimum

Even in sun-scorched New Mexico, a total of 135 solar panels are required to collect the sunlight needed for KTAO's signal. Excessive compared to some solar installations, this large number of solar panels is expected to keep site maintenance and station downtime to a minimum.

To reserve solar energy, the design uses 60 batteries, more than enough to store power for five cloudy days. Based on

site. Don't write for your free copy if you're afraid of heights. The pictures are breathtaking. Copies of the 1991 calendar are still available, and you can get on the mailing list to receive the company's 1992 calendar by sending a written request to: SG Communications, 210 South Third Street, North Wales, Pa. 19454.

\*\*\*

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

historical weather reports, which go back 70 years, it is unlikely the area will experience more than five cloudy days in a row. The system, says Hockmeyer, "is designed for one down day in 20 years."

Still, Hockmeyer isn't leaving anything to chance. "We're going to have backup power," he says. "But we don't ever intend to use it." A propane backup generator has been ordered for this purpose.

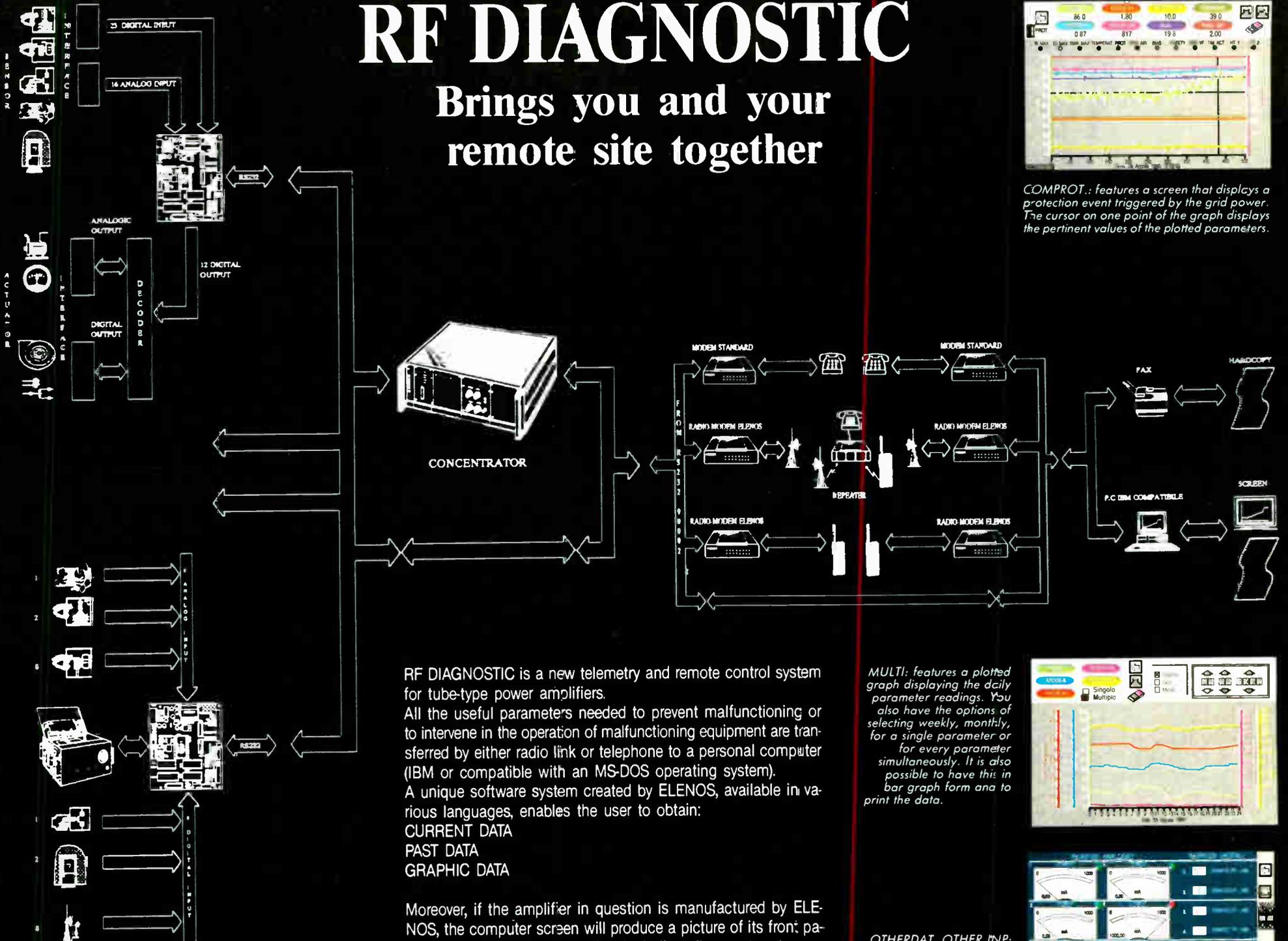
Expected to be the largest solar-powered station in the nation—perhaps in the world—KTAO-FM will power up with solar energy this month to the fanfare of a large celebration. Nationally popular musicians are anticipated to commemorate the event, as well as plenty of local enthusiasm.

\*\*\*

Dee McVicker is a free-lance writer and regular contributor to RW. She can be reached at 602-899-8916.

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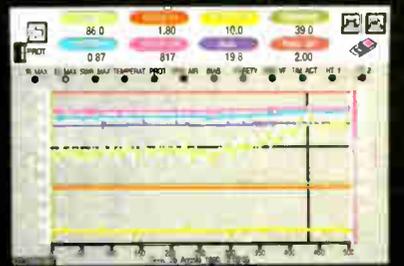
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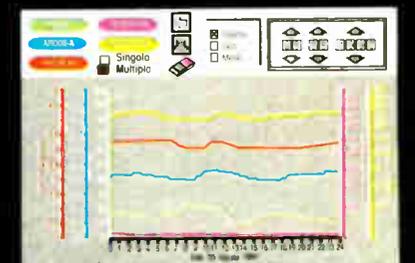
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**COMPROT.**: features a screen that displays a protection event triggered by the grid power. The cursor on one point of the graph displays the pertinent values of the plotted parameters.

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



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



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

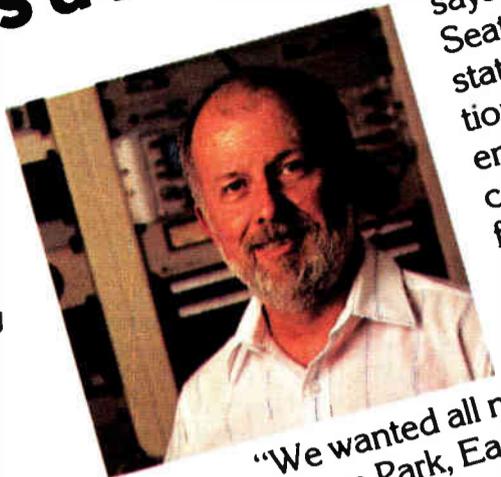


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Vic Orlando, Production Director, KBSG-FM 97.3, Seattle Washington, Viacom Broadcasting



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Mono feedback amp for cutting vinyl records, must work on Gramphin cutter head. H Sewell, Oakridge Music Rcrding, 2001 Elton Rd, Ft Worth TX 76117. 817-838-8001.

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Bogen AP35 stereo tube amp, \$50. M Saady, First City Rec, 141-60 84 Rd #3E, Briarwood NY 11435. 718-846-2062.

Tascam 1 headphone amp, 200 hrs; (2) Tascam LA-8 line amp, like new; call for prices. D Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

CBS Labs 1602 dist amp, dual 1x8, \$150. P Cibley, Cibley Music, 138 E 38 St, NY NY 10016. 212-986-2219.

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Marti PGM-20 line amp, \$40. P Wells, KJOY San Diego, 619-238-1037. FAX: 619-238-6157.

Perma Power S-102 amp w/S1420 batt holder, mobile/portable PA unit, 12 W out, SS, excel cond, \$100; Altec 1591A compressor amp w/15095 & 1578A matching xformers, all SS, mint cond, \$125. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Carvin FET900 200 Wchnl stereo pwr amp, fan cooled w/variable compressor, subsonic filter, ultrasonic filter, bridge switch, 3 space, 10" deep, 35 lbs, as new cond, \$400. B Fisher, KPOK, Box 477, Bowman ND 58623. 701-523-3883.

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Celwave CFM-LP-3 FM antenna, 3 bay w/deicers, tuned to 104.5, excel cond, \$2000. J Jetzer, WXER, 414-893-1045.

Celwave CP-1000 2-bay, 2 kW antenna, missing harness, tuned to 107.1, can sell sep as (2) 1 kW single bays, BO. J Galanses, WAWI, POB 25016, St Croix VI 00824. 809-773-3693.

Belden cable: 8449, 8790, 8422, 9750, 8448, 8663, 8627, various lengths, new, \$1100/all or will sell separately, you ship; (4) Andrew 78ARF, 3" helix connectors, never used, \$300 ea/\$1100 all. R Kerbawy, WTUN FM, Box 1127, Beckley WV 25802. 304-877-5592.

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Bendix Radio, 24" x 6" diameter, loading coil w/5" diameter variometer inside, unused, made for US govt, \$70. J Cunningham, YS-DA, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Andrew 1-5/8" splice kit, new; used 1-5/8" splice kit; 3-1/8" to 1-5/8" reducer; BO. D Tabor, WLCK-WVLE, Box 158, Scottsville KY 42124. 502-237-3148.

Cablewave splice for 1-5/8" coax, \$195; Cablewave gas blocking end connector for 1-5/8" line, w/EIA flange, \$145; Phelps-Dodge CFM-LP-4 4-bay FM antenna. 94.3 MHz w/randoms, circ, excel cond, ready to ship, \$1500. B Brewer, KOKL, 410 W 6th, Okinulgee OK 74447. 918-756-3646.

ERI FML 3-bay tuned to 92.5 FM, used 2 yrs, packed in orig boxes w/all parts, like new, changed freq, \$2900. H Thompson, WLYU FM, POB 111, Lyons GA 30436. 912-526-8122.

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## FM ANTENNAS

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2 BAY	2,300
3 BAY	3,150
4 BAY	4,000

MORE BAYS AVAILABLE  
All warranted, tuned and tested

ARMSTRONG TRANSMITTER CORP.  
5046 Smoral Road (315) 488-1269  
Syracuse, NY FAX (315) 488-1365

Beam antenna (2), 160 MHz. T Noordyk, 616-924-4700.

Cablewave FLC-7850J solid conductor AM line, 100', 7/8". BO. B Graham, WYMK/WEMR, RR#3 Box 1460, Tunkhannock PA 18657. 717-836-1460.

Andrew 194' antenna, 1-5/8" semi flex w/connectors, you ship, BO. J Harper, KQMC-FM, Box 44, Brinkley AR 72021. 501-734-1570.

Celwave 6-bay FM, 10000 W bay, 105.1 MHz, \$4000. R Murphy, 602-855-1051.

Jampro JHPC 5 bay antenna, tuned for 104.3 MHz, unused, \$6000 FOB. D Peluso, KJUL FM, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

Andrew ADF7-80A 1-5/8" foam dielectric xmission line, 197', \$6/ft. S King, KATP-FM, I-40 W, Amarillo TX 79110. 806-355-9777.

Rohn 80, 41" face w/guys & lighting, BO. O Eatmon, Mega Comm, 19 W Hargett St, Raleigh NC 27601. 919-990-1906.

Pi-Rod 320' solid steel twr & lights, 24" face, new in '82, you take down & haul, \$3000. C Jennings, WOLA, Box 1530, LaFollette TN 37766. 615-566-1000.

## FM - ANTENNAS

Designed and built for your frequency. Choose from 1 to 12 bays and five power levels. Financing available. Call Jimmie Joynt at S.W.R. 800/279-3326

Kintronics AM-3 twr phaser w(3) weather-proof tuning units & main/aux switch, all new, never used, \$8000. J Salov, SHGR/WUPS, 517-740-1165.

Utility 340, 300' of 18" tower near Enid OK, \$5000. Brian, WWNH, 603-742-8575.

ERI/Harris FMXL-3E 3-bay FM antenna, rototiller style, on air at 93.5, w/1.5588 pwr gain, 1-5/8" end input, you ship, \$4000/BO. S Mattingly, WWWO, 5216 Bradburn Dr, Muncie IN 47304. 317-289-9500.

Potomac AM-19 (204) 3-twr AM antenna mon, excel cond, \$850. J Salov, SHGR/WUPS, 517-740-1165.

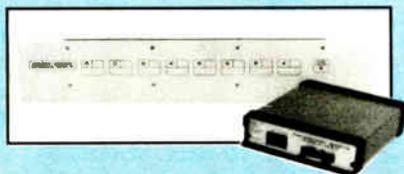
### Want to Buy

ERI rototiller antenna, 6 or more bay, on or near 93.3 & 95.5; tower, 500' taller, standing on ground; feedline also needed. R Wachter, KNSX, FAX: 314-921-2122.

Tall towers & antennas, 1 10-bay 107.1, 1 10-bay 98.3 or tunable; also, xmission line. B Zellmer, Colorado Farm Net, Box 2475, Greeley CO 80632. 303-330-1342.

Cablewave/Celwave 150-160' 1-5/8" air dielectric xmission line in gd used cond. K Diebel, KTJC-FM, 1207 Louisa St, Rayville LA 71269. 318-728-5852.

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**ANTENNAS . . . WTS**

Cablewave HFM LP-4 antenna, 4-bay horiz only, tuned on or near 95.9 MHz; Also, any Class A antenna, horiz only, 4-8 bays, tuned to 95.9 or 96.7 MHz, incl Phelps Dodge, RCA, Collins, etc. T English, 70 Middle St, Bridgeport CT 06604. 203-366-9321.

Grid dishes, 6', 8' & 10' for 950 MHz STL systems, reasonably priced; (6) pieces 7/8 heliex in at least 300' lengths w/connectors, reasonably priced. K Austin, Austin Brcdst, 1101 Hwy 81 N, Marlow OK 73055. 405-658-3330.

Circular 6-7 bay, lw pwr tuned to 103.3 MHz. R Murphy, 602-855-1051.

High pwr FM antenna, 10 bay, 94.7. T Noordyk, 616-924-4700.

FM CP antenna, 10/12 bay, on/near 98.5 MHz; also, 500' of 1-5/8 or 3-1/8 coax, must be gd cond; 450' of 24" tower, w/light kit, prefer on ground but will consider take down. Brian, WNNH, 803-742-8575.

Lexicon 224, 404 reverb, excel cond. BO; UREI 529 EQ, excel cond, BO. F Virtue, Virtue Studios, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Lang PEQ-2 EQ, \$500; Organ 672A, \$500; Gates Sta-Level, \$300; dbx 160, \$350; dbx 166, \$350; Yamaha GC2020 2-chnl compressor, \$150; Yamaha R1000 dig reverb, \$125. M Helejak, Milwaukee Sound, 610 N Water St, Milwaukee WI 53202. 414-272-7085.

Universal Audio 1008 tube mic preamps, \$200 ea; Langevin AM-16 mic preamps, \$150 ea; APSI 559 graphic EQ, \$300 ea. M Linnett, Yr Place or Mine, 1600 Las Flores Dr, Colendale CA 91207. 818-244-1909.

Orban 245E stereo synthesizer, gd cond; Ibanez AD202 analog delay audio processor. C Freinwald, KBSG, Seattle. 206-343-9700.

Orban 536A 2-chnl de-esser, excel cond, \$225+shipping; Crown UFX stereo crossover, \$75+shipping. B Seifried, Eclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

Howe 2100 Phase Chaser w/all connectors & manual, \$550. S Schweiger, WXL0-FM, 146 Worcester Cir, Worcester MA 01608.

Auto answering circuit box, home made, & Sparta mono PB tape deck used to provide weather forecasts on dedicated phone #, \$350/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

**Want to Buy**

RCA, WE, Altec & other tube amps; also, tube mixers, consoles, EQs, compressors & recorders. R Van Dyke, Caffrey House, 2 Squires Ave, E Quogue NY 11942. 516-728-9835.

dbx Type 1 audio processing equip incl CD players & EQs. S Wood, Modern Syst Res, 12648 La Crosta Ct, Los Altos CA 94022. 415-941-8000.

Yamaha/Eventide harmonizer/effects unit. T Noordyk, 616-924-4700.

Ham radio operators looking for surplus audio processors, mixers & mics, as well as other inexpensive gear that could help bcdt engs play radio at home among enthusiasts for vintage AM. Please write w/offerings. WA3VJB, Box 73, West Friendship MD 21794-0073.

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**Kris Elliot at 818-992-4288 or write to: J&I Audio/Video 20899 Kelvin Pl., Woodland Hills, CA 91367**

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**AUDIO PRODUCTION**

**Want to Sell**

Eventide BD980 stereo delay, 15 kHz, excel cond, \$3500; Orban 222A stereo enhancer, excel cond, \$500; Tascam RS20 spring reverb, excel cond, \$100. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

dbx 128 Type II NR w/comp & expander, \$150+shipping. Philip, Big Red Sound, 172-28 Henley Rd, Jamaica NY 11432. 718-523-2815.

Dolby 361 SR & A type NR stereo pair w/cards for SR & A, work fine, \$2200/pair; BSR/dbx stereo tape hiss reducer, RCA inputs, variable low pass filter dynamically dependent on program content, \$49. R McMillen, 503-239-6070.

dbx 140X NR in orig box, not used, \$100. S Cassidy, Radio Prog Services, Box 472, Manitou CO 80829. 719-661-1744.

Digital LED up timer (5), 2", resets to 0 when 9:59 is reached or momentary closure made, self-pwr'd, \$5750 ea, prepaid UPS. D Peluso, KJUL FM, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

Universal Audio 175 tube limiting amp, vgc, \$600; dbx K-9-22 card for Dolby A-360 main-frame (2), BO. J Gullebeau, Deer Tree Grp, 2165 E Clairborne St, Springfield MO 65844. 417-833-0120.

Yamaha SPX-90 Series II digital audio effects processor, vgc, \$285+shipping. B DeFelice, DeFelice Prod, 93-2R Fowler St, New Haven CT 06515. 203-397-2595.

Radio Design Labs pods to make (2) control boards, modular design, new, unused, request list, \$10,000 all FOB. D Peluso, KJUL FM, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

# 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**

Attention getting talk radio, full spectrum personality. H Friedman, 512-445-5453.

Announcer w/5 yrs exper, esp in major market Baltimore, seeks FT shift in S-central PA, W MD or MD Eastern Shore, prod skills are excel, write for T/R: 8432 Pleasant Plains Rd, Baltimore MD 21204.

11 yrs radio exper, PD, prod, DJ, traffic & news, seeking PD & On Air pos in Albuquerque/Farmington, NM. John, 503-267-2249.

IDs, sweepers, sports, billboards, etc, for sm market budget minded station. 803-457-4556.

Station manager w/news & prog exper, also, computer billing, collections, automation & strong sales background, very willing to relocate, young & highly motivated. Stan, 404-884-8531.

New DJ wants to break into TX market, any format, strong in commercial & news prod, any shift, tape & resume avail. S Bradshaw, 7727 Nimrod, San Antonio TX 78240. 512-523-2035.

Aggressive, tireless, company-minded 31 yr old P/O/M seeks turnaround situation w/limitless opportunity, 11 yrs exper, ACA/OR/urban, SE location. James, 801-841-6815 nights.

Recent grad, announcing since '87, wants to begin career, work anywhere, pay not important. T Morrow, 2353 Nebraska, Blair NE 68008. 402-533-2821.

Chief eng, former tech dir of 26 stations, seeking eng mngr pos, SBE certified, FCC license, 13 yrs exper w/FM & AM directional. D Nelson, 206-387-3558.

Engineer w/5 yrs exper, studio construct, TX site construct, all levels maint & planning, anywhere in Mid-Atlantic. Engineer, Rt 1 Box 179, Callaway VA 24067.

Exper eng accepting temp/FT assignments, anywhere, projects, construction, restoration, gen mgmt. T Low, 2946 Amanecer Pl, Escorido CA 92027. 619-741-1054.

15 yr vet, On Air & PD, top 40, oldies, rock, hot AC, please no dance station, SE only. 803-457-4556.

Jazz host/producer, 12 yrs exper, seeks Or-Air slot in Orlando/Tampa area, FT pref. P Lamattina, 6 Pineybranch Rd, Cranbury NJ 08512.

Broadcaster w/2 yrs non-commercial exper seeks PT/FT commercial pos in SE PA, NJ or N DE. Mill, 215-533-3773.

20+ yrs radio/TV: anchor, sls mgr, PD, ND, etc, seeking mgmt/ownership, family man, ham AI, 405-242-4800 eve.

Losing Oldies time slot on FM college station, seeking weekends to continue show. D Hogenmiller, 4612 Theiss Rd, St Louis MO 63128. 314-894-8194.

Engineer w/20+ yrs exper & personal commitment to AM radio seeks CE pos. J Pearce, POB 17502, Colorado Springs CO 80935.

Creative, respon air talent w/6 yrs exper seeks challenging, stable pos, versatile skills w/marketable personality & a winning attitude. Randy, 919-275-3498.

DJ, all formats, 5 yrs exper, seeks pos in CO, AZ & CA, some prod exper. 602-493-5312.

Prog/promo asst w/2 yrs maj market exper & college degree seeks similar/more adv pos, ambitious, creative & responsible. S Waller, 28415 Basswood Ave, Rancho Palos Verdes CA 90274. 213-375-4494.

Engineer exper in all areas, studio construct, hi-pwr FM, directionals, automation. Paul, 904-654-1697.

Country jock w/exp in #1 stations seeking any FT pos in Austin/San Antonio area, top-notch refs. C Jones, 915-365-2313.

Have 10-share rated prog, nostalgia, big band, trivia format, seeking shortwave, intern'l or syndication brcdstrs, 20 yrs exper. R Butler, 401-635-2533.

Quality air talent w/2 yrs exper in college radio seeking commercial station pos in MO. Kim, 314-635-0020.

**HELP WANTED**

BE ON TV., many needed for commercials. Now hiring all ages. For casting info call 615-779-7111 Ext T-1765.

**AUTOMATION EQUIP**

**Want to Sell**

SMC DAS 612 digital audio switcher, (2) SMC chnl 4 programmers, (2) Magnavox computer mon 80, SMC MSP-12, (3) mono SMC Carousels, racks, cables, etc. BO. P Berger, WNAM/WUSW, POB 707, Neenah WI 54957. 414-727-2040.

Conex CG25 tone encoder, excel cond, \$200; \$225; Gates time pulse module, gd cond, \$100; Gates ATC logging encoder, gd cond, \$125; Schafer 903 automaton system incl (4) R-R, (3) Carousels, used, \$4000; (3) Sonomag 250 cart Carousels, gd cond, \$200 ea; (2) Sonomag TS-25 tone decoder, vgc, \$200 ea. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

SMC 450 Carousel (3), gd cond; triple deck cart player; MSP-1 programmer & control head; 350 Carousel for parts; SMC tone gen. J Galanes, WAVI, POB 25016, St Croix VI 00824. 809-773-3693.

MEI Satmaster 1000 event satellite programmer & (2) SMC 452 stereo Carousels, manuals, cables, recently removed, \$6000+shipping. R Kerbaw, WTNJ FM, Box 1127, Beckley WV 25802. 304-877-5592.

IGM Go-Cart 24, used 1 yr, w/manual, gd cond, \$3000/BO; Systemation Superswitch, 6 closures, w/manuals, like J Pescatello, WMMW-AM, 900 E Main St, Meriden CT 06450. 203-634-1470.

IGM Go-Cart 24 (2), 2.5 yrs old, on air, mint cond, must sell quickly. BO. J Amburn, KTUE/KJMX, POB 1260, Tulia TX 79088. 806-995-3531.

Shafter/Cetec 7000 brain; also, (1) Audiofile & (2) SMC 248 Carousels, pick-up only, BO. D Doughty, H&D Brcdst Group, POB 781, Ulica NY 13503. 315-797-1330.

Sonomag 350RS Carousel (2), used but operate, \$1000 ea/BO; (3) standard equip racks, used, \$300 ea/BO; BE automation rack, used, \$400/BO; Gates 5-chnl stereo Statesman board, needs work, BO. S Willett, WAYI/WBZA, Glen Falls NY. 518-792-2151.

IGM Rampart Satellite System, brain, controller cards, 72-tray Go-Cart, 48-tray Instacart, Carousel Plus/parts, SMN controller & clock system, complete manual set, mono but capable of stereo, in service & working, \$6500/BO. M Johnson, 2745 Alexander Ln, NE Albany OR 97321. 503-926-3994.

SMC system, (4) 350 RSB mono Carousel, (2) double cart transport, PDC-5 clock, DS-20 switcher, DP-2 programmer & racks, will part out, BO. D Blankenship, WTKT AM/FM, 2600 Iron Works Rd, Georgetown KY 40324. 502-863-1580.

Harris 9000 w/R-R, 48-tray Go-Cart, (2) 24-tray Go-Cart, (6) other source cards, spare boards, you ship, \$2600. G Falus, WZMX, 100 Executive Dr, Farmington CT 06032. 203-677-6700.

Otari ARS-1000DC (4), PB only w/brackets, tone sensor & auto rewind, excel cond, \$900 ea. B Christie, Grande Radio, POB 907, LaGrande OR 97850. 503-963-4121.

Otari ARS-1000 R-R tape transport (2), \$675 ea. S King, KATP-FM, 1-40 W, Amarillo TX 79110. 806-355-9777.

SMC TS-25 tone sensor, new, w/spare chips & manual, \$300/BO/trade; Gates FA-25 25 Hz tone filter, passive, gd cond, no manual, \$100/BO/trade. D Willey, Life Brcdstng, POB 96, John Day OR 97845. 503-575-1840.

Shafter 903E, complete in fair cond, (3) wrking Audiofiles, (3) Audiofiles need repair, keyboard, RAS cards updated, new PS battery, \$5000, you haul/pay shipping. M Hoffman, KNCK/KCKS, RRI W 11th, Concorde KS 66901. 913-243-1414.

SMC 250RS 24-tray cart Carousel (3), w/front panels, mounting hardware & full doc, wrking for parts, you ship, \$400 ea/\$1000 all. A LoPresti, AJL Soundwave, 21 Carter Rd, Geneva NY 14456. 315-789-4019.

Tone detectors from diff mfrs (8), 25 Hz, some spare units for parts, \$50 ea/trade all. S Callahan, WCEG, 1120 Pinellas Bayway, St Pete FL 33713. 813-821-9549.

SMC/MSP 12, w/(3) 450 Carousel, (2) rack, set up for Unistar Adult Contemp, in use, removed when sold, BO. C Veirs, 901-772-3700.

Harris System 9000, complete w/all assoc equip incl (4) Otari PB, (2) Go-Cart Carousel, data terminal, keyboard, printer, gd wrking cond, \$7000/BO. R Cressman, WJMA, POB 271, Orange VA 22960. 703-672-1000.

SMC SSP 3060 automation stepper w/AS-10 audio switcher, controls 10 sep sources, \$2000/BO; (2) SMC 250 Carousels, stereo PB, \$350 ea/BO; SMC 350 Carousel, stereo PB, \$475 ea/BO; (3) SMC RSC-50 50-step Carousel controllers, \$200 ea/BO; SMC mounting rack, \$200; all of above for \$1500 incl cabling. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

SMC automation system: SSP 3060 stepper, AS-10 switcher, (2) SMC 250 Carousels, SMC 350 Carousel, (3) RSC-50 50-step random access controllers for Carousels, (2) SMC 700 series snpl P cart machines, SMC 700 series R/RP cart machine, (2) system real time clocks, plus much more, all equip listed is stereo, wiring harnesses & manuals incl, \$7000/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

Shafter 903 brain, keyboard & (4) Shafter R-R, xtra source cards for carts, etc, w/manuals, wrking when removed, BO. P Delaney, WOSX, Box 921, Marshfield WI 54497. 507-895-2065.

Broadcast Auto 2501-G tone gen (2), need little work, \$30. P Barzizza, KJBR, 603 Madison, Jonesboro AR 72401. 501-935-5598.

ATC Harris SP-10 system: (3) Scully, (5) Carousel, cart, RA-5, SP-10, gd wrking cond, w/spare RA-5, SP-10 & Carousel, \$2000/complete, will consider selling items separately. G Williamson, WASK, POB 7880, Lafayette IN 47903. 317-447-9504.

Complete automation pkg: BAI brain, (3) Otari reels, (3) Carousels, snpl play, all new or rebuilt, w/music, used less than 3 yrs on Sundays only, \$12,500 incl shipping. J Alsip, KSCQ, Box 1528, Silver City NM 88062. 505-538-3396.

Instacart (2), 48-hole, '84, w/Sentry IBM compatible firing system; also, a R-R. Dale, 503-774-0459.

**Want to Buy**

Cetec 7000 Level 1 or 2 system, left-end rack w/monitor panel, card cages, pwr supply, doors, terminal w/CPU board, SIO board, RTC board, RAM & ROM boards, PIO board, VEL board, minimum memory of 3680, & universal source cards, audio control, monitor & distribution boards. D Williams, Lincoln County Broadcasters, 1103 Utah Ave, Libby MT 59923. 406-293-6234.

Small automation system or Carousels in gd cond, note: lw budget. Brian, WNNH, 603-742-8575.

**BUSINESS OPPORTUNITIES**

**Want to Sell**

Prior owner/operator w/22 yrs exper will build your AM/FM station, facility construct to hiring/training staff, upgrades, turnarounds, will consider equity. R Ritchey, 512-828-9252.

**CAMERAS (VIDEO)**

**Want to Sell**

Ikegami 730A w/Canon J12X9 BIE lens, plate, case, excel cond, \$4200. M Veselich, Walden Group, POB 10451, Marina Del Rey CA 90295. 213-871-0392.

Hitachi FP-10 industrial color ENG camera w/pwr supply, shotgun mic, road case, manual, \$1800. D Bailey, Rock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Sony DXC-6000 k/1, high resolution, motorized 10x f1.6 zoom lens, lw light, prbrcst ENG, excel cond, w/case, tripod bracket, cable, battery pack, \$5000. Jaye, Nimbus Prod, POB 5903, Takoma MD 20912. 301-507-3358.

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**CART MOTORS REBUILT** to quiet flutter-free perfection-shafts resurfaced

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# EMPLOYMENT SECTION

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

**POSITIONS WANTED:** Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 3 issues of Radio World. Contact information will be provided, but if a box number is required, there is a \$10 fee which must be paid with the listing (there will be no invoicing). Responses will be forwarded to the listee, unopened.

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

**CARTS ... WTS**

Spotmaster TP1-B cart tape reloading machine w/timer; Spotmaster S-302 3-deck, mono, excel cond; (2) Spotmaster 500C open top mono cartridge recorder. C Freinwald, KBSG, Seattle. 206-343-9700.

ITC R/P-0004 Premium series, stereo, 3 tones, excel cond, gd heads, vy little DSP, \$1600/BO. C Jennings, WQLA, Box 1530, LaFollette TN 37766. 615-566-1000.

ITC SP record amp for use w/SP series cart equip. C Freinwald, KBSG, Seattle. 206-343-9700.

**Want to Buy**

Tapecaster 700 RB & RP, poor-gd cond. A Ishkanian, 9723 Riggs Rd, Adelphi MD 20733. 301-439-7222.

ITC Omega series R/P cart machine, excel cond. K Conlin, WJKC, 449 Caromar Dr, Madison WI 53761. 608-233-6185.

**CASSETTE & REEL-TO-REEL RECORDERS**

**Want to Sell**

Teac/Tascam 35-2 & 35-2B R-2R trk rcrdrs, (1) w/dlx, recently refurb, w/attractive, custom, side-by-side console, excel cond, \$1700/BO+shipping. W Ahlberg, Davis Glick Prod, 11846 Ventura Blvd #306, Studio City CA 91604. 818-509-9100.

Ampex 602 FT mon, portable case, ave cond, \$60 UPS paid; Ampex AG500 FT mono, portable case, gd cond, \$150 UPS paid. W Amett, WBAT, Box 839, Marion IN 46952. 317-664-6239.

Sony TC105-A (3), (2) wrkg, (1) for parts, \$50/all+shipping; Marantz PMD 200, for parts, \$10+shipping. P Mueller, KUTA-AM, N Hwy 191 G-1, Blanding UT 84511. 601-678-2261.

Misc R-Rs incl: Ampex, B&H, Omnibal, Revox, Scully, Teac, call for models & prices; Goldstar port cassette recorders, vgc, \$15. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Denon DRM2 (4), (3) w/hw motor & idler arm, mic inputs, gd cond, all working, \$75 ea/BO or \$250/all+shipping; Uher R-R, DKN I/Os, cables, \$100/BO. B Strapko, 708-830-0701.

Magnecord PT-6, (2) stereo, (3) FT mono, amps, cases, parts, manuals, all/part, fair-gd cond, BO; RCA 2" tape transport components, (1) capstan motor, (2) reel motor w/platforms, brakes, guides, pinch rollers, gd cond, BO; Shaler logging recorder, 10-1/2 reels, 3/6 ips, 1/4-trk, 2-chnl, gd cond, \$200. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

**HEAD RELAPPING/REPLACEMENT**  
All tape and film formats  
30 years experience



350 N. Eric Drive  
Palatine, IL 60067  
708-358-4622

Ampex 440-C 4-trk w/servo capstan, heads marginal, \$500. C Bener, WUSL-FM, 440 Domino Ln, Philadelphia PA. 215-483-8900.

Otari MX5050 1/4" 4-trk; Teac 32-2B 1/4" 2-trk. J Edman, Results Brcdstg, 7732 Tampa Way, Shreveport LA 71105. 318-797-3211.

Scully 280 4-trk, in console cab, gd cond, BO; Scully 260 2-trk, w/portable cases, gd cond, BO. F Virtue, Virtue Studios, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Ampex AG440 1/2" 4-trk w/console & dbx Type II NR, \$650. R Correns, Madison Park Prod, 700 W Pete Rose Way, Cincinnati OH 45203. 513-651-5375.

Audiotronics AV123-4TS 1/4-trk; Infonics RR-1, 73M, FT; Infonics RR-2, 74M, 2-trk; all gd cond, all/part, \$200 ea. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

MCI JH-110B FT stereo for 14" reels, in metal roll-around cabinet, \$1875/trade for computer, etc. P Wells, KJCY San Diego, 619-238-1037. FAX: 619-238-6157.

Otari ARS1000-DC R-R PB tape deck (2), w/tone sensors, excel cond, \$600 ea. B Brewer, KOKL, 410 W 6th, Okinulgee OK 74447. 918-756-3646.

ITC 750 reel deck (2), (1) w/record amp & extra parts box, \$700/all; (2) Magnecord mono R/P, (1) rebuilt, (1) unknown cond, BO; Roll-around adj tape deck rack, gd cond, \$50+you pick up. R Ness, WGEN, 1003 S Oakwood Box 67, Geneseo IL 61254. 309-944-4633.

Tascam 22-2, 1/4", 1/2-trk, 7.5/15 ips, clean, just tweaked, \$400. J Kreines, DeMot/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

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Otari 5050B, new capstan motor w/PC board, \$100; Panasonic SV3500 DAT demo, checked by mfr, \$850/BO. R Rhodes, Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

Otari MX-5050B 2-trk stereo, gd cond, \$995; Otari MX-5050 2-trk stereo, gd cond, \$795; Otari MX-5050 FT recistereo play, \$595. B Mountjoy, WITM-AM, POB 1240, Elizabeth TN 37644. 615-543-5849.

Tascam Mini Studio Porta II, like new, w/all papers & instruct, \$399. Dan, 206-546-1498.

Studer 820 2-trk master rcrdr, latest mods & software, mint cond, \$9000+shipping. R Canata, Cantrax Recorders, 2119 Fidler Ave, Long Beach CA 90815. 213-498-6492.

Ampex 300 ('53) w/tube elec, w/new spare pinch roller & manual, drive motor may not operate, \$75+shipping. J Morinelli, Morinelli Entertain, 901 Fairfax Rd, Drexel Hill PA 19026. 800-666-2641.

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Ampex PR-10 stereo rack mounted R-R, w/some spare parts & manual, excel cond, \$250/trade. S Callahan, WCEG, 1120 Pinellas Bayway, St Pete FL 33713. 813-621-9549.

Ampex AG-440 2-trk stereo, console mounted, w/manual & all cables, gd cond, \$750. D Harbour, KISU, 212 S Main, Malvern AR 72104. 501-337-9000.

Ampex 601, w/out cover, many spare parts & manual, excel cond, \$150. S Callahan, WCEG, 1120 Pinellas Bayway, St Pete FL 33713. 813-821-9549.

MCI 110B, several; also, 110As, Otari 5050Bs; all gd wrkg cond, plus many spare parts; \$500-1500+shipping. M Shea, Precision, POB 723, NY NY 10276. 212-989-2684.

Ampex 300, 350, 351, 440 NAB spring-type hold down adapters (6), as new, \$20 ea. M Saady, 1st City Rec, 141-60 84 Rd 3E, Briarwood NY 11435. 718-876-2062.

Telefunken M15A 1/4" stereo in console w/meters, 15/30 NAB, w/manual, \$4000/BO; Otari 5050B rebuilt capstan motor w/PC board, \$125/BO. R Rhodes, Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

Revox PR-99 MK II 1/2-trk stereo P (5), \$1200/each FOB. D Peluso, KJUL FM, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

Tascam 38 8-trk R-R, brand new, w/(4) reels Ampex tape, all manuals, in box, new cond, must sell, \$1700. B LeCato, WKRE, POB 220, Exmore VA 23350. 604-442-5000.

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Atari R-R PB (3). G Gilbert, CSRG, POB 50539, Denton TX 76206. 817-380-0229.

Tascam RC-71 wired 12-pin remote for model 38 & similar equip, \$55. B DeFelice, DeFelice Prod, 93-2R Fowler St, New Haven CT 06515. 203-397-2595.

Tascam Mini Studio Porta II, 4-chnl, like new, w/all papers & instructions, \$399. Dan, 206-546-1498.

Ampex AG-440C stereo, fair cond, \$400. G Faltus, WZMX, 100 Executive Dr, Farmington CT 06032. 203-677-6700.

Ampex 351 FT, excel cond, transport w/tube electronics, \$300; w/Novonics, \$450. L Beigel, On-Cue-Rcrdng. Call/fax: 800-726-9813.

ITC 770 2-trk PB (4), rack mount, almost new heads, gd cond, BO. P Lierman, KCSP, 601 W Collins Dr, Casper WY 82601. 307-265-5414.

Otari MX-5050, wood cabinet, manuals, wrkg when removed, gd cond, \$475 incl shipping. J Alsip, KSCQ, Box 1528, Silver City NM 88062. 505-538-3396.

ITC 750 2-trk stereo rcrdr, metal roll-around cabinet, gd cond; ITC 750 2-trk stereo rcrdr, rack mount, fair cond; ITC 850 2-trk stereo rcrdr, metal roll-around cabinet, gd cond; Tascam A2300S 2-trk stereo rcrdr, wood cabinet, looks gd; MCI JH-140 4-trk 1/2" rcrdr, excel cond, heads recently re-lapped, roll-around cabinet. C Freinwald, KBSG, Seattle. 206-343-9700.

Metrotech 400 logger w/books & months worth of tapes, gd wrkg cond, \$500. M Vanhooser, KSKY, 4144 N Central Exp #266, Dallas TX 75204. 214-827-5759.

Ampex AG440 1" 8-trk rcrdr, 10 hrs on relapped heads, excel cond, \$3800. B Seifried, Eclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

Tascam 34 1/4" 4-trk rcrdr, \$650/BO. J Lang, PSI, Box 4085, Anchorage AK 99501. 907-333-2221.

Scully 270 R-R PB only (4), \$300/BO; Scully 270 R-R PB only for parts, \$200/BO; all (5) for \$1200; also, (2) dual 25 Hz tone sensors for above decks, \$200/BO; (2) SMC mounting racks, \$200; buy all for \$1500. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

Teac A-3340S, 4-trk, 4-chnl simul-sync, built into factory travel case, incl wired remote, like new cond, \$850/BO. D Deuth, Audio Prod, 1801 Commerce Blvd, Mound MN 55364. 612-472-1619.

Telex 300 stereo w/master & 5 copiers in 3 cabinets, blowers in ea cabinet for air circ, excel cond, BO. G Kristiansson, Villa Skansen, 122 Fairmount St, Burlington VT 05401. 802-864-9779.

SMC 700 series stereo cart R/PB (2), 3 tones, \$650 ea/BO; Sony TC-560 7" 1/4-trk, 7 ips max, ESP auto rev, \$250/BO; Teac 2300-A 7" 1/2-trk, 7 ips max, \$350/BO; Pioneer RT-1050 10" 1/2-trk, 15 ips max, \$500/BO; Pioneer cassette deck, hi-speed dubbing, Dolby B-C, \$75/BO; (3) Otari ARS-1000 R-R PB only, w/tone sensors, \$750/BO; Gates mounting rack, \$200; buy Otari decks & Gates rack for \$2100. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

Revox A-77 1/4-trk, in walnut case, excel cond, \$500; (2) Tascam 22-2 1/2-trk stereo, 7.5 & 15 ips, excel cond, \$400 ea. C Jennings, WQLA, Box 1530, LaFollette TN 37766. 615-566-1000.

Tascam 40-4, grt shape, BO. S Winthrop, Winthrop Prod, 10 W 94th St, NY NY 10025. 212-662-8685.

Otari MX-5050 QXD 4-trk, mint heads, vgc, \$1500. B Hanson, 314-449-8433.

**Want to Buy**

Otari 4-trk in gd cond. J Laprad, Sunspots Prod, Box 403 W Side Station, Worcester MA 01602. 508-755-0732.

Ampex 351 stereo headstack, fair-excel cond. D MacKenzie, WJBR AM-FM, 2617 Ebright Rd, Wilmington DE 19810. 302-475-4000.

Ampex MR-70, gd cond. D deForrest, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 702-732-2200.

Uher recorders, all conds; also, access, manuals, new parts stock, promo items & ads; mini R-R recorders, esp 2" reel capacity; plus, empty 2" & colored reels up to 5"; vintage open reel access from '60s. J Morinelli, Morinelli Entertain, 901 Fairfax Rd, Drexel Hill PA 19026. 800-666-2641.

Stellavox SF7 stereo; ABR Irg reel adaptor for SP7; Stellavox TD88. R Cummins, 212-219-3670.

Ampex PR-10 manual & schematic. L Johnson, 3928 Red Oak Dr, Doraville GA 30340.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 1131 Virginia Ave, Campbell CA 95008. 408-866-8434.

MCI/Sony capstan & reel motors, any cond., recdg heads, most mfgs, machines, new, used. Relapped then sold. Amp Services, 224 Datura St No 614, W Palm Beach FL 33401. 800-826-0601, In FL 305-659-4805.

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

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Studer A727 studio CD player w/balanced XLR outputs, rack mount & complete doc, excel cond, \$1175+shipping. B DeFelice, DeFelice Prod, 93-2R Fowler St, New Haven CT 06515. 203-397-2595.

**COMPUTERS**

**Want to Sell**

Wang 2200 PC Business System: for use w/Computer Concepts Broadcast System, BO. M Ring, WTNV AM/FM, 134 Mallin St, Watertown NY 13601. 315-288-0790.

IBM Proprinter dot matrix, \$40; Proprinter II for parts, \$15; (4) TAB 132/15 editing terminals, 15" screen, \$25 ea. P Russell, Bowdoin Coll, Sills Hall, Brunswick ME 04011. 207-725-3066.

Apple II+ w/2 disk drives & monitor III; w/Mountain Computer Music system & Alpha Centuri cards, \$50 ea. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011.

**CONSOLES**

**Want to Sell**

Gates Ambassador 5-chnl w/(4) xtra chnls, used, \$300; Gates Yard II mono 8-chnl, vgc, \$500; Prokit audio mixer, 6-chl, used, \$75; Shure, M68 mixer, vgc, \$100; Sony MX14 6-chl mixer, gd cond, \$30; Sony MX650 6-chnl mixer, gd cond, \$50; Sparta S-15 mixer, used, \$25. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Radio Systems ESA-10 w/manuals & copy stand, \$4500; BE 5S150 w/manual, \$1500. T Pless, WHVY, 112 Main, Annapolis MD 21401. 301-626-0103.

Russco 505S stereo 5-chnl board w/10 inputs, cue & mon systems, \$600. J Laprad, Sunspots Prod, Box 403 W Side Station, Worcester MA 01602. 508-755-0732.

RCA 6B6 tube-type 2-chnl, functions wrkg, grt old board, \$800+shipping/BO. T Heathwood, Heritage Radio Classics, POB 16, Boston MA 02167. 617-969-9966.

Collins 8081-1 portable console w/TT, all transistor, never used, like new, BO. J Anderson, WKCU/WXRZ, 2192 Hwy 72 E, Corinth MS 38834.

Pyramid PR8900 mixers (2), grt cond, \$300/BO. J Galanses, WAVI, POB 25016, St Croix VI 00824. 809-773-3693.

Henry Fast Trac dubbing system, \$400. B Lord, Lord Brcdstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Roland CompuEditor automated fader system (2), locks to SMPTE, \$700 ea; Trident Series 80, spare chnl & misc parts, \$200. B Seifried, Eclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

McMartin 1082V 8-chnl stereo console w/slide faders, 20 inputs, gd cond w/pwr supply, spare parts & manual, \$1000; Harris Medalist-10 10-chnl stereo console w/rotary faders, excel cond w/spare parts & manual, \$2000; Harris Medalist-8 8-chnl stereo console w/slide faders, excel conde w/spare parts & manual, \$1800. B Mountjoy, WITM-AM, POB 1240, Elizabeth TN 37644. 615-543-5849.

ADM S/TV-24, 24-input w/4 subs, subs have EQ, 4 yrs old, excel cond w/doc & records, \$20,000. B Covey, WATL-TV, 1 Monroe Pl, Atlanta GA 30324. 404-881-3600.

Audio Arts Engineering 8X recording console, factory patch bay, 24x8x24 trk mon, brand new cond, \$7800. D Kocher, Digital Sound Makers, 1901 Hanover Ave, Allentown PA 18103.

Tascam 5-A mixing boards (2), 200 hrs: call for price. D Curtis, Creative Sound, 2219 W 4th St, Appleton WI 54914. 414-733-2899.

CCA Ultimate 10 10-chnl dual mono console, \$400+shipping/BO; Ramko DC-5M 5-chnl mono console w/touch control, BO. B Graham, WYMK/WEMR, RR#3 Box 1460, Tunkhannock PA 18657. 717-836-1460.

Ramsa WR-8210A, 10x4, XLR mic-ins, RCA line-ins, 3-band EQ/chnl, effects I/O, like new, \$995. M Friend, WTJU, 804-924-0885.

Shure SR101 Series 2 portable audio mixer, SS, 8 chnl mixer/preamp w/verb, rack mount in port case, excel cond w/manual, \$395; Collins 212T-1 audio control system, 28 inputs, 2 wrkg chnl out, 2 aux, 2 mon, mint cond w/manual, \$595. R Summer, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Shure M67 & M675 mic mixer & prod master, excel cond, \$300. M Saady, 1st City Rec, 141-60 84 Rd 3E, Briarwood NY 11435. 718-876-2062.

Shure M267 mic mixer, vgc, \$250; Shure M268 mic mixer, new, used once, \$150. A Smothers, 803-365-9268.

Harris Medalist 12, gd cond, recently removed, \$2900. G Faltus, WZMX, 100 Executive Dr, Farmington CT 06032. 203-677-6700.

RCA 8-chnl stereo, circa '65, SS, wrkg when removed, \$1500/BO. Don, KCKN-KBCQ, POB 670, Roswell NM 88202. 505-622-6450.

Audix MXT1000 8x2 mix down board; Yamaha PM700 12x2x2 PA board; Shure 8x1 rack mount mixer; UREI Cooper time cube delay line & MXR flanger doubler; all BO. J Krepol, RNDL, 7 Dustin Dr, Wilmington DE 19703. 302-798-4076.

LPB Signature II. G Gilbert, CSRG, POB 50539, Denton TX 76206. 817-380-0229.

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**Micro-Trak 6618** 6-chnl stereo, wrkg when removed, \$375 incl shipping. J Alsip, KSCQ, Box 1528, Silver City NM 88062. 505-538-3396.

**Gates Diplomat** w/books, \$500; Ramko DC8M, touch control, w/books, \$1000; both in gd wrkg cond. M Vanhooser, KSKY, 4144 N Central Exp #266, Dallas TX 75204. 214-827-5759.

**LPB S-12** Signature II series, 5 chnl, stereo, step attenuators, excel cond, vry cln, \$975. C Jennings, WOLA, Box 1530, LaFollette TN 37766. 615-566-1000.

**Tascam M-30**, 8x4x2x2, gd cond, \$350/BO. J Lang, PSI, Box 4085, Anchorage AK 99501. 907-333-2221.

**BE 4S150A** 4-chnl, 12 input stereo console, in use 4 months, grt cond, \$1100; (2) BE 85150A 6-chnl, 16 input stereo consoles, 2 yrs old, gd cond, \$1000 ea; Orban 8100A/ST studio unit, gd cond, w/cards, \$500. R Clemons, 9485 Regency Sq Blvd #93, Jacksonville FL 32225. 904-727-0933.

**Collins 212**, 9 chnls, tube type, mid 60s vintage, complete, will sell cheap. P Delaney, WOSX, Box 921, Marshfield WI 54497. 507-895-2065.

**Peavy 720** 7-chnl pwrld mixing board, 120 W/chnl, \$300. P Barzizza, KJBR, 603 Madison, Jonesboro AR 72401. 501-935-5598.

## Want to Buy

**API or Neve** consoles; esp API 550A & 550B; also API & Neve EQ & other modules; anything considered. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

**RCA BC3, BC5 & 76B2** spare parts. L Scott, POD 1449, Highland City FL 33836. 813-533-4654 ea.

**Langevin AM4A** w/documents. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

## DISCO &amp; SOUND EQUIPMENT

## Want to Sell

**JBL 4350** w/crossover 523AA, new cones, \$2100; JBL 4343, new cones, \$1500; Altec 604A w/time align crossover, \$750. R Nelson, Tropical Brcdstg, 14093 SW 142 St, Miami, FL 33186.

**RCF/Altec** 3-way PA system, all horn loaded, 18" bass, 15" mid compression horns, sell separately, \$800; BES 255 Mark II 3-way bipolar home mns, 4"x22"x32", orig box, \$400+shipping. Philip, Big Red Sound, 172-28 Henley Rd, Jamaica NY 11432. 718-523-2815.

**Furman RV-1**, 1-space rack mount spring-type reverb w/limiter, tone controls, unbal 1/4" I/O, excel cond w/manual, \$110. S Hofmann, Cameron Univ Theatre, 2800 W Gore Blvd, Lawton OK 73505. 405-581-2428.

**Shure M67** remote audio mixer, balanced terminal post output, adjustable metering & Shure M68 4-chnl 1-aur mixer w/balanced I/O, (2) ORK 3-speed TT w/tone arm & cartridge, \$250. J Brown, CAV Corp, POB 3471, Charlottesville VA 22903. 804-979-0402.

**Urei 813B** studio mns, \$1600. R Tiegen, Plum Sound, 335 Merrimac St, Newburyport MA 01950. 508-465-5653.

**Comm Light & Sound RS440** 4-way spkrs (2), w/Community VB790 bass bins, Anvil cases, excel cond, \$1250+shipping. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

**JBL 4312** (2), latest version of L-100, 4311, etc, deluxe studio 3-way mon, new, under warranty, will ship UPS, \$550/pair; Yamaha NS-104 2-way studio mns, pair avail, will ship UPS, \$280/both. C Keith, ALI, POB 313, Keane NH 03431. 603-352-8960.

**Dolby A301** 2-chnl NR, \$300/BO. R Rhodes, Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

**EMU Emulator II+** sampling keyboard, \$1000; Foxtex 4030/4035 sync system, w/remote & cables, \$1000; Foxtex 4010 SMPTE reader/gen, \$500. B Seifried, Eclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

**API 553 EQ** (10), 3-band proj, \$175; APSI 559 graphic EQ, \$325; Langevin AM-16 discrete mic preamps, \$150 ea; Universal Audio 100B tube mic preamps, \$200. M Linett, Your Place or Mine, 818-244-1909.

**JVC NR-1020 NR** (3); call for prices. D Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

**AKG BX-10** reverb wrack mount panel, like new; call for price. D Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

**Phase Linear 1000 Series II NR**, removes tape hiss, \$150; Burwen DNF 1201-A dynamic noise filter, removes record/tape noise, \$200. D Bailey, Rock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

**Peavey 19-10 Flite case** (2), 6-space road case w/front & rear removable covers, laminated 3/4" construction w/steel corners & handles, vgc, \$125 ea/BO; Apex Type C aural exciter, 1-rack-space unit in excel cond, \$150/BO. B Fisher, KPOK, Box 477, Bowman ND 58623. 701-523-3883.

**dbx 21 Type II NR** decoder, \$25. D Bailey, Rock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

**Ramsa WS-A 200 & WS-A 240** portable hi pwr bi-amp PA speaker system w/WS-SP2A subwoofer processor, pair 2-way 12" WS-A200 full-range cabinets & pair 12" WS-A240 subwoofers, as new cond. B Fisher, KPOK, Box 477, Bowman ND 58623. 701-523-3883.

**SAE 5000** impulse NR, removes clicks & pops, excel cond, \$125. R Glenn, WJGR, 1718 Shanna, Wimauma FL 33598. 813-634-1940.

**Dyma Engineering Resonator** 2 audio reverb, \$50. Don, KCKN-KBCQ, POB 670, Roswell NM 88202. 505-622-6450.

**Auratone Super Sound Cubes**, trade industry stand sm ref mon, like new, \$75/pair. Davis, MCP, POB 521, Newberry SC 29108. 803-276-0639.

**Fostex 3030** dual 10-band EQ, \$170; Yamaha E1010 analog delay, rack mount, remote foot switch, \$225; Lt Sound Thompson Vocal Eliminator D2, \$200; dbx 224 Type II NR, recording tech series, \$200; Sony NR-115 stereo Dolby unit w/CAL tapes, \$95; dbx NX-40 NR, \$85; Ultimate Support Systems TS-33 tripod, 9" + base unit, w/8" ext & case, \$175. D Death, Audio Prod, 1801 Commerce Blvd, Mound MN 55364. 612-472-1619.

**Oberheim DX** drum machine, lots of alternative sound chips, BO; Shure PA system, (2) lrg columns, (2) mon & PA head, gd cond, BO. S Winthrop, Winthrop Prod, 10 W 94th St, NY NY 10025. 212-662-8685.

**CRL DX2 NR** or Symetrix 511A, excel cond; Symetrix SX201 parametric EQ (2), excel cond. B Tidwell, WAFT, POB 338, Valdosta GA 31603. 912-244-5180.

**Rane ME-15** stereo EQ, excel cond, \$200/BO. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

**Roland DEP-3** effects processor, \$225; Yamaha SPX-90, \$275; Roland DEP-5 effects processor, \$275. J Lang, PSI, Box 4085, Anchorage AK 99501. 907-333-2221.

**dbx 150X NR** (2), vgc, \$325; Yamaha SPX90II special effects box, 99 presets, mint, \$500. B Hanson, 314-449-6433.

## Want to Buy

**Rane MT-6** multi-chnl 70/25 V xformer system. M Nardella, Nards Inc, 1446 Emerson Ave, McLean VA 22101. 703-821-8629.

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**CBS 411 Stereo Volumax**, vgc, \$300; CRL PMC300 AM limiter, vgc, \$400; (2) Dorrugh DAP-610 triband processor, vgc, \$1250; Elcom Bauer Level Guard AGC gain controller, gd cond, \$150; Harris MSP-90 AGC/limiter, gd cond, \$500; Inovonics 705 stereo gen w/FMX, excel cond, \$1000; many more, call for details. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

**Gregg Labs FM** stereo processor, extremely rare, mint cond, serious inq only, \$8600. P Christensen, WXXL-FM, 337 S Northlake, Altamonte Springs FL 32701. 904-721-9111.

## Optimod 8000A \$1495 &amp; UP 414-482-2638

**Moseley TFL-280** audio limiter (2), \$300/both. R Ness, WGEN, 1003 S Oakwood Box 67, Geneseo IL 61254. 309-944-4633.

**API 525**, vgc, \$375; (2) Audiotronics 201, excel cond, \$500 ea. M Linett, Your Place or Mine, 818-244-1909.

**Gates Solid Statesman** limiter, \$275. P Wells, KJQY, San Diego, 619-238-1037. FAX: 619-238-6157.

**Century D-70** limiter (2); call for price. D Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

**Howe Phasechaser Series 2000**, corrects phasing probs in stereo tape sys & phone lines used in EQ prog lines & STLs, BO. D Donovan, KCGR FM, 1620 American Bank, Corpus Christi TX 76226. 512-888-8555.

**Audio Design Transdynamic** stereo brdct limiter, can control up to 6 add'l limiters for 3-band limiting, never used, w/user-service manual, \$650+shipping. M Shea, Precision, POB 723, NY NY 10276. 212-989-2684.

**CBS Stereo Volumax** peak controller, older creme-colored unit, no front covers, manual, \$150. S Callahan, WCEG, 1120 Pinellas Bayway, St Pete FL 33713. 813-821-9549.

**Durrough DAP-310** tri-band audio processor (2), for AM/FM brdct use, vgc, \$325 ea+shipping. B DeFelice, DeFelice Prod, 93-2R Fowler St, New Haven CT 06515. 203-397-2595.

**Spotmaster CLA 20/40A** compressor/limiter (2), w/manual, \$275/both. K Gutzke, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

**Audiotronics 201** rms/peak limiter, \$500 ea; API 525 limiter, \$340 ea. M Linett, Yr Place or Mine, 1600 Las Flores Dr, Colendale CA 91207. 818-244-1909.

**Orban 464A** Co-operator transparent AGC/limiter, excel cond, \$600/BO; Texas RCF-1 replacement card 5, \$350. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

**CBS Audimax** stereo compressor, \$200/BO; CBS Volumax stereo limiter, \$200/BO; \$350/both; also, (2) Marti CLA-40H compressor-limiters, mono, \$75 ea/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

## Want to Buy

**Tube limiters, compressors & EQs:** Fairchild 660/670; Teletronix/UREI LA2A, LA3A; Pultec; MAVEC; Lang; API; etc.; also, other tube signal processing gear. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

**Urei LA-3A/LA-2A** compressor/limiter, prefer operating cond, need (2). R Kaufman, Pams Prod, POB 482247, Garland TX 75046. After 3PM: 214-271-7625.

**Gentner Audio Prisms** stereo pair, late generation pref. P Christensen, WIVY-FM, 3101 University S, Jacksonville FL 32216. 904-721-9111.

**CRL PMC-200-800-900** AM limiter, mono. P Palagona, WSKW, POB 159, Skowhegan ME 04921. 207-474-5171.

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

## MICROPHONES

## Want to Sell

**Neumann TLM 170** mics, rare pair of consecutively serial numbered mics, \$3350/pair. R McMillen, 503-239-6070.

**Sony ECM-50** lavalier mic, \$50. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

**Saba stereo mic**, vgc, \$10; Shure 565SD, vgc, \$50. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

**Sony ECM-50** lavalier mic, \$50. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

**Altec 639B**, vgc w/bag, \$400. C Bucy, Cisco Sound, POB 16583, Lubbock TX 79490. 806-792-1662.

**Altec 639** classic ribbon/dynamic (2), w/yokes & straight mount, \$450 ea. L Beigel, On Cue Rcrdng, POB 85032, Iowa CA 90072. 800-726-9813.

**Electro Voice 644** shotgun mic, \$140; Electro Voice 664A variable D dynamic, indust standard, \$100; AKG D-310 dynamic, \$100; all like new, complete, no blems. C Keith, ALI, POB 313, Keane NH 03431. 603-352-8960.

**HP 15109, 15108, 15119, 15118** laboratory reference mics, any cond. S Dorsey, WCVW, 173-7 Merrimac, Williamsburg VA23185. 804-864-4056.

**Sony ECM-22P** condenser mic (5); Sycron S-10 condenser mic for pipe organ only; (4) Atlas mic stand & misc cable; call for prices. D Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

**Neumann M-250** w/cable & pwr supply, vgc, \$4500. M Linett, Your Place or Mine, 818-244-1909.

**Shure 51** (41) & 555W (51) antique mics, \$300/both+shipping. D Besler, 207 Fort St Rm 312, Winnipeg Manitoba CN R3C-1E2.

**Electro Voice 666** variable D cardioid dynamic, '60s type, gd cond, \$65/BO; Electro Voice 666 variable D dynamic, '50s type, fair cond, \$50/BO; Electro Voice 635A dynamic omni-directional, fair cond, \$40. M Saady, First City Rec, 141-6084 Rd #3E, Briarwood NY 11435. 718-846-2062.

**Neumann U67** (5), various cond, \$1500-2400; also, U67, \$1250; SM2, \$2400; accessories. M Heleiak, Milwaukee Sound, 610 N Water St, Milwaukee WI 53202. 414-272-7085.

**AKG D190ES** dynamic cardioid, on/off switch, new cond, complete, \$100; (4) Altec C71 omni condenser, flat response, excel for recording, 0-30 db attenuator selector, vgc, \$125. A Allegra, Calvary Baptist Church, 1380 Valley Forge, Lansdale PA 19446. 215-368-4444.

**RCA 44** vintage ribbon mic, late 50s model, works well, \$375/BO; Shure SM-7, used few hrs, like new, in case, \$350. Davis, MCP, POB 521, Newberry SC 29108. 803-276-0639.

**Arrakis MK-5** 5 mic amp to 5 line-level 600 R outputs, will mix to sngl 600 R out, requires ±15 VDC. M Friend, WTJU, 804-924-0885.

**RCA 77DX** vintage ribbon mic, excel cond, BO. R Kaufman, Pams Prod, POB 462247, Garland TX 75046. After 3PM: 214-271-7625.

**Altec 639** (2), classic ribbon Y dynamics, \$400 ea. L Beigel, On-Cue-Rcrdng, Call/fax: 800-726-9813.

**EV RE-20**, mint cond, \$275; Valley People 400 mic compressor, vgc, \$300. B Hanson, 314-449-8433.

**Sennheiser 421** w/case, \$200. J Lang, PSI, Box 4085, Anchorage AK 99501. 907-333-2221.

**Shure 530** omni-dynamic (5), w/12" long barrel, built for interviews, guaranteed wrkg, \$25 ea, \$100 all+UPS. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

**EV 630/635** w/cable; RE10 EV-desk mics, EV & Shure all very reasonable; baby booms (3), Mr. Oliver, 212-874-7660.

**Presto 45 rpm** adapter sleeve for 6N disc cutter, new; manuals: Sencore tube conductance analyzer, Sams transistor sub book #8 & #6, RCA tube manual. Mr. Oliver, 212-874-7660.

## Want to Buy

**Neumann U-67** pwr supply, cable connectors, shockmount, will pay cash/trade other vintage mics. W Kremer, 301 SW 16th St, Ft Lauderdale FL 33315. 305-524-5652.

**Desk mount flex mic arm**, heavy duty, & shock mount for heavy RCA mic. T Heathwood, Heritage Radio Classics, POB 16, Boston MA 02167. 617-969-9966.

**RCA, Neumann, WE** & other vintage mics; also, parts, flags & stands. R Van Dyke, Caffrey House, 2 Squires Ave, E Quogue NY 11942. 516-728-9835.

**RCA 44BX/77DX; WE & RCA** velocity mics. D deForrest, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-5401.

**Tube condenser mics:** Telefunken ELAM 250/251; AKG C12/C24; Neumann U47, M49, KM54, U64, U67, SM2, SM69; also, other pro condenser mics, wrecked mics, any cond. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

**AKG C-12/412/414**, tubular/diamond-shaped body; Synchron AU7A; Fairchild F-22; RCA KU3A. M Heleiak, Milwaukee Sound, 610 N Water St, Milwaukee WI 53202. 414-272-7085.

**RCA 44 & 77** mics, prefer chrome, will consider TV grey; also, 77DX desk stand. R Kaufman, Pams Prod, POB 462247, Garland TX 75046. After 3PM: 214-271-7625.

## MISCELLANEOUS

## Want to Sell

**Symetrix T-101** telephone interface, \$250; Audio Digital TC4 digital delay unit, \$800. T Pless, WHVY, 112 Main, Annapolis MD 21401. 301-626-0103.

**Telex Audiocom IF-1** interface unit, interfaces headset intercom system w/2, 3 or 4 wire communications systems, excel cond w/manual, \$150. S Hofmann, Cameron Univ Theatre, 2800 W Gore Blvd, Lawton OK 73505. 405-581-2428.

**AM dummy load**, 1 kW, typical of those inside Gates BC-1G & H series xmtrs, BO+shipping. D Kelley, KISZ-FM, POB 740, Cortez CO 81321. 303-565-1212.

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**McMartin TG-2** EBS encoder, vgc, \$125; Ford mono AM/FM car radio, vgc, \$15; Gates on-air light, gd cond, \$40; Spolmaster cart winder, gd cond, \$100; (2) WE KS19645-L2 recorder coupler, gd cond, \$50; various racks; call for details. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

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

**Blackbourn 1200** (363), black vinyl page for 3-ring binder holds 4 cassettes w/o boxes, compl sale preferred, \$250+shipping. B Strapko, 708-830-0701.

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**Marti AR-10** receiver (4); (3) 2-way radio at 161.64 w/base. T Noordyk, 616-924-4700.

**Yaesu FRG7700** comm rcvr, 10 kHz-30 MHz, w/o memory freq, digital readout, AM/FM/SSB, mint cond, \$350; Kenwood R1000 comm rcvr, 10 kHz-30 MHz, digital readout, mint cond, \$300. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0800.

**Wacom WP-641** VHF duplexer, on 154 & 155 MHz, will tune to 150-156 easily, like new, \$350. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011.

**Motorola Moxy 25** W SS under-dash mobile radio (3), on 161.640 MHz, w/base station mic & pwr supply, base station vertically polarized antenna w/6 dB omni-directional gain & adjustable radiation pattern, much more, \$1000/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

**Want to Buy**

**Technics JT9030** FM tuner, J Ramsey, WWUH, Univ of Hartford, W Hartford CT 06117. 203-243-4703.

**Sony SRF-A100** AM stereo radio, Ralph, 55 K-USA, St Louis MO. 314-997-5594.

**REMOTE & MICROWAVE EQUIP**

**Want to Sell**

**Gates RDC 10** studio only remote, used, \$150; Marti HRC-8A 950 combiner, excel cond, \$100; Marti SCHR8H STL subcarrier rcvr, excel cond, \$225; (2) Moseley TRW-15 wire remote, gd cond, \$500. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

**MA-COM MA12XC** 12 GHz portable/fixed microwave system, w/xmtr, receiver & portable horn antennas, \$800. N Borenstein, 5406 Hayes St, Hollywood FL 33021. 305-961-7747.

**Moseley TRC-15AR** 15-chnl remote control, 110 kHz/67 kHz w/spare board, gd cond, must sell, \$450/BO. J Ramsey, WWUH, Univ of Hartford, W Hartford CT 06117. 203-243-4703.

**Mark P-972** 6' parabolis grid for 944-952 MHz STL, (2) avail 10/91, BO+shipping. D Kelley, KISZ-FM, POB 740, Cortez CO 81321. 303-565-1212.

**Micro Controls RCR-9/RCT-9** 9-chnl remote control, 6 yrs old, gd cond, \$1500. R Swan, WROY/WRUL, POB 400, Carmi IL 62821.

**Wegener 1602 & 1601** mainframes w/these cards: 1621, 1645, 1646, 1606-21, 1683-08 & 1605-12, used for SMN; also, TTT 7610 xmtr remote w/relay panel, needs some work. J Galanses, WAVI, POB 25016, St Croix VI 00824. 809-773-3693.

**Comrex LX7 & LX-R** telephone freq extender, transmit & receive units, excel cond, \$200 ea/BO. D Gander, KDUZ/KJUR, Box 10, Hutchinson MN 55350. 612-587-2140.

**Telos 10** 10-line phone system, used 6 mnths, \$1100. B Lord, Lord Brcdstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

**MCI RCR/RCT-9** 9-chnl remote w/digital read out & relay interface, STL subwire, works grt, \$1200; Moseley ISO-coupler, 450-470 MHz, \$200. D Tabor, WLCK-WVLE, Box 158, Scottsville KY 42124. 502-237-3148.

**TFT 7601** digital remote w/SCA gen for control via STL/wire line (any voice-grade chnl from 300 Hz-3 kHz), w/manual, BO. D Donovan, KCGR FM, 1620 American Bank, Corpus Christi TX 76226. 512-888-8555.

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**Moseley TRC 15AW** remote control system, gd cond, \$500. G Gilbert, CSRG, POB 50539, Denton TX 76206. 817-380-0229.

**Marti RMC-2AX** 25-chnl, gd cond, manuals, \$500/BO/trade. D Willey, Life Brcdstg, POB 96, John Day OR 97845. 503-575-1840.

**Microtrak 6444** 3-chnl stereo audio mixer w/TTS, needs tone arms, \$1000/BO. Don, KCKN-KBCQ, POB 670, Roswell NM 88202. 505-622-6450.

**Moseley PBR-30** 30-chnl wireline remote, wrking when removed, \$600/BO. R Brace, WGY AM/FM, POB 1410, Schenectady NY 12301. 518-381-4800.

**Telephone equip:** ADC 109D & 109H repeat coils, 4 primary & secondary terminals, 600/900 ohm, use bridged/terminated, \$10 ea; Wescom 2/4 wire balanced hybrids, gd null features, make grt talk show phone syst, \$50 ea. R Weaver, WHEVAM, Creech Rd, Garner NC 27529. 919-552-9357.

**Moseley 600** system, excel cond, rcvr recently tuned by mfr, \$3600. G Faltus, WZMX, 100 Executive Dr, Farmington CT 06032. 203-677-6700.

**Hallikainen PCC180** processing control computer, permits automatic logging operating w/Moseley TRC-15 remote system, wrkd grt when removed in '89. C Freinwald, KBSG, Seattle. 206-343-9700.

**Gates RDC-10** remote, plus 1 for parts, \$100; (2) Comrex telephone coupler with 1/4" line out jack, \$50 ea. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

**Hallikainen DRC-190**, brand new deluxe R/C w/computer, printer, CRT, all manuals, \$1200; Moseley TRC-15 studio & xmtr units w/manuals, set-up for Teko, wrk grt, \$400. J Salov, SHGR/WUPS, 517-740-1165.

**Moseley MRC1600** remote w/16 chnl control/telemetry/status, gd cond, BO. P Delaney, WOSX, Box 921, Marshfield WI 54497. 507-895-2065.

**TFT 7601 systems:** (2) 7601-C & (2) 7601-R, both complete, excel cond, vry clin, \$1600/BO. C Jennings, WQLA, Box 1530, LaFollette TN 37766. 615-566-1000.

**Moseley TRC-15** remote control system, 12 yrs old, wrking fine, gd cond, \$750. M Cities, WCBC, Box 1290, Cumberland MD 21502.

**Symetrix TI-101** phone interface (2), new condition, original boxes, \$600/both. Charles Notley, 703-777-9451.

**Want to Buy**

**Marti tube-type xmtrs**, freq: 161.67, gd working order. C Webster, WCLD, 1101 S Davis, Cleveland MS 38732. 601-843-4091.

**Moseley STL system** for FM. T Noordyk, 616-924-4700.

**Marti STL 8** stereo STL system, reasonable. J Ingram, WBLE, Hwy 6 W, Batesville MS 38606. 601-563-4664.

**Moseley PCL 505C**, Marti or TFT 950 MHz STL equip for export, priced right. K Austin, Austin Brcdst, 1101 Hwy 81 N, Marlow OK 73055. 405-658-3330.

**SATELLITE EQUIPMENT**

**Want to Sell**

**Scientific Atlanta DAT-32** receiver, 15 kHz stereo audio card for use w/all major networks, like new cond, \$1000/BO. Chip, KCPS, POB 946, Burlington IA 52601. 319-754-6693.

## Satellite Systems

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**Scientific Atlanta satellite rcvr system** w/Voice Cue, Data, SEDAT & 15775 kHz DAT cards installed, used by NBC Talknet/ABC/CBS sports affiliate w/switchable crystals, \$5500. J Zecherle, WKTS, 414-457-5561.

**Want to Buy**

**Fairchild Dart 384** receiver w/down converter. M Rollings, Rollings Comm, POB 882, St Louis MO 63006. 314-726-9595.

**Satcom 1-R 7325** 75 kHz decoder, will trade Satcom 1-R 7325 digital processing unit, 150 kHz, dual audio decoder, never used. J Swartz, WCSM AM/FM, Meyer & Schunk Rds, Celina OH 45822. 419-586-5133.

**Varian or MCI** pwr supply for Klystron TV up-link, need 8200 V at 1 amp, 3 phase reg; also, 5 meter TV uplink dish antenna, C-band, folding on trailer OK. U George, Ugly George Satellite TV, 314 W 52 St, NY NY 10019. 212-969-0240.

**Scientific Atlanta Unistar AM-only** format receiver. C Tarkenton, WCOH/WMKJ, 154 Boone Dr, Newnan GA 30263. 404-253-4636.

**Scientific Atlanta 6600** satellite receiver. J Wagner, WMBI AM-FM, 820 N LaSalle Dr, Chicago IL 60610. 312-329-4279.

**SOFTWARE**

**Want to Sell**

**Wire service capture and news editor.** Save on paper! Computer and software: lease \$60 month, purchase \$1,495. Software only, \$495. Info: FAX 605-892-2669.

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**Want to Sell**

**1000KW AM Station** in Eastern Ohio, will serve Ohio, Penn, WVA markets (overlaps Wheeling, WVA, only 35 miles west of Pitts, PA); R. Dawkins, POB 970, Steubenville OH 43952. 614-264-2566 or 614-282-1046.

**Non DA daytime, DA night, 50 kW, lw dial pos, clear chnl, unlimited time, AM in capital city; also, 3 kW FM, can upgrade to 6/25/50 kW; owner financing.** Glenn, 501-470-1525 after 5 PM.

**Complete Broadcast facility** set up for Talk, News, & music. All late high quality equip, 14'x30', 2 axle mobile studio, less than 5 yrs old. Ideal for export (mono) or for new use in any market. 503-774-0459.

**AM, 1 kW, 1480 kHz, w/PSSA**, covers city plus gd equip, gd terms, \$139,000. B Ludwig, KRRV, 4211 N Elizabeth, Pueblo CO 81008. 719-542-2121.

**FT C&W station**, to 1850 W, new automation, in VA, on air since '60, owner anxious to retire, financing avail after sm down payment. A Terry, WODY, POB 545, Bassett VA 24055. 703-629-2509.

**Radio/TV combo:** old dependable AM & new LPTV in gd market in E NC, nice buildings & acreage, new twr & new TV studios, \$450,000 w/\$100,000 down, owner financing. 919-965-5328 after 7PM.

**Want to Buy**

**10 yr+ broadcaster** seeking to take over FM station in KY, OH, WV, looking for no money down/debt assumption, any pwr OK. Mike, Star-Comm, 8078 Lyon Circle #103, Manassas VA 22110. 703-368-2955.

**AM/FM/combo** wanted to take over w/no down, owner financing. L Haber, POB 136, Woburn MA 01801. 617-246-5634.

**FM CPs** wanted in sm, med, lrg markets, college/resort preferred, will consider dark/bankruptcy. E Polleek, 1st Brcdstg, POB 691, Wilmette IL 60091. 312-263-6868.

**STEREO GENERATORS**

**Want to Sell**

**AEL 2213**, gd cond, no manual, \$100/BO/trade. D Willey, Life Brcdstg, POB 96, John Day OR 97845. 503-575-1840.

**McMartin SCA gen** on 67 kHz, like new, \$750/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

**Want to Buy**

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

**SWITCHERS (VIDEO)**

**Want to Sell**

**American Data Corp 553** w/onboard digital spec effects gen w/9 effects, colorizer, (7) inputs w/TBC ports, excel cond, \$850. Pinetucket Rcrding, 747 Wire Rd, Auburn AL 36830. 205-826-0390.

**JVC KM-2000** w/special effect gen, almost new, 8 video inputs on A/B/C buss, use w/1/2 or 3/4", genlock, \$2400. Jaye, Nimbus Prod, POB 5903, Takoma MD 20912. 301-507-3358. 789-4019.

**TAPES/CARTS & REELS**

**Want to Sell**

**Dynamax, Gold Master, & Red Master** carts (135), 100s-55s, some Reds unused rebuilt, \$250 as-is/\$325 cleaned, bulked & splice-found. M Friend, WTJU Radio, Box 711 Newcomb Hall St, Charlottesville VA 22901. 804-924-0885.

**Pepper-Tanner & TM Prod** library records (200?), variety avail. P Wells, KJQY San Diego, 619-238-1037. FAX: 619-238-6157.

**Adult contemporary library** w/2200 songs on CD & cart, incl 93 Golddiscs & 230 misc CDs, add'l 170 songs dubbed on Scotchcart IIs, \$6500; country library w/1500 songs on 66 CD Golddiscs & 500 add'l Scotchcart IIs, \$5000; (380) 3.5 min Scotchcart IIs w/country songs, \$2 ea; all used 6 mnths. B Lord, Lord Brcdstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

**Audiopak AA4 (1000)**, 2.5-5.5 min carts, loaded w/new tape, \$4 ea lots of 100, \$325/0/all, incl shipping. S Cassidy, Radio Program Services, Box 472, Manitou CO 80829. 719-661-1744.

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**C&W & Gospel albums (3000 ea)**, '60-'91, some never used, special price if buy all of 1 category. A Terry, WODY, POB 545, Bassett VA 24055. 703-629-2509.

**Scotch 176 (34)**, 1/4" x 2500', used once, \$125/BO. D Pulwers, 703-751-9346.

**Plastic tape reels, 1/4"**, all regular hub, excel cond, incl: (49) 10.5", (106) 5" fat hub, (66) 5" sm hub, (8) 4", (64) 3", \$85/all postpaid. D Emberton, Clarence Brown Theatre, 1714 Andy Holt Ave, Knoxville TN 37996. 615-974-3256.

**Reels w/NAB hubs, 10"**, many avail, come w/box, \$1 ea & you ship. J Harper, KOMC-FM, Box 44, Brinkley AR 72021. 501-734-1570.

**Scotchcarts (500) & (60) Scotchcart II**, 3.5-5.5 min, vgc, little use, all part, \$1 ea. R Young, KSNL, Santa Maria CA. 805-925-2582.

**7" reels (125)**, 1 mil tape, played once, in boxes, you ship, \$300/all. A LoPresti, A.J.L. Soundwave, 21 Carter Rd, Geneva NY 14456. 315-789-4019.

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American Top 40 shows w/Casey Kasem, 4-record set or 3-piece set, no finders fees, must be gd cond, will pay \$25. B Davis, BDMZ Prod, 408 N 11 St, St Joe MO 64501. 816-279-6851.

Old 45/7" station collections, promotional otherwise. S Groff, Yesterday & Today Records, 1327 Rockville Pike, Rockville MD 20852. 301-279-7007.

### TAX DEDUCT EQUIP

AM xmtra. carrier current/lw pwr LPB type, wanted to wire Spanish-speaking neighborhood; also, FM exciter or cable TV FM modulator for same reason; will pay shipping. B Diefenderfer, Morning Star Ministries, 590 Main St, Slatington PA 18080. 215-767-5985.

Youth radio station in public housing seeking donations of radio broadcast equip, tax deductible. Frank/Julie, ARHA, Alexandria VA. 703-549-7115.

Brdcst Training School for Underprivileged in need of any AM brdcst equip, will pay shipping on sm items. F Smith, 615-624-7126.

Portable PA system needed for missionary work in Ghana; also, need (4) Utility towers, 80-100'. C Riddle, World for Christ Radio, 703-878-4141.

Monte Vista Christian School, would appreciate any donations of used TV broadcast equipment. T Quinn, 408-475-0423.

Eng student desiring donation of old brdcst equip (anything) in repairable cond, will pay all shipping charges, EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

### TEST EQUIPMENT

#### Want to Sell

B&W 210 tone oscillator, gd cond, \$75; B&W 410 distortion analyzer, gd cond, \$100; Gates M3625 gain set, vgc, \$100; Heath 1G-72 audio gen, gd cond, \$30; Heath V7A VTVM, gd cond, \$25; Leader 3060D storage oscilloscope, new, \$3000; many more, call for details. B Williamson, WWWK/WELV, Ellenville, IN. 914-858-2941.

B&K 1250 NTSC gen; B&K 1035 wow & flutter meter; B&K 1045 telephone product tester; B&K 530 lab semi-conductor tester; B&K TP-28 temperature probe; HP 645A test oscillator; Leader LDM-170 distortion meter/ACVTVM; Tektronix RM-529 waveform analyzer; call for price & compl details. E Wilkie, 602-547-0227.

Fluke 4085 412B high V pwr supply, 2 kVs DC max, rack mount; Boonton Elec 93A, true RMS voltmeter, portable; HP 5201L scalar/timer, rack mount; Princeton Applied Research 120 lock in amp; Radio Freq Labs 459A crystal impedance meter; all gd cond; BOtrade motion picture equip. H Biller, 108 Hamilton Ave, Silver Spring MD 20901. 301-565-2798.

Tektronix 575 transistor curve tracer, \$500. B Seifried, Eclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

General Radio 1932A distortion analyzer, like new, w/case, \$1500/BO; Vu-Data portable oscilloscope, 25 MHz BW, dual trace, gd cond, \$200. S Wood, Modern Syst Res, 12648 La Crosta Ct, Los Altos CA 84022. 415-941-8000.

Leader LPM880 RF wattmeter, 3 scales: 0-5 W, 0-20 W & 0-120 W, new, \$150; several audio xformers: Triad, Ampex, Hycor, VTC, WE, \$150 ea. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Sencore FC45 freq counter, range 30 Hz-230 MHz, w/Sencore PR47 UH7 prescaler, extends counter to 600 MHz, \$350. L Stone, Semo Eng, 843 Wilcox Rd, Poplar Bluff MO 63901. 314-785-1956.

Telco 88 EBS encoder/decoder, new w/warranty, \$388. M Jones, WIVK, 6711 Kingston Pk, Knoxville TN 37939. 615-588-6511.

B&B AM2B phascope, checks headroom, used 6 mnths, \$900. B Lord, Lord Brdcstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Tech Materials Corp 5 kW dummy load, convection cooled, 50 ohms, up to 30 MHz, in 6'x4'x2.5' ventilated weather-proof fiber glass cabinet, new, \$1000/BO; ITT 17" oscilloscope w/manuals, fair cond, \$500/BO. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

Leader LFR-5600 audio response test unit w/recorder, \$1500. C Bucy, Cisco Sound, POB 16583, Lubbock TX 79490. 806-792-1662.

B&W 410 distortion meter; B&W 210 audio oscillator; Leader Elec LBO-53B oscilloscope; BO ea. R Ness, WGEN, 1003 S Oakwood Box 67, Geneseo IL 61254. 309-944-4633.

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B&K 667 SS tube tester, grt shape, \$70. P Russell, Bowdoin College, Silts Hall, Brunswick ME 04011.

Coherent Communications 1/3 octave analyzer for use w/scope, \$50+shipping. B Seifried, Eclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

Gorman Redlich CM antenna phase mon, 2-twr, digital display. C Freinwald, KBSG, Seattle. 206-343-9700.

HP 334A THD analyzer w/brdcst options, mint cond, \$1100; Boonton 81A EC AM/FM mod analyzer, \$500; HP 651A 10 MHz test oscillator, vgc, \$125; Tektronix FG504/TM503 40 MHz function gen & 3-hole mainframe, mint cond, \$1400; HP 8708A phase lock sync for 600 series RF gens, \$150; HP 202H 50-216 MHz AM/FM gen, vgc, \$200. J Friih, WLNG, POB 804, Bridgehampton NY 11932. 516-725-4683.

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Sparta 701A 1 kW AM xmtr, tuned to 1190 kHz, vgc, \$6000; CSI T-25A1 25 kW AM, 200 hrs, tuned to 1200 kHz, like new, \$30,000/trade for Nautel 10 kW; Collins 20V AM, 1 kW, tuned to 1090 kHz, gd cond, \$1000. G Arroyo, WONO, 2483 John Young Pkwy, Orlando FL 32804. 407-293-0000.

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RCA 5-H, dismantling, all parts for sale. R Humphrey, WLTJ, 7 Parkway Ctr, Pittsburgh PA 15220. 412-922-9290.

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CCA 10-D 10 W mono exciter, 99.3 w/pwr supply, BO, D Tabor, WLCK-WVLE, Box 158, Scottsville KY 42124. 502-237-3148.

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Collins 820 hybrid exciter & stereo gen, \$200. S King, KATP-FM, I-40 W, Amarillo TX 79110. 806-355-9777.

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Alcon-Bauer 690-B, programmable, in use, w/manual, \$1200; Harris MS-15 revision D, programmable, in use, \$1200. D Donovan, KCGR FM, 1620 American Bank, Corpus Christi TX 76226. 512-888-8555.

Henry 4.5 amp DC filter choke (3), mfr'd by Peter Dahl Co, new in shipping crate, \$525+shipping. D Dodd, KKTZ, 107 W 9th St, Mountain Home AR 72653. 501-425-5100.

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Harris TE-3 stereo exciter tuned to 103.1, \$1000. Mr Dolgoff, 904-386-5141.

Continental 27.5 kW FM xmtr, '87 model, excel cond. Kevin/Corey, 512-345-9300.

BE FM 30 kW xmtr minus driver, BO. O Eaton, Mega Comm, 19 W Hargett St, Raleigh NC 27601. 919-990-1906.

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**Bext, Inc.**  
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Gates TE-1 exciter & stereo gen, \$500/BO; Collins A-830 exciter & stereo gen, \$750/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

Bext has some show units at sale price. Full 2 yr warranty, like new. Exciters, amplifiers, STL's. First come first served only. Call for details. Bext, 619-239-8462.

Used Transmission Line, many sizes & lengths, many like new. 816-635-9599.

Plate transformer, 3-phase, 6000V, 3 amps, 15 KVA, \$495. Mr. Emerald, 714-964-3912.

Harris FM-35K, 3 years, like new. 816-635-9599.

TMC GPT-10K, 10 kW, 2-28MHz, complete, gd cond, \$2495. Mr. Emerald, 714-964-3912.

**Want to Buy**

**WE BUY MOSELEY PCL-303 & 606's**  
414-482-2638

CCA, Harris, BE, 4-5 kW FM, '86 or newer. J David, KMPL/KSTC, POB 907, Sikeston MO 63801. 314-471-7520.

**USED TV TRANSMITTERS,**  
antennas, cable, rigid line, etc.  
one watt to 110 kW.  
Fair market price paid.  
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FAX: 602-582-8229  
Kenneth Casey

FM xmtr, 4 kW-5 kW, prefer late model in excel cond. T Pelowset, Wolverine Radio, POB 1844, Midland MI 48640. 517-631-5583.

Robt A Jones/Tepco singl or dual 10 W translator. J Stromquist, WNCB, 2828 Piedmont Ave, Duluth MN 55811. 218-722-3017.

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AM and FM Transmitters, all powers. Finders fee for locators. DON'T take the chance of not being paid, sell to the oldest broadcast supply house in Latin America.

**GUARANTEE RADIO SUPPLY CO.**  
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LAREDO, TX 78040  
(512) 722-3233  
(512) 727-8458 (fax)

10 kW FM, 20-25 kW FM & 10 kW AM, older OK but must be vgc. B Zellmer, Colorado Farm Net, Box 2475, Greeley CO 80632. 303-330-1342.

Gates 6095 FM exciter, working; Gates 5534 FM exciter, working; Gates 6146 stereo modulator. J Richardson, KXIO-FM, POB 37, Clarksville AR 72830. 501-754-2076.

FM xmtr, 25 kW. T Noordyk, 616-924-4700.  
Late model FM xmtr, 500 & 1000 W, stereo gen. R Murphy, 602-855-1051.

Continental for 10 kW TPO, might consider clean 10 kW Harris in gd cond. D Dayton, Dayton Brcdst, 1907 Lincoln Ave, Mendota IL 61342. 815-538-4681.

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5046 Smoral Rd  
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FAX (315) 488-1365

Low pwr, 3-10 W. J Benjamin, JC Enterprises, 3923 E Thunderbird Box 139, Phoenix AZ 85032. 602-493-5312.

FM exciter, any make/model, must work & have manual, offering \$100+shipping. B Elliott, 6709 Ridge Rd 300B, Ft Richey FL 34668. 813-849-3477.

Used 10 K xmtr, '80/late preferred, all makes considered. B Aldeich, WLNG AM/FM, Box 2000, Sag Harbor NY 11963. 516-725-2300.

FM xmtr, 10/20 K, gd wrkng order, remote control wired, sm budget but will consider leaseable box. Brian, WWHN, 603-742-8575.

McMartin AM/FM xmtr, any model, exciter or stereo modules. Goodrich Ent., 11435 Manderson, Omaha NE 68164. 402-493-1886.

**TUBES**

**Want to Sell**

Johnson Capacitor 124-0113-001, several, new & in box, BO; 8122 driver tubes & (2) sockets, BO. D Tabor, WLCK-WVLE, Box 158, Scottsville KY 42124. 502-237-3148.

**FACTORY NEW TUBES**

3CX10000A3, 3CX1500A7, 3-500Z, 4CV100000C, 4CX1000A, 4CX1500B, 4CX1000D, 4CX250B, 4CX300A, 4CX35000C, 4CX350A, 4CX5000A, 4-400A, 4-400C, 572B, 6146B, PL328/TH328, PL347/TH347, 807, 813, 833A, 833C, and more...

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3CX1500A7, 4CX5000A, 6146B, 4CX250B, 4CX3000A & more. We carry large inventory all major brands, Eimac, Amperex, RCA, etc. Call Stew 1-800-842-1489.

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Tubes, Transformers, filter capacitors, receiving tubes, \$500+up; 500 watt modulation transformer, \$500.00. Madison Electronics, 1-800-231-3057.

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Partial List: 6623, 23791, TH150, 6425F, 5604, 6696, 6697, 5681, 5682, 5671, 7804, 3CX10,000H3, 3CX20,000H3, 4CX5000A, 4CX35,000C

**Vacuum Tube Industries, Inc.**

**1-800-528-5014**  
**508-584-4500**

**Want to Buy**

Telefunken VF14 & AC701, used OK, must work. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL36054. 205-285-6179.

**ELECTRON TUBES**

Partial List: 6623, 23791, TH150, 6425F, 5604, 6696, 6697, 5681, 5682, 5671, 7804, 3CX10,000H3, 3CX20,000H3, 4CX5000A, 4CX35,000C

**Vacuum Tube Industries, Inc.**

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Eimac 8170/4CX5000A, new, \$1095. Mr. Emerald, 714-964-3912.

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**TURNTABLES**

**Want to Sell**

QRT rim drive TT, used, \$100, call for details. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Technics SL-1200 w/Audio Technica cartridge, like new cond, \$250. B Weiss, KLSI, 3101 Broadway #460, Kansas City MO 64111. 816-753-0933.

Empire 1000ZEX cartridge, any cond; Weathers ML1 & ML234; Rek-O-Kut B-12 & B-12GH w/white deck plate; Grey 33H; components PBT; Pickering 800; Scott 710; Empire 698; auto-lift add-on device for manual tonearms, any brand. W Laughlin, 753 Ruth Ln, Hurst TX 76053. 817-282-9033.

Technics SP10, SH10 ps, w/16" Rek-O-Kut tone arm & Stanton 500 cart, spare shell, no base, \$450. L Beigel, On Cue Rcrdng, POB 85032, Iowa CA 90072. 800-726-9813.

Russco Cue Master TT pair, incl tone arms & cart, \$245/both. Davis, MCP, POB 521, Newberry SC 29108. 803-276-0639.

Technics SL-3200 direct drive manual TT (2), w/arms, \$75/BO; (2) Russco stereo brdcdst preamp, \$150 ea/BO; all for \$400; also, (2) Russco TT w/arms, no cartridges, \$40 ea/BO. B Williams, KPSM, 2009 W Gary, Broken Arrow OK 74012. 918-455-9522.

SP10 MK 2A TT, PS, 16" Rek-O-Kut tone arm, Stanton carts, for custom mounting, \$400; Op Amp Labs TT preamp for (2) TTs, to +4 dBm, w/pwr supply, \$200. L Beigel, On-Cue-Rcrdng. Call/fax: 800-726-9813.

Technic SP-15 w/EPA-A501H tonearm & solid cherry based dust cover, excel cond, \$900/BO. P Barzizza, KJBR, 603 Madison, Jonesboro AR 72401. 501-935-5598.

**Want to Buy**

Fairchild disc rcrdng equip, #740 & similar. Presto, Rek-O-Kut, RCA, etc; also, accessories incl amps, limiters, heads, manuals, needles. K Gutzke, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

Rabco SL-8E straight-trking tone arm in gd cond. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

RCA 70-D spare parts & service manual; Gates CB-11 floor cabinet; RCA BQ2A 76 & Gates CB11 spare parts & manuals; Gray SP-600 tone arms. L Scott, POD 1449, Highland City FL 33836. 813-533-4654 eve.

Fairchild disc rcrdng equip, #740 & similar. Grampian/Gotham, Neumann, Presto, Rek-O-Kut, RCA; also, accessories incl amps, limiters, heads, manuals, needles; also, disc cutting equip by same mfrs. K Gutzke, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

Micro-Trak 303 tone arm in wrkng cond. J Kimple, WMCO, Stormont St, New Concord OH 43762. 614-826-8376.

Rek-O-Kut CVS 12/125, prefer w/16" arm. R Caldwell, WTVF, 474 Jas Robertson Pkwy, Nashville TN 37219. 615-244-5000.

Ramko ESP38 pickup preamp EQ, want (2). R McDonald, Mission Rcrdng, 5231 Horton, Mission KS 66202. 913-722-2677.

**TV FILM EQUIP**

**Want to Sell**

RCA FR35 35mm film proj, variable speed, gd cond, \$7500. J Kiss, Multi Video Grp, 50 E 42 St, NY NY 10017. 212-986-1577.

**Want to Buy**

ND Filter Wheel assembly for automatic light control on telecine film chain, must reference to video output of film chain for level control & have optional manual override. K Knowles, Knowles Video, POB 12127, Tallahassee FL 32317. 904-878-2298.

**VIDEO PROD EQUIP**

**Want to Sell**

Sony BVP507 Beta SP package, incl BVP7 camera, BVV5 recorder, Fujinon 8.5x super-wide 5.5-47.5 zoom, (5) batts, case, rain cover, mint, \$21,000/BO; also, Sachler Video 20 II w/legs, case, nice, \$3200. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Panasonic NV8500 VHS editor (2), w/NV500 controller, all cables, covers, vly hrs, \$3500; (2) JVC TM-13U color mon, \$500. Duane, Safair Prods, 7984 E Boojum St, Tucson AZ 85730. 602-721-0550.

COHU, color bar gen, sync gen, rack mount, gd cond, BO. S Wood, Modern Syst Res, 12648 La Crosta Ct, Los Altos CA 84022. 415-941-8000.

VIP Hybrid-8 SEG, video dup-proc w/hybrid digital video effects, A/B, split screen, wipes, dissolves, 6 spec effects, auto fades, enhance, more, \$395. Davis, MCP, POB 521, Newberry SC 29108. 803-276-0639.

Sony CUM1250 12" color video mon w/UHF-VHF tuner, A/V I&O, excel cond, \$300/BO. R Glenn, WJGR, 1718 Shannoa, Wimauma FL 33598. 813-634-1940.

QVS Mini Prompter tele prompter, portable, almost new, carrying case, tripod & camera bracket, cable control, pwr supply, built-in light, \$1500. Jaye, Nimbus Prod, POB 5903, Takoma MD 20912. 301-507-3358.

Panasonic 2022 laser video disk recorder, uses 5" laser disk, 1 side records up to 12,000 images, digital read out, excel cond, \$3000; Aquastar III bright projector, 500 lumens, remote, extended cable, \$2800. Jaye, Nimbus Prod, POB 5903, Takoma MD 20912. 301-507-3358.

Klieg lrg studio lights (100), 2 & 5 K, fresnels & scoops, w/hooks, \$150 ea. U George, Ugly George Satellite TV, 314 W 52 St, NY NY 10019. 212-969-0240.

**Want to Buy**

Sony BVE-500 & RM-430 edit controllers. U George, Ugly George Satellite TV, 314 W 52 St, NY NY 10019. 212-969-0240.

**VIDEO TAPE RECORDERS**

**Want to Sell**

Ampex 7900A 1" video proc recorder, flying erase, horz lock, high band color, like new, \$1500; Ampex 7800A 1" video proc recorder, color, vertical lock, gd cond, \$500. S Wood, Modern Syst Res, 12648 La Crosta Ct, Los Altos CA 84022. 415-941-8000.

Sony LDP-1000A indust laser video disk player for CAV & CLV disks, RS232C serial port for computer interface, w/remote & flight case, excel cond, \$500. J Krepol, RNDL, 7 Dustin Dr, Wilmington DE 19703. 302-798-4076.

Sony 34" U-matic top loaders: VP-1000, VP-1200, VP-2000, VO-2630, VO-2800; editing controllers BVE 500, BVE 500A (A/B roll); (6) 1/2" EIAJ recorders & players; Ampex Quad VR1200B parts inventory; all BO. J Krepol, RNDL, 7 Dustin Dr, Wilmington DE 19703. 302-798-4076.

Sony VO-5600 34" U-matic R/P, excel cond w/manual, \$900. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

JVC CR-4400-LU portable 34" U-matic, \$600; Sony SLO-340 portable industrial beta w/pwr supply & soft case, lw hrs, \$500. D Bailey, Rock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

JVC RM-86U VHS pro editing system, edit controller, edit deck BR-8600U, hi fi stereo video recorder BR-7700U, cables, lw hrs, \$3000. Jaye, Nimbus Prod, POB 5903, Takoma MD 20912. 301-507-3358.

JVC RM86U, CR8250, CP5550 34" edit system, w/(2) JVC TM41 mon, cables & manual, excel cond, \$4000. Gene Sive Prod, 619-749-7662.

**IMPERIAL TRANSMITTER — NOTICE —**

Persons who have consigned items for sale to Imperial Transmitter Worldwide or purchased equipment not yet received, please contact:

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A-5

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These consoles give you full multitrack production capability while at the same time providing familiar program and audition busing so your production room can double as a back-up on-air facility. They free up your primary Air studio for routine calibration and maintenance sessions. They are a perfect solution for complex talk or news formats.

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doesn't tie up your line inputs: an intercom module that lets you communicate with other Wheatstone consoles and rackmount locations throughout your facility: plus a studio control module, line preselectors, tape controllers, and automatic timers.

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