



RAB Foresees Wireless As Future Wave

by Randy Sukow

DALLAS Past communications conventions and symposia have dwelt on the technological wonders of the future to be delivered over the "information superhighway." This year's Radio Advertising Bureau (RAB) 1994 Managing Sales Conference and Executive Symposium skipped the wonders and went right into shock therapy.

The era of digital communications has already come a long way, and the radio industry must catch up, said RAB President Gary Fries: "If you're going to live in the past, there is no future for radio."

Fries made this prediction at the opening of the four-day (Feb. 17-20) RAB meeting at the Loews Anatole Hotel in Dallas. A record 1,723 broadcasters (up 116 from the previous record set in 1993) heard several speakers who reinforced Fries' message.

Foremost among those speakers was John Abel, executive vice president, operations, National Association of Broadcasters, who in recent months has given several addresses on the future digital media and broadcasters' need to come to terms with them (See *RW*, "Readers Forum," Feb. 23).

"You're in a technology, but you don't know anything about it. You don't have a clue," Abel told an RAB audience. "Most of you educated in the 1960s and 1970s have a bad education and you're trying to catch up."

If he had been leading a talk about digital technology 40 years ago, Abel said that radio executives would have more readily understood his message because the founders of the radio industry tended to be technologists. Broadcasters should think more like their grandfathers than their fathers, the salesmen and promoters who later dominated broadcasting, Abel said.

Much of superhighway should be wireless and broadcasters have the chance to take advantage of it he said. "It is stupid and silly to have broadband fiber into the home," he said, because broadband

continued on page 7 ▶

WBBR Is First Audio Superstation

by Frank Beacham

NEW YORK Perhaps earning himself a place in history as America's first radio broadcaster to offer multimedia programming, WBBR(AM) owner Michael Bloomberg has begun delivering an interactive version of his New York station's audio feed, to computer terminals and will soon become the first U.S. audio "superstation" to be delivered directly to homes via satellite.

Bloomberg, who paid \$13.5 million for the transmitter and frequency (1130 kHz, 50,000 watts) of the former WNEW in the fall of 1992, created WBBR (Bloomberg Business Radio) and began broadcasting a business-oriented format on Jan. 3, 1993. The service uses information produced by Bloomberg's worldwide reporting team, which specializes in news, financial information and business analysis.

Without public announcement, Bloomberg has begun an interactive version of the radio station's audio segments to customers of "The Bloomberg," a leased multimedia computer terminal that provides on-line business and financial information from throughout the world to Bloomberg's clients in the financial industries. By typing "WBBR" on the terminal, the user is presented a menu of audio reports from the station that can be

played through a speaker at a single click of a button.

Beginning in May, WBBR's programming will also be available to a national audience as an audio service on DirecTV, the new direct broadcast satellite service being launched by GM

Chamber of Commerce. A second Bloomberg audio-only channel will be carried on DirecTV and used to supplement material presented on the video service.

DirecTV programming will be received by the RCA-brand DSS (Digital Satellite



Mover and shaker
Michael Bloomberg
in the studios of superstation
WBBR

Hughes Electronics. This is expected to make WBBR the first audio "superstation" delivered by direct broadcast satellite to homes across the entire United States.

Branching out

The WBBR feed on DirecTV will be joined by a new business news video service called Bloomberg Direct. It will be produced by Bloomberg Financial Markets, in association with the U.S.

System) manufactured by Thomson Consumer Electronics. DSS will be sold nationwide for \$699 at consumer electronics stores, satellite television dealerships and rural utilities. DSS is a three-component system consisting of an 18-inch satellite antenna, a compact digital receiver and a remote control.

The approximately 1500 stories produced each day by Bloomberg's 250 business reporters in 42 bureaus around the world serves as the basis for the new broadcast enterprises.

Bloomberg terminals, which rent for about \$1,000 a month, are found in nearly every North American bank, insurance company, broker/dealer and investment management office. Special versions are available for radio stations that allow news departments to use both text and audio feeds.

A mover and shaker

Bloomberg, a former trader and information systems specialist who was fired by Salomon Brothers in 1981, pooled his knowledge of financial markets and computers and started his business news service at the age of 39. Today, his information company is a star on Wall Street and the fastest growing company among much larger competitors that include Reuters, Telerate and Quotron.

In addition to his computer terminals, Bloomberg's information is distributed extensively throughout the world as sound, video and print media. Readers of 62 U.S. and international newspapers receive Bloomberg information, as well as television viewers on PBS, CNBC and USA.

When he expanded into radio in late 1992, Bloomberg abandoned traditional broadcast operations and created a new breed of radio station.

continued on page 3 ▶

**CCA Broadcast Transmitters...
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reliability: the quality or state of being reliable; the extent to which an experiment, test, or measuring procedure yields the same results on repeated trials; the descriptive quality of any radio transmitter manufactured by CCA Electronics, Inc. in Fairburn, Georgia.

reliably: in a reliable manner; suitably or fit to be relied on; dependably.

reliability: the condition or attitude of relying; the condition or attitude of one who relies; dependence on military power to achieve political or someone's aim.

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NEWSWATCH

NAB Says No To Satellite CD Radio

WASHINGTON The NAB has asked the FCC to reject a waiver request by Satellite CD Radio Inc. that would allow the company to sell public stock without losing its place among other applicants to provide a satellite-delivered digital audio broadcast service.

The NAB contends that such a move would be premature until the FCC develops a broad digital broadcasting policy. The NAB emphasized that the FCC has not even allocated any spectrum for

DAB, although the S-band was pushed by the U.S. previously at WARC (World Administrative Radio Conference) in 1992.

The NAB, however, may not be able to stem the tide of satellite digital broadcasting. Action already is moving ahead on another satellite front: audio service will become available later this year when the DirecTV service begins broadcasting. There also is talk of a satellite digital broadcasting service to automobiles.

Satellite broadcasting may be able to get a foothold because terrestrial digital broadcasting by existing radio stations is

still several years away, industry analysts predict.

Harris Purchases Broadcast Services

RICHMOND, Ind. Harris Allied bought the radio studio inventory of Broadcast Services, the broadcast equipment distribution business based in Raleigh, N.C.

Under the agreement, Broadcast Services Founder Neal Davis will serve as a sales and marketing consultant for Harris Allied.

"I'd like Broadcast Services customers

to know that they will be able to get the same attention and support along with the security of a larger entity...." Davis said.

Public Radio Conference Scheduled for April 9-13

SAN ANTONIO The Public Radio Conference will be held April 9-13 in San Antonio. Most events are scheduled for the San Antonio Marriot River-Center.

The annual conference will include sessions on programming management, development and engineering. Individual sessions will cover digital audio broadcasting, radio engineering in a multimedia world, public radio's infrastructure and "datacasting." The keynote speaker will be James Gullen, president of Bell Atlantic.

continued on next page ►

When looking for a digital audio system for automation of satellite programming or live assist, there would appear to be many choices. But if you're looking for a system which is flexible enough to give you total control without sacrificing your sanity, there is only one choice. The Phantom by RDS.

You will see the difference as soon as you see the Phantom in action. The display provides you with all of the information you need to see in a clean, concise manner, without the crowded look that you'll find in other systems. If you are familiar with the most popular software on the PC, then you may already know how to use the Phantom. The Phantom's pull-down menus guide you through all of the steps involved in setup and daily operation, from creating and scheduling clocks to creating and editing logs.

The PHANTOM Digital Audio Automation

The Phantom ends the confusion of automation by keeping everything organized. The Phantom simplifies your daily operations by keeping information such as input changes, voice changes, and clock changes in their own individual schedules rather than in the log. You can leave those liners and other voice drops out of the log because the Phantom will do them for you. The Phantom allows you to date new schedules to begin weeks, months, or even years in advance. When your satellite network informs you that there will be a voice substitution on Thursday, two weeks from today, you can prepare for it *today*.

The Phantom can retime spots to fit them cleanly into a satellite break without inserting silence, overlapping, or running late. The Phantom



can create reports to keep you informed on a number of topics, from a list of expired spots to an analysis of potential mistakes in your log. The Phantom also maintains a history of system activity.

The Phantom has the features that others would want you to believe are theirs exclusively. The Phantom remains *completely* functional during recording, sensing relay closures and starting breaks as easily as it does when it is not recording. The Phantom can fill incomplete breaks with spots from a list you specify without ruining product separation.

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**Audio Writer
Feldman Dies
From Cancer**

GREAT NECK, N.Y. Noted audio equipment reviewer Leonard Feldman died Feb. 14, succumbing to cancer after a long battle with the illness.

Feldman, 66, was a staple with Audio Magazine for many years, providing no-nonsense subjective and objective analysis of audio equipment. He also was an informal consultant with RW on digital technologies, such as MiniDisk and DCC, and provided radio tuner reviews in 1992 and 1993. His columns also appeared in other trade publications.

He was extensively involved with the Audio Engineering Society (AES) and served on various audio committees during his long career. In the mid 1980s, Feldman was instrumental in convincing Congress that the "copy-code" notch proposed for CDs would audibly affect the audio quality. He also testified on the consumer-based Serial Copy Management System (SCMS) anti-copying systems for digital recorders which became a requirement in 1992.

Feldman is survived by his wife and two children.

**Elmira-Corning
On Arbitron List**

ELMIRA-CORNING, N.Y. has become a new market for the Arbitron radio measurement system, scheduled to become effective with the Spring 1994 survey. The new market, consists of Chemung and Steuben counties, and will rank 191 out of 264 metro markets.

WBBR Is First Audio Superstation

▶ continued from page 1

Gone is master control. No one operates a board. There are no crusty editors barking out assignments and searching for "lead" stories. Instead, at WBBR, the computer is king.

Each reporter sits in an open cubicle equipped with a Windows-compatible PC, boom microphone, mixer, phone patch and DAT recorder. It is here they write, record and edit their own news segments on the PC, and then deliver them with instructions for airing over a data network to a central computer. The central computer places each segment automatically into the station's pre-formatted programming wheel. Finally, a MediaTouch system automates on-air sequencing.

Most of the systems at WBBR are custom-designed. "I'm a big believer in doing everything ourselves," Bloomberg said. "I really am paranoid and to the extent possible I don't like to depend on anybody else."

Under wraps

Bloomberg has kept quiet about the new interactive audio service because his company is in the midst of an equipment conversion process. "We've been doing the audio service three months," he said. "We only have about 19,000 of our 34,000 terminals converted to sound so far. We haven't announced it because we are converting people as fast as we can. We expect to convert the whole system in the next six months."

Though he may have the distinction of becoming America's first multimedia radio broadcaster, Bloomberg doesn't consider himself a radio broadcaster at all. Instead, he sees himself as an information provider who uses the best technology available to effectively distribute his information product.

"When I bought WNEW, I never looked at their books," Bloomberg said,

who contends he could care less about how the station performed in a traditional broadcasting sense. "I'll argue I did not buy a radio station. I didn't buy their studios, music, format, people, reputa-

services. Bloomberg said he doesn't really expect WBBR to become a model for other information providers.

"I don't know much about radio stations and the people in them but they

The approximately 1500 stories produced each day by Bloomberg's 250 business reporters in 42 bureaus around the world serve as the basis for the new broadcast enterprises.

tion. I didn't even want their call letters. I happened to buy a piece of equipment over in a swamp in New Jersey and the federal government gave me a license to run the damn thing."

Bloomberg said he decided to offer WBBR's audio over computer after seeing lots of stories in the press about multimedia and information on-demand. "You'd have to be in a real vacuum not to have seen this," he said.

Resistant to change

Even with recent calls by the NAB to encourage their member radio broadcasters to offer over-the-air multimedia

don't look like they accept new ideas easily," Bloomberg said. "And it's funny because it's an easy business to get into. There's lots of sticks out there you can buy. Lots of radio stations don't make money so you don't need lots of money to go take over one."

"I went to an NAB convention a year and quarter ago in New Orleans," he continued. "What struck me was there wasn't a good idea since 1929. When you talk to people their whole thought process was how do we do well within the constraints of what we've been doing. Nobody every looked at the forests. These were tree people."

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Radio Gripped by Disco Nostalgia

WASHINGTON Many of you might feel a little beaten up by this issue of **RW**. We have two front page stories and an editorial taking you to task on a seeming unpreparedness for the imminent days of the "information superhighway."

That is all well and good: It is the task of the editorial page to take tough stances on issues of importance. The truth is, though, that between the big moments in electronic media history (the advent of AM, then FM, then TV, then cable) are long stretches of time when a broadcaster has to concentrate on successfully running his or her business.

Technical progress happens in small steps as well as large. Just recently we had a Sony MiniDisc cart unit out in the field undergoing real-world use and evaluation at an FM station. Preliminary reports are very positive and we will have a complete product evaluation for you soon in the newspaper.

Just today we received a prototype of the Denon MD-Cart, and it too will soon be on its way to a real-world test and evaluation. Denon and Sony are both



ready to ship product. Slowly but steadily, the old NAB cart machines are being challenged by digital technology which also includes the many automation systems in the marketplace.

★ ★ ★

If radio broadcasters stand accused of resisting change, however, they can take solace in the knowledge that radio users seem to be more tied to the past than ever. 1970s fever has taken over the airwaves of television talk shows and news pro-

grams, fashion design and even local radio.

Radio World International Managing Editor and *USAirplay* columnist Charles



RW's Charles Taylor visits with the Gibb brothers.

Taylor has been working on this subject for his column (which you will read in the next issue of **RW**). There you have it. Although broadcasters may be boning up on digital this and compression algorithm that, listeners want to tune in and hear the Bee Gees, Village People, KC & the Sunshine Band, and anyone else from that "Saturday Night Fever" era.

As Chuck explains it, radio programmers have traditionally formatted dance on their radio stations on Saturday nights. Urban-formatted radio stations have captured the younger listeners with hip-hop and rap programming, leaving the Hot AC stations to cash in on the retro-disco sound.

And cashing in they are. Pictured right is Chuck (center) with Maurice (l) and Robin Gibb in the studios of Washington's WRQX(FM) "Mix 107.3." The Gibb Brothers were in the studio for the station's immensely popular weekly "Retro Saturday Night" disco retrospective. Chuck tells me that programs like this are sprouting up all over the country.

The nostalgia for the '70s goes beyond the disco craze. Classic rock and oldies stations are playing more of the Eagles, Fleetwood Mac, the Doobie Brothers, etc. Case in point is the recent country music tribute to the Eagles, the "Common Threads" CD.

It may go out from a digital cart

machine and over the air through a digital air chain, but the sound is from the past. Even Radio X developer Cheryl Broz (see *USAirplay*, March 9) describes the sound of her alternative/progressive format as "familiar."

What it boils down to is something I've written about before and something onto which entrepreneur Michael Bloomberg (see page 1) has latched his business: The programming is the thing.

Bloomberg is using the resources of his radio station to provide audio programming through a variety of vehicles: PCs, satellite and good old over-the-air AM transmission. He is using cutting edge technology, but what will ensure his success is the programming, or information, he delivers to his customers.

★ ★ ★

Speaking of radio entrepreneurs, Liberty Broadcasting completed an agreement to buy Beck-Ross Communications and its subsidiaries. The latest deal adds three stations to the Liberty group. Hot AC WBLI-FM Long Island, N.Y., WHCN(FM) Hartford, Conn., and WSNE(FM) Providence, R.I., for a grand total of 11 radio stations.

The deal gives Liberty its second duopoly (WBLI(FM) and already-owned WGBB (AM)-WBAB-FM). Liberty recently closed on its first duopoly right here in the Washington market when it took over WHFS(FM) Annapolis, Md. It already owned WXTR-FM Waldorf, Md.

You may remember that Liberty was formed in mid-1992 by chairman and COO Mike Craven and President and CEO Jim Thompson, both formerly of Group W Radio. Beck-Ross' Jim Champlin now joins Liberty as executive vice president.

RW's Mark Lapidus (*Promo Power* columnist) also joined Liberty Broadcasting as its director of marketing.

Mark will continue to be based in the Washington area. Congratulations, Mark, and good luck.

Many of you will recall that Mark worked for Jim and Mike previously, as promotion director at Group W's WCXR(FM) here in Washington. (WCXR is now owned by Viacom). Is anyone else having trouble keeping up with all the station trading going on?

★ ★ ★

I'd like to leave you with a parting thought. Don't take our tough talk personally. So much is going on right now that will undoubtedly impact your way of doing business. The NAB show is in full swing right now, and I can only guess at how much new stuff we'll be throwing at you in the issues to come.

Whether you are a technical person or a programming or a management person is irrelevant. You all need to digest and understand the huge changes about to take the radio business by storm.



Dave Newton was appointed director of marketing services for Broadcast Electronics. Newton's responsibilities include directing the advertising and marketing programs for both Broadcast Electronics and its newly acquired division, Broadcast Programming (BP).

Newton will be based in Broadcast Programming's Seattle office. He was formerly copywriter-consultant of BP.

David Klahr was appointed regional director of operations for the Southeast region of Metro Networks. Metro-Networks produces long- and short-form programming for radio, among other things, and owns Metro Traffic Control.

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EBS fundamentals

Dear RW,
As the third major EBS technology developer, we find it interesting that the other two continue to debate the merits of in-band signaling v. RDS subcarrier signaling ("Readers Forum," Jan. 12 and Feb. 9) without addressing the fundamental issue of whether either approach actually improves the Emergency Broadcast System.

Like the old EBS, both approaches depend on relaying emergency information between commercial broadcast facilities to achieve wide geographical coverage. Neither approach deals with how emergency information is generated and delivered to the EBS for distribution. When viewed as a system, however, both TFT's EIS and an RDS-based alerting system can play important roles in the new and improved EBS.

Information Systems Laboratories' approach, called EBSAT, uses TFT's EIS as part of a highly efficient feeder network for emergency information destined for state and local Emergency Operations Centers (EOCs). At the EOCs, the EBSAT emergency message processor integrates voice and text emergency messages arriving over the feeder network and transmits them, via satellite, to those broadcast facilities and other receive sites that are specifically addressed.

At the broadcast facility or other receive site, the EBSAT-receive message processor distributes the voice and text emergency messages, along with activation signals, to devices that alert the general public, like RDS-FM subcarrier generators, video crawlers and other alerting system generators.

As the FCC's decision on the proposed rule making for the new EBS nears, the three major players have a unique opportunity to contribute toward the realization of a truly new and improved Emergency Broadcast System. It is time to limit the rhetoric and get on with developing a system that is not intrusive, simple to operate

and test, reliable and effective in distributing messages that will ultimately save lives.

Barry P. Shay, vice president
Information Systems Laboratories
Vienna, Va.

Relief on the way

Dear RW,
Your editorial about the FAA getting into the broadcasting business was well written (RW, Feb. 9). I wonder if there are any numbers available as to how many stations have been held off the air because of a single bureaucrat at the FAA.

Well, there is light at the end of the tunnel. The FAA, on the other side of their mouths, is talking about decommissioning the VOR service over the next few years. The Global Positioning System is such a huge success that it makes VOR navigation look like a spark gap transmitter.

Several manufacturers are expecting type acceptance of their aircraft systems in the near future. When that happens, airplanes will be able to fly air routes and approaches with far more precision. There will be a massive shift from the VOR system and, hopefully, VOR's rapid decommissioning.

Who knows, we may even get more FM channels where the aviators used to be—just what we need, more stations.

Lawrence J. Tighe Jr., president
WRNJ-AM-FM Hackettstown, N.J.

Cable considerations

Dear RW,
I was very interested to read Richard Mertz's article "LAN Plan Beats Walking with Floppies" (RW, Feb. 9). He is indeed correct that many versions of RG-58 work poorly as data carriers (as opposed to RF carriers). For instance, Belden lists eight kinds of RG-58 but only one, 9907, is specifically made for "thin Ethernet" networking.

Many network designers are now using unshielded twisted pairs (UTP). These cables look very much like standard phone wire (usually 24-gauge, solid pairs, in the standard telephone color code). But they are very different in performance.

For one thing, you can get much more bang for the buck than coax. You have from two to 25 pairs in a cable instead of individual coaxes, and UTP performance can easily equal or surpass IEEE 802.3 specifications.

There are five recognized grades called "categories." Most network designers are using cable like Belden #1229A (four-pair Category 3, 4 megabits per second), Belden #1455A (four-pair Category 4, 16 Mbps) or Belden #1583A (four-pair Category 5, 100 Mbps). There is even a new Belden twisted pair cable (#1700A) that goes way beyond Category 5 and runs in excess of 700 Mbps.

To convert from coax to twisted pairs, you need only buy a "balun" for each terminal. This converts the signal to twisted pairs (which are BALanced") from coax (which is UNbalanced). Just be sure that the baluns you buy support the data rate you are running.

The most common connector on the twisted pair side is the RJ-45, which is a

Tough Talk

This issue's front-page stories share two basic themes:
1. Communications media are rapidly changing and expanding, and the radio broadcasting companies that are prepared to explore new ideas beyond traditional commercial-supported audio services are the ones that will survive.
2. Many radio broadcasters are only vaguely aware of technological and business developments and are doing little to prepare for them.

If these two themes are taken as the premises of a deductive argument, the conclusion is unpleasant.

Michael Bloomberg of Bloomberg Business Radio and WBBR(AM) New York, after attending the National Association of Broadcasters' 1992 Radio Show, concluded that broadcasters are stubbornly resistant to change and have not had any good, new ideas since 1929.

Bloomberg's comments might seem arbitrarily and excessively harsh, were it not for the fact that NAB's John Abel, an advocate for the broadcasting industry, said something very similar at the recent Radio Advertising Bureau conference in Dallas.

Abel bluntly told a crowd of general managers and general sales managers that they were vulnerable because of their ignorance of technology. "You don't have a clue," he said.

Nobody in the audience challenged him. Nobody even seemed offended. But many seemed glad to be told what to expect, some of them for the first time.

Radio is playing catch-up on the proverbial "superhighway," but the good news is that some rare opportunities may soon present themselves.

Congress is considering granting the FCC the power to give broadcasters flexible use of their licensed spectrum to deliver ancillary digital media; to expand duopolies beyond the 1992 limits, and perhaps remove crossownership barriers with many other media.

The FCC's final rules could potentially spark broadcast-cable and broadcast-telco convergences to form a wireless-based superhighway, drastically modifying (and improving) the currently envisioned model of a mostly fiber infrastructure formed out of cable-telco convergence.

Broadcasters stand to benefit from these trends, as long as they remember that radio frequencies are an increasingly important resource when used wisely and diversely.

Radio has traditionally been a medium of entrepreneurs willing and able to react quickly to marketplace dynamics. Their ability to reap benefits from LMAs and duopolies—a fairly recent phenomenon—is but one of many such examples. With the right combination of knowledge, fresh blood and fresh ideas (a la Bloomberg, e.g.), the future for radio could be very pleasant indeed.

—RW

very simple and cheap crimp-on clear plastic connector, the big brother to the RJ-11 phone connector in use on virtually every phone.

Comparing the cost of coax versus twisted pairs and RJ-45s versus BNCs, there is a substantial decrease in the cost per terminal and an equal increase in performance. If RFI is a problem, shielded versions are available and if you're installing cables without a conduit in drop-ceilings or raised computer floors, "plenum" fire-rated versions are available.

The only question I ever hear is, "If I'm running a 2 Mbps network, why would I need 16 or 100 Mbps?"

You can only answer that once you know the answers to a series of other questions. What are you going to plug in that jack next week or next year? Are you going to run digital audio on your hard disk? Are you going to run graphics? What boxes are you going to buy?

If you're not sure, you can future-proof your installation by installing higher-data-rate cable than you presently need. This will also mean it will be a long time before you have to rip out the cable and put in a new one.

The increased cost for higher-speed cables is only pennies per foot.

Stephen H. Lampen, field sales
Belden Wire & Cable, San Francisco

Looking for soap dope

Dear RW,

I was once told a "no joke," or in other words, a joke with no punch line. It went like this: "Two giraffes were sitting in a bath tub, and one said, 'Pass the soap.' The other giraffe said, 'No soap, Radio!'"

I thought this was absurd enough to make a station liner out of it: "...And the other giraffe said, 'No soap, Radio!'—Paradise 104..."

Since then, I have stumbled across other references to 'No soap, Radio.' In "The Odyssey of Flight 33," a 1961 episode of "The Twilight Zone," the flight crew of Global 33 is having trouble communicating with the tower when someone delivers the line: "It's no soap, Captain. I can't raise anyone on the radio."

In an episode of "The Simpsons," Homer is taking a shower with a soap on a rope that has "No soap-radio" written across it.

I am interested in finding out the origin of this phrase. Hopefully, someone will be prompted to write in and help solve this radio pop culture mystery.

Matt Locker
ProVoice Broadcast Voiceovers
San Francisco

Mo' NEMO

Dear RW,

Many words in the English language derive from ancient Latin and Greek. "NEMO" is derived from the Greek for "far away" or "remote" (RW, Dec. 22, 1993).

Erik J. Disen, director of
Engineering & Facilities
KRLD(AM) Dallas

Good additions

Dear RW,

I have been a fan of your publication for years and am even more so after reading the Jan. 12 edition.

I was thrilled to read two very informative articles regarding radio sales. Bob Harris and Karl Baehr both added to what many feel is the thrust of our industry: sales!

Mark R. Schmit
senior marketing consultant
WCIB(FM) Falmouth, Mass.



Vol. 18, No. 6 March 23, 1994

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Radio World (ISSN: 0274-8541) is published bi-weekly by Industrial Marketing Advisory Services, Inc., 5827 Columbia Pike, Suite 310, Falls Church, VA 22041. Phone: 703-998-7600, Fax: 703-998-2966. Second-class postage rates are paid at Falls Church VA 22046 and additional mailing offices. POSTMASTER: Send 3579 forms and address changes to Radio World, P.O. Box 1214, Falls Church VA 22041. Copyright 1994 by Industrial Marketing Advisory Services, Inc. All rights reserved.

—PRINTED IN THE USA—

Next Issue of
Radio World
April 6, 1994

KKSF-FM Serves Listeners Via Modem

by Nancy Reist

SAN FRANCISCO Tim Pozar, chief engineer for San Francisco's KKSF-FM, has been working with computer networks since the mid-1970s. He even operated a FIDONET BBS for the station, but he says management didn't get too excited.

But when Pozar installed an Internet drop and showed them what it could do, he said, "Now they're starting to be really jazzed about it."

Internet is a global computer network where a wide variety of computers can talk to each other. KKSF uses a UNIX system with a 14-kilobit-per-second (kbps) modem. Pozar, who was scheduled to speak about the topic at the NAB, said KKSF's Internet connection provides a number of benefits including an E-mail link with listeners and an efficient information distribution system within the station.

Using Internet

Pozar also has developed a "server" on Internet for KKSF which provides information to listeners, including interviews with artists, descriptions of current events and details about the station and its staff. Information on the server can be updated as frequently as KKSF wants. The text is illustrated with pictures and maps. Pozar said he also plans

to include audio files soon.

KKSF serves its information with an Internet program called Mosaic. Pozar said Mosaic is a user-friendly, menu

anybody can walk up to the computer and start using Mosaic and be able to get information off Internet. It takes a lot of the arcane command line syntax



Welcome to KKSF

We're glad you found us

- [About KKSF-FM.](#)
- [On-Air Features.](#)
- [Music Notes.](#)
- [Who's Who.](#)
- [The KKSF gopher server.](#)



This is the symbol to bring you back to the KKSF-FM Home Page.

Except where noted, everything on this server is Copyright 1993-1994 by KKSF-FM

Listeners hooking up to the KKSF server via PC are welcomed by the above pictured screen.

driven program which can provide text, graphics, animation and sound. "Mosaic is a very nice front end," he said. "Most

that people have to learn and it hides it with a button push."

The only drawback is that people operat-

ing PCs at home with slow modems might not be able to use Mosaic, because the large files would take too long to transfer. For these listeners, KKSF provides information through the Internet Gopher. The Gopher is a menu system that helps users find things in the Internet. KKSF's Gopher server provides the information without the graphics and "pretty" text.

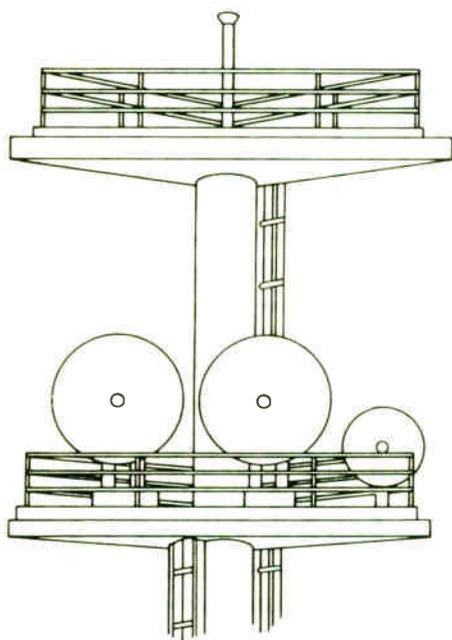
Pozar estimated that there are over two million computers on Internet. But how does a potential user find out about KKSF's server? For current listeners, they promote the service on the air with a brief spot giving an E-mail address for further information. But Pozar said they also advertise the server on Internet itself.

"There's a computer conference on the Internet called USENET," he said. "In there, there's a number of subject areas. One of them is a Bay Area Internet discussion group. Another is a Bay Area broadcast conference. So I'll plug it in there."

A private Gopher

KKSF also has a private Gopher that distributes information to the station's staff. Pozar explained that it is an efficient and cost-effective method of communication. "I wrote a program that takes the Associated Press wire feed, shoves it into my computer, munges it, and any computer on our computer network can get the Associated Press wire stories as they are coming off the wire. We don't have to pay for wire-ready this

continued on next page ►



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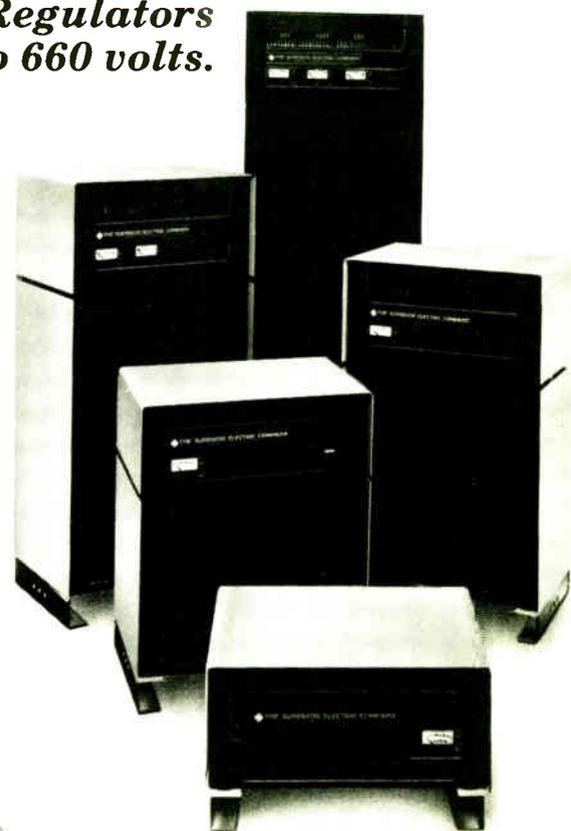
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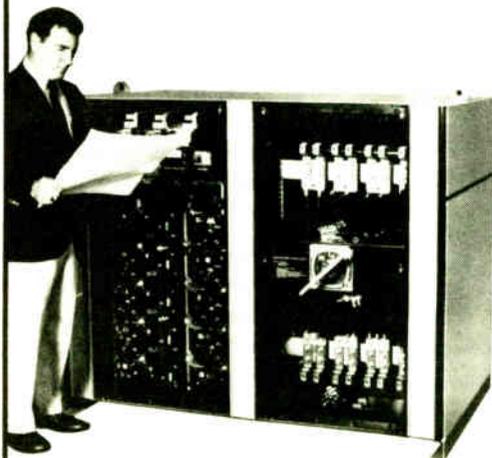
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World Radio History

RAB Foresees Wireless Future Wave

► continued from page 1

services can be delivered by wireless carriers and outgoing signals from the home will almost never need fiber's broadband capacity.

Bud Paxson, chairman of Paxson Communications and founder of the Home Shopping Network, said it more directly: "The future is wireless. The information superhighway will ride on the airwaves, not on fiber optics."

The radio industry's first step toward insuring its survival is to stop thinking of itself as simply an audio service. Abel said. Even with today's analog technology, broadcasters have the ability to become "bit distributors" and in the not-too-distant future, digital information will be the only type of information broadcast by broadcasters.

Bit broadcasters with AM or FM spectrum will be able to send any form of digital data now sent over wires: audio, video, text, still photos, telephony and others not yet considered. But broadcasters must be bold enough to embrace the technology.

The next step, which Paxson said should be beginning right now, is to "grab spectrum. The FCC is the center of the future of the information superhighway. They will allocate and license spectrum for the wireless future."

Paxson told radio station operators to immediately begin looking at ways to control more and more frequency space, such as through LMAs of full-power TV stations or purchase of low-power TV stations. He also told them to "go for the PCS licenses" which will replace the current cellular phone service and be a platform for other new digital services.

Within the next 12 to 18 months, Paxson predicted, the FCC will lift current radio/TV crossownership limits and change its rules to allow television duopolies. Within 12 to 18 months, the FCC will relax current duopoly rules beyond the 1992 limits, to three AMs and three FM's in large markets and up to 50 per-

cent of the audience in small markets.

These rule changes will allow for control of even greater amounts of spectrum and greater shares of future communications industries, he said.

This futuristic message was for the ad salesmen in the RAB membership as much as it was for the general managers. "We have to change the way that we sell because what we've done in the past is

not good enough," Fries said. Salesmen will be required to understand entirely new technologies and be able to demonstrate to advertisers how they can strategically benefit from appearing on packages of digital media. The radio industry will need "marketers, not spot sellers," Paxson said.

Underneath the tough talk, the futurists at RAB gave reasons to remain optimistic.

"I'd be naive to tell you that it was not going to affect us in the radio business. But I'm here to tell you that I think it's going to affect us in a very positive way," Fries said.

"There is still going to be, as there was when I started in this business, a radio—a communications device that is going to be part of our lives."

On-Line PC From KKSF

► continued from previous page

way. It's actually a much better system than wire-ready, much more flexible."

Stories that are marked urgent are automatically printed out on a specific machine, according to Pozar.

Archive access

The staff Gopher also can be used to access the AP archive system. Pozar said: "If I clicked there and typed Joe Montana, it would show me all the articles related to Joe Montana. So I can search for something."

KKSF's Internet services already are valuable, but Pozar said he plans to continue expanding them. The station is currently putting together a fifth CD in a series of music samplers to raise money for AIDs services.

"I'd like to get rights to about a minute of the music to be able to put up on Internet server so that people can sample the sampler," Pozar said. "We'll have a list of the cuts and the artists and they'll click on that. They'll hear the artist for about 30 seconds. They can get an idea of whether they want to buy the CD or not."

So how does a radio station hook up to Internet? You need to contact a company like Pozar's RGNNet which provides Internet services. You also need to decide what kind of access you want. Pozar explained that there are three basic kinds. The most limited provides only E-mail access. This can be an attractive way to communicate with listeners, but doesn't accommodate file transfers or access to the programs on the Internet.

Pozar said the next level is called "shell access." This allows you to use many of the services by connecting your computer to a remote computer that is part of Internet. "The problem is if there's a really neat program that you want, it adds an extra step to things since the file will be transferred to the computer on the Internet. Then you have to download it to your computer."

All access

KKSF has the third level which is called full Internet access. This means that their computer is part of Internet. Files can be transferred directly on and off their computer. You also must decide how fast your Internet link needs to be. The faster lines are more expensive, but may be worth it if you work with many large audio or video files. Pozar said that KKSF has been satisfied with their 14 kilobits per second modem connection.

"The next step up is a 56 kbps lease line," Pozar said. "The next step up from that would be what's called a T1 lease line which would be 1.544 megabits per second. There are also some things in between that. For example, you can use Switched 56."

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Arbitron Pushes to Educate Consumers

by Randy Sukow

DALLAS Arbitron is well into its plan to raise sample sizes by 70 percent (albeit, not as successfully as the company had hoped, with stations in only about 30 percent of the measured markets agreeing to the new samples so far). Now Arbitron and its customers are turning more attention to the next conundrum, survey response levels.

But Arbitron President Steve Morris told an RAB conference audience that increasing response will be harder to achieve than increasing samples, which only required additional capital investment.

Money alone will not change the habits of today's American consumers, who have answering machines and other shields from survey takers, which have also hurt the response rates of other research companies and the U.S. Census Bureau in recent years.

"We can't really change that," said Steve Morris.

Arbitron's plan, Morris said, is to attack the barriers with the best weapon radio has—promotion, not only of Arbitron, but the radio industry in general.

For itself, Arbitron is taking what some are calling the "Budweiser approach" by getting its logo displayed at crowded public events and pushing to have its executives quoted in "USA Today" and other national print media whenever radio-related advertising or lifestyle stories are published.

For the radio industry as a whole, Arbitron is sponsoring the third annual

"Great Radio Promotion" awards, a special category within RAB's Mercury Awards (scheduled for June 15 in New York). The company is offering a total of \$200,000 in cash, including \$100,000 to

station general managers, is also looking at other strategies to boost response.

One alternative is modification or replacement of the current diary system. "I think (Arbitron) is living in the past.

How would you feel if you got a diary? Would you like to fill out a diary if you were an 18-to-24-year-old male?" asked RAB President Gary Fries, an advisory council member.

Arbitron is also considering a passive meter system. A small device could be attached to a survey respondent's radio to record the day's radio listening. Data from the devices could then be transmitted to Arbitron by phone lines at the end of the day.

But from the council's perspective, passive meters are not "a slam-dunk solution," Fries said.

Several issues are complicating the passive meter project, such as

the cost to stations, miniaturization of the meters and adequate battery power for the devices, said fellow council member Mark Bench, general manager, WMXV (FM) New York.

Also, there is no guarantee that those who do not take the time to return diaries would be any more conscientious about downloading passive meter data, he said.

A small response level improvement might be achieved with a more user-friendly redesign of the diaries. "Of the diaries (Arbitron) gets back, a large number are not useful because they have not been filled in properly," Bench said. "For example, they will toss away a diary if a (listener) didn't listen that day and didn't check the right box."

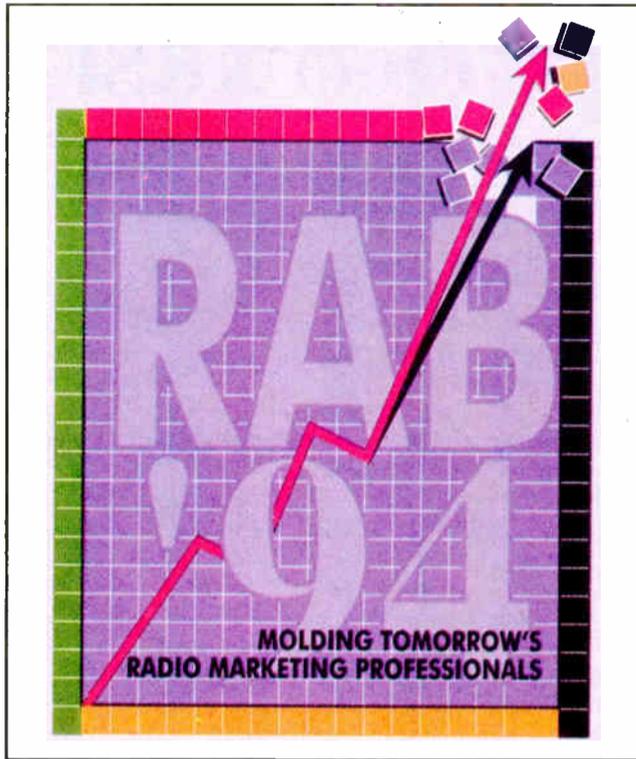
Another way Arbitron is attempting to upgrade service, besides sample size and response increases, is by venturing into the qualitative research business. Radio will have a harder time competing as cable TV and other narrowcasting advertising media grow.

Arbitron's LocalMotion software, shown for the first time at RAB 1994, helps stations prepare "micromarketing" pitches with consumer profiles of historic buying behavior based on geography, down to the county, or, if needed, down to the zip code.

Other companies at RAB were also promoting qualitative services. Tapscan Inc., Toronto, featured its established "Business Intelligence" programs. "A lot of (radio) people out there are trying to get other ratings sources to enhance their industry," said Tapscan Vice President Drew Simpson. "All these guys are believers that sales go beyond the single ratings point."

□ □ □

Entries to the Great Radio Promotion must be submitted on two reels per spot (no cassettes accepted), with five seconds of plastic leader at the head of the tape and labels on the reels and tape boxes. Send tapes to: The Great Radio Promotion III, The Arbitron Co., 142 W. 57th St., New York, NY 10019. Entries must be postmarked by April 29.



the first-place "Gold Award" winner, for the best 60-second spots promoting radio as an advertising medium.

Entries will be judged by the Arbitron Radio Advisory Council. That same 16-member group, made up mostly of radio

Sports Events Key to Major Advertisers

by Bob Harris

DALLAS The message came through loud and clear from an RAB conference panel on sports advertising: Do not sell radio. Sell integrated sports marketing campaigns.

"Sports is a buy ruled not by CPM or CPPs, but by enthusiasm, marketing savvy and imagination," said Terry Reckerd of the Capitol Radio Network, Raleigh, N.C.

Sports events create selling opportunities for out-of-demo buys and provide an opportunity to sell time at premium rates. They create long-term billing for improved cash flow and the opportunity to sell packages to improve the profitability of other inventory.

All aspects of a sports program should be sold in a unified presentation, the panel said. The actual game with play by play can be in packages with coaches shows, sport talk shows, weekend updates and morning drive reports.

But there should not be too many packages. Stations should aim for a few packages at higher prices, rather than several packages at low prices.

Sports programming should not be underpriced, the panel said. It is prime time on many stations and deserves premium rates.

It helps to put plenty of show business in the presentation. Some stations create sports clubs for a select group of advertisers. Club members may be offered commercials on all station sports programs, as well as team apparel, game tickets and several other perks.

A sports team or sports network will offer several items and perks to make the sales job easier. Steady advertisers are sometimes offered: season tickets and VIP parking; use of a skybox suite at the stadium; signs in the stadium; space for tailgate parties; players and coaches for personal appearances; cheerleader appearances, and public address and scoreboard advertising.

Even stations that do not have rights to the local team's games can make money on sports. They can package sports score updates and reports from special events, like the Olympics. A local team's star can be hired to do daily or weekly features for the station.

Some sponsors are willing to support a player-of-the-week promotion or hold a simple guess-the-score contest with in-store entries. Such ideas can be implemented at any sized market to sell sports, even at the high school level.

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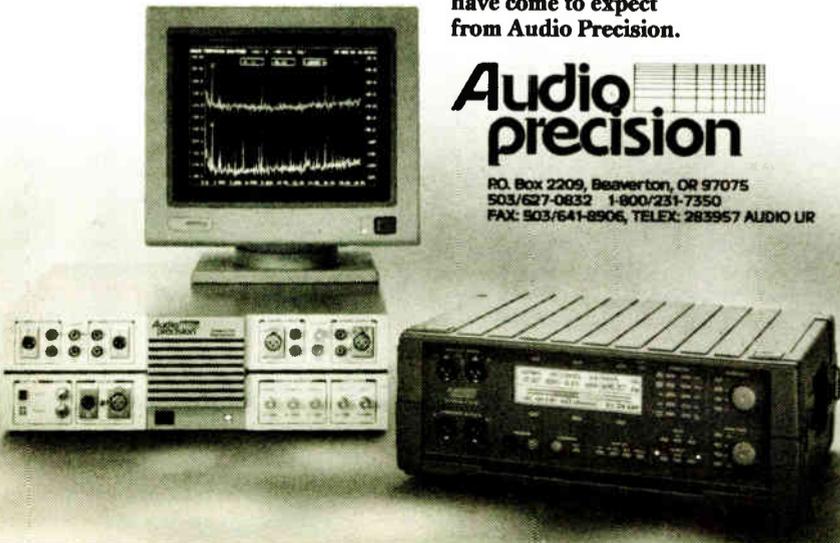
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Lobbying Washington Is Important

by Randy Sukow

DALLAS RAB gave National Association of Broadcasters President Eddie Fritts time at its annual conference to present a session on how to make "sales calls on Washington." In return, Fritts staged a modern-day Orson Welles "War of the Worlds" show, featuring a Martian attack from Capitol Hill.

Fritts started the session by introducing a surprise guest speaker, Rep. John Pendergrass, a freshman congressman from

Pennsylvania. After telling a few cozy stories about his teen years listening to the radio and about his friends who once worked at radio stations, Pendergrass launched into a series of politically incorrect pronouncements for any roomful of radio managers and salesmen.

• On labeling beer and wine spots: "I think you have to look at this as citizens and not look only at the bottom line...Your industry can look at this in a narrow, self-interested manner, or you can take an enlightened view." His

position did not soften, even when an audience member said that long disclaimers would likely drive all beer and wine advertising off radio and on to other media.

• On political advertising: "I think the way to control campaign spending is to give me some free drive time. If I could be on during drive time, there would be an improved discussion of the issues."

• On the fairness doctrine and other free-speech issues: "I think my constituents are being poi-

soned by unbalanced and unfair (broadcast) information." The congressman was especially exercised by a radio talk show host at a station in his district, where he suggested a call-letter change to WTJP for "trash John Pendergrass." He said that stations airing such controversial material should be forced to air the other point of view. "Democracy requires shared responsibility. We need sacrifices to move this country ahead," he said.

The audience was hostile and

argumentative by the end of the speech, when Fritts finally revealed that Rep. John Pendergrass was actually Jon W. Plebani, a political consultant with the Washington firm of Arter & Hadden, who learned how to imitate a typical congressman's responses during years of experience as a Capitol Hill aide.

"This is not unusual. Jon Plebani has personified a lot of the thinking in Washington," said John David, NAB senior vice president, radio. It is up to broadcasters to educate legislators about broadcast issues, he said.

Jim May, NAB executive vice president, government relations, said writing letters will not do the job. Broadcasters must form personal relationships by inviting legislators to their stations or by visiting them at their district or Washington offices. When Pendergrass-like speeches are made by members of Congress, "it's not shame on them, but shame on us for not teaching

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Broadcasters must form personal relationships with legislators.

them," May said.

The NAB staffers said there are several other issues radio operators should be lobbying their representatives to address. A performance royalty bill was recently introduced by House Copyright Subcommittee Chairman William Hughes (D-N.J.), which would require broadcasters to pay copyright fees to performers of recorded music as well as the composers.

They also suggested that operators study the new EEO rules, which will have a significant effect on the next round of radio station license renewals, set to begin in June 1995.

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IPS Is Non-Traditional Opportunity

by Bob Harris

DALLAS One of the exciting new sales opportunities for radio is not on the air, but on the phone. The new "information superhighway" has opportunities for radio stations through interactive phone systems (IPS).

A room of radio sales managers at the recent RAB conference heard the future of IPS as presented by Ruth Preslaff from The Media Gallery.

Advantages to investing in IPS include the chance for a station to get closer to its audience; removal of on-air clutter; the chance to build a database, and additional revenue.

The interactive phone concept is not new to radio stations, but it is increasingly being embraced by various rival media, such as newspapers and phone companies.

IPS has been a large- or medium-market opportunity so far. The market size must be about 100,000 or more before interactive systems pay for themselves. Most small-market broadcasters cannot afford it.

Equipment costs are the major investment when establishing an IPS. Installation costs can range from \$10,000 to \$40,000 for a large system with several incoming lines and abundant computer memory.

Information is the next largest expense. The most popular IPS lines, said Skip Finley, general manager, WKYS(FM) Washington, are "soaps, jokes and (horo)scopes." These services are available from syndicators.

A station must also take into account the manpower necessary to maintain and update the system. Information and sponsor IDs may change on a daily basis and the time this takes employees away from other tasks must be listed as an expense.

But the potential returns often justify the expenses. Finley says his station has sold over \$1 million of air time for ads sold in conjunction with the "KYS Connection."

WKYS took over 14,000 calls on its snow closing hotline during one of the past winter's stretches of bad weather. The system averages 37,000 calls a month, Finley said.

Drew Horowitz, general sales manager, WTMX(FM) Chicago, said his "MIX Info Line" receives 25,000 calls a month. Stations must promote the lines to make them work, he said. They must also create focused services that certain classes of listeners will want and need. WTMX's mortgage rate line, for example, is very popular.

Some advertisers are willing to sponsor customized IPS lines. In one market, Midas sponsored a car tip line. In another, a sausage company sponsored a line for listeners to call in and share their recipes.

Weight Watchers sponsored a weight loss tip of the day line. Callers were connected directly to the local Weight Watchers office at the end of the phone message, if they desired.

CBS Radio Sports at the Olympics



One of the most anticipated moments of the 1994 Olympic Winter Games was Dan Jansen's final Olympic event, the 1000-meter speed skating competition. After setting a world record in that event and taking the Gold, Jansen talked with CBS Radio Sports' Olympic studio anchor Jim Hunter.

CBS Radio Sports provided hourly updates on all the Olympic action and covered Team USA hockey and portions of the Ladies' Figure Skating competition live to 250 stations across the country. Look for more coverage on CBS in the next issue of **RW**.

Team CBS Radio Sports covered the venues, got the interviews and captured all of the Olympic moments of the XVII Winter Games.

Gathered for the team photo are, standing left to right: Jim Hunter (studio anchor), Mike Woodley (hockey color), Ed Coleman (hockey and ski jumping), Bill Schweizer (CBS Owned AM stations), Dave Eanet (speed skating). Bottom row, left to right: John Rooney (studio anchor), Gary Cohen (hockey). Not pictured are Ann Liguori (alpine skiing) and Tommy Tighe (bobsled and luge).



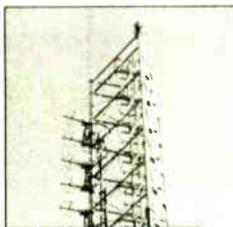
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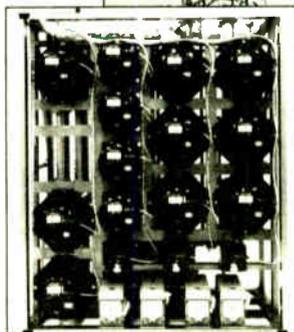
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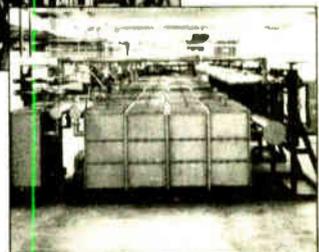
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Duopoly Adjustments Can Be Difficult

by Randy Sukow

DALLAS Radio's current era of consolidation, brought on by the FCC's 1992 relaxation of duopoly and local marketing agreement (LMA) rules, has been a positive experience for many station owners. But certain unexpected details have ruined the benefits of some deals.

A major consideration before closing a consolidation deal is how the merged sales departments

are likely to work together. Should the sales teams be merged?

There is no single, definitive answer. "Very few situations are alike, and what works in one case won't work in another," said Alan Box, president, EZ Communications, which has entered into eight duopoly deals and already been involved in the "unpairing" of FM station duopolies in two markets.

Eddie Esserman, general manager of a four-station consolidation

in the San Francisco area (KABL-AM-FM/KNEW (AM)-KSAN-FM) agreed there is no universal rule. Most consolidated stations will have one general manager and one receptionist. "The rest is up for discussion," he said.

Box said he uses two key factors to decide whether to keep sales staffs separate. If the formats of stations are different and if both earn revenues healthy enough to survive on their own, he tends to keep the sales operations separate.

Without both of those factors, Box said he is more likely to combine them. A stronger station should "put legs under the weaker station," he said.

Robert Gourley, general manager, KKCS-AM-FM Colorado Springs, Colo., who entered an LMA to operate KIKX-FM Manitou Spring, Colo., a year and a half ago, gave the opposite advice. "Just because your station is dominant in the market and controls all the advertising, don't

believe your new station will play right into that," he said.

In his case, Gourley said, a number-one station combined with a number-twenty station with disastrous results. Salesmen from the stronger station tended to go after the easy sell on the stronger station and pitched the weaker station as an afterthought.

Esserman, whose own combined sales operation has been successful, said some stations make the mistake of trying to cut budgets by cutting back staff after a consolidation. "In the larger markets, the object is not to save your way to success. The big win is in being able to have more stations that are each successful in their own rights," he said.

"We are two and a half years into it and darned glad we did it," said Jim Timm of the Radio Results Network, who oversees the combined sales staff of a four-station LMA combination in LaCrosse, Wis.

Timm had several suggestions for establishing a unified sales perception in the minds of both the sales people and advertisers. Sales people should be required to become as intimately knowledgeable about the new station as they are of the old station.

He advised managers to be patient with sales people who have a hard time adjusting to the new situation, but to "keep raising the bar" for those who excel but fall into a "comfort zone" of steady, reliable sales without breaking new ground.

Paul Fiddick, RAB chairman and radio group president Heritage Media, said that rivalries within merged sales staffs can be avoided if salesmen from the new station are treated equally. "Treat these people as if you recruited them, not as if you bought them," he said.

Heritage has duopoly combinations in Milwaukee, Rochester, N.Y., and is about to complete a deal in St. Louis. It has tried combined and separate staffs, but Fiddick suspects most staffs should be separate. "Hasn't our experience been that AM-FM combos sell best separately?" he asked.

Steve Sandman, general sales manager for KRZY(AM)-KRST(FM) Albuquerque, N.M., who also oversees sales at an LMA station, is a strong believer in keeping the staffs apart. "The only one that should have a dual letterhead is the GM," he said.

So far, the risks and benefits of combining sales staffs do not appear to change dramatically by market size. Stations in even the smallest markets, where duopolies are still prohibited, may soon have the opportunity to make the same decisions.

"We have a petition before the FCC to take the duopoly issue down to the smaller markets than what they agreed to do initially. We anticipate that there will be something coming forward on that in the near future," said National Association of Broadcasters President Eddie Fritts.

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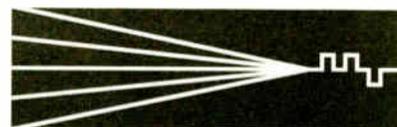
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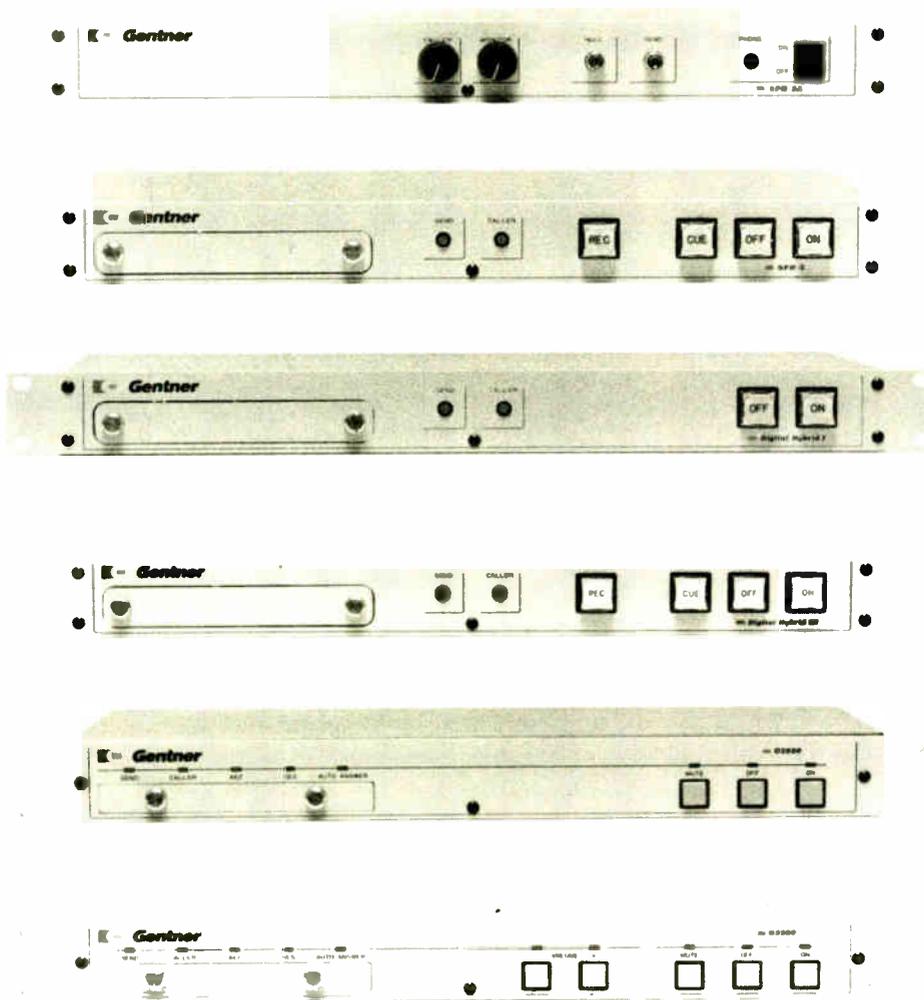
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See p. 17.

Equipment and Applications for Radio Production and Recording

PRODUCT EVALUATION

Impressive Storage from DigiCart/II

by Ty Ford

BALTIMORE When 360 Systems announced the Version 2 upgrade for its DigiCart/I, the operational, hardware and software features they added made the DigiCart/II (\$4,995 with Bernoulli drive and 240MB internal hard drive) faster and easier.

New file sorting options, record overwrite, pause during record, secondary and tertiary cues, easier stack manipulation, pre-set "hot keys," an updated ES-bus serial interface and operating system plus other features make the DigiCart/II a formidable opponent in the cart replacement market.

The DigiCart/II offers the option of using Dolby AC-2, but only with the 48 kHz sample rate. Regardless of your concerns about data reduction, using Dolby AC-2 looks very tempting. The 48 kHz sample rate with Dolby AC-2 provides five times the storage of an uncompressed file.

Storage time in stereo minutes, using Dolby AC-2 compression at 48 kHz sample rate, is 111 minutes for the 240MB drive, 240 minutes for the 500MB and 480 minutes for the 1GB drive. 360 Systems recommends only its drives be used.

Recording the audio

Recording is easy. When you hit the record button, the system finds an empty space or tells you that the disk is full. You can set recording time limits of 30 seconds, 1, 5, 30 and 60 minutes or "none" to further conserve space. There is an adjustable record threshold; you hit record, play and when your source audio exceeds the threshold, you're recording. Head and tail trim editing are easy, and the system allows you to copy the edited or original versions to other disk locations and rename them.

Using 48 kHz with Dolby AC-2, I did A/B comparisons between CD sources and DigiCart/II playback. I first used classical string quartets with all of those fragile bowed sounds. Even at levels that were well below -27 dB (and not even showing on the meters), the quieter, more fragile bowed parts sounded fine. The stereo image was intact, the highs, mids and lows all were in balance.

Next I used my "system killer," the KIX "Hotwire" CD. Even the very dense waveforms of KIX's high energy rock caused the system no problem. I followed that by recording a few spots from a nearby station's DGS terminal to the analog ports of my DAT machine. Although the spots sounded a bit "edgy" before I recorded them on the DigiCart/II, they didn't sound any worse on playback.

Another incentive to use Dolby AC-2 is that you can only use the "Preset" buttons for playback of sounds recorded with Dolby AC-2. I may regret saying this, but

I have no complaints with Dolby AC-2 as it is used in the DigiCart/II.

The Bernoulli

Okay, so the 105MB Bernoulli disk took about 13 seconds to boot up after insertion. But you would have to have an army of interns with brain implants all wired to your synapses to handle a cart library with as many cuts as you could get on a fully loaded DigiCart/II.

Although I didn't subject the Bernoulli drive and disk to any rough handling, I suspect that they are more fragile than the standard workhorse cart and cart machine. But since one of the main features of the DigiCart/II system is that it stores audio on the internal hard drive and up to five more external drives, each as big a 1GB (480 stereo minutes with Dolby AC-2 per drive), you would probably use the Bernoulli for less stressful tasks, like backing up and changing cuts. 360 Systems suggests that you optimize the hard disks at least every six months, making sure to back up all drives to Bernoulli disks first.

File transfer time also is impacted by the use of Dolby AC-2. It took only 25 seconds to copy a Dolby AC-2 encoded five minute stereo file from the removable Bernoulli drive to the internal hard drive. When I transferred a 60 second, non-encoded stereo file, it took 26 seconds. From this, I deduced that the compression ratio for this application of Dolby AC-2 is about 5:1. If your plan is to use the

Bernoulli drive to update the hard drive, using Dolby AC-2 makes even more sense.

The system

The DigiCart/II stores its cuts in a basic hierarchical file system of disks, directories, cuts and stacks. There are only four buttons needed to move about. The left and right arrows on the RC-205, RC-210 and RC-220 move between layers, the up and down buttons on these remote controls (or

I had to spend some time with the manual learning the right sequence of moves for some of the edit functions, especially the copy function. While these navigations are not hard to learn, it was obvious that the designers and I had different intuitional models. More precise screen prompts would be helpful. Once I was up to speed, however, I found the system to be surprisingly fast.

The "FIND" feature, which allows only the RC-210 mini keyboard to search by name or number, is an essential addition. My first problem was that the search function didn't come up after pressing F5. The DIN/ADB adapter on the end of the keyboard cable extends in rather a clunky

fashion when plugged into the back of the chassis. Pushing the assemblage in that extra 1/16 inch solved the problem, but moving the keyboard made the plug work loose. Adding some strategic strain relief stabilized the connector and cured the problem.

If the file names are similar, such as "Bumper A" and "Bumper B" the system will find "Bumper A" first. A second search will take you to "Bumper B." As easy to

use as this feature is, it could use a little tweaking. The search criteria are limited to the first letters of any title. After loading in my narration demo and naming it

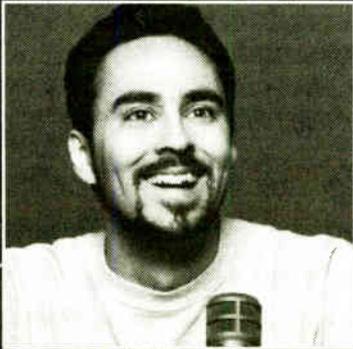
continued on page 27 ▶



DigiCart/II uses Dolby AC-2 for more efficient use of storage space.

the rotary selector knob on the front panel of the main chassis) move you up and down within whatever disk, directory or layer you happen to be in. My navigation improved with practice.

Perfect Bob.



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PRODUCT EVALUATION

The Other Road Taken: Tascam's DA-88

by Bruce Bartlett
with Jenny Bartlett

ELKHART, Ind. It's bound to happen. Sooner or later, you'll switch to digital recording for your station's production. And today, if you are looking at multi-track capability, the eight-track digital recorder is a convenient format.

The two prime contenders are the popular Alesis ADAT (see *RW* Dec. 22, 1993) and Tascam's DA-88. Priced at \$4499 list, the DA-88 is one of the new modular digital multitracks (MDM). It is based on the Hi8 video tape format.

As your need for tracks increases, you can add on more eight-track modules via cable connection. In this way, you can hook together up to 16 units to get up to 128 tracks. Modules sync up in two seconds, and the sync does not use up any tracks.

Specifications

Since the DA-88's sound is digital, there is no wow and flutter, no intermodulation noise and no tape hiss. Tascam specs the frequency response as: ± 0.5 dB from 20 Hz to 20 kHz, and the S/N ratio at 92 dB or greater.

Product Capsule: Tascam DA-88	
 Thumbs Up	 Thumbs Down
<ul style="list-style-type: none"> ✓ clean, digital sound ✓ rugged and reliable ✓ fast, responsive transport ✓ long tape running time 	<ul style="list-style-type: none"> ✓ transport whines during shuttle ✓ somewhat pricier than ADAT ✓ may have more features than you need
For more information, circle Reader Service 95 ; or call Tascam at 213-726-0303	

In past issues we've touted the virtues of disk-based digital workstations. But a digital tape recorder (like the DA-88) has some advantages for the same price: faster mixing, longer recording time, multiple-track overdubs and removable media.

The Alesis ADAT competes directly with the DA-88, but has had a couple years head start with more than 20,000 units in the field. Unlike the DA-88's Hi8 format, the Alesis ADAT, and more

recently the Fostex RD-8, use a transport that handles S-VHS video tape.

Tascam opted for the Hi8 format for several reasons, according to the company. In the Alesis and Fostex models, the transport is made to run at about three times the normal speed, which may add stress, according to Tascam. Also, the DA-88 employs direct-drive motors rather than the flywheel/belt system used in an

(Editor's note: Despite questions about the ADAT's robustness, users have said they have held up well and offer great digital sound—the latter was a conclusion reached by Ty Ford in the December review.)

Ins and outs

The DA-88 is made to accept only Hi8 tape and will not accept a Hi8 tape record-



The Hi8 videotape format is now used for multitrack audio.

S-VHS transport.

Another advantage of Hi8 is its long recording time on a small 120-minute cassette: one-hour, 48 minutes.

A video format

Hi8 also offers Automatic Track Finding (ATF). The tracking-control signal is embedded in the helical scan. Since the program and tracking signals are on the same track, the deck constantly aligns itself. Tascam says this gives perfect tracking without errors. With S-VHS, the control track is a separate longitudinal track.

Speed is another advantage of Hi8. When you press a transport control on an S-VHS transport, it takes a few seconds to respond. The Hi8 transport responds almost instantly. It can shuttle a 120-minute tape in just 80 seconds.

Alesis has stated that S-VHS tracks are much wider and less dense than Hi8 tracks, so S-VHS should be less error-prone. In response, Tascam said that the computer industry relies on Hi8 for data backup, so it must be reliable. Hi8 uses very dense metal-particle tape which keeps error rates down.

ed with video.

The digital circuitry uses the same converters as the Tascam DA-30 DAT recorder. The A/D is a Crystal 5339 with 64x oversampling, and the D/A is an 18-bit, Analog Devices DA-1865N with 16x oversampling.

Both 48K and 44.1 kHz sampling rates are available. Use 48 kHz for best frequency response. Use 44.1 kHz to avoid sample-rate conversion if you have a digital mixer and are mixing for CD release.

You'll find the DA-88 readily accessible for servicing. All the circuit boards and transport plug into the chassis. Analog audio inputs and outputs are unbalanced RCA connectors with a -10 dBV level. There's also a pair of balanced D-sub 25-pin connectors running at +4 dBm. Tascam offers a cable that converts from D-sub to XLRs.

The digital I/O format is Tascam's TDIF-1 digital interface. It takes the form of a D-sub connector and is used to copy between two DA-88s—eight tracks at a time. Optional interfaces let you convert TDIF-1 to the usual AES/EBU and SDIF-2 formats. Two word-sync jacks can be used to lock the DA-88 to Tascam's RA-4000

hard-disk recorder, Tascam's DA-60 DAT recorder and Digidesign's ProTools.

The DA-88 comes with a wide variety of handy features, such as pitch control, a jog wheel for cueing, fast shuttling, two auto locate points, track delay and punch in/out. Options include a punch in/out footswitch, meter bridge, remote control, stand, RC-848 System Remote Controller for up to six DA-88s and the SY-88 synchronizer board that provides SMPTE chase sync, MIDI machine control (MMC) and RS 422 compatibility.

Impressions

There's no doubt that this is a professional machine. It's well-made, heavily shielded and weighs 33 lbs. The clearly labeled controls operate with a sure touch. Made for rack mounting, the DA-88 stands four rack spaces tall.

A word of caution: After you receive the shipped unit, make sure that the circuit cards are still well-seated. My review sample had been dropped during shipment, which caused some digital errors until the unit was checked.

The easy-to-read manual led me through the DA-88's controls, displays and operations with no hassle. The DA-88 almost reminds me of an analog deck in its ease of use. Every function works without a glitch—even punch-ins. In an attempt to create glitches, I pulled out the power cord while overdubbing. But I heard no click on any tracks during playback.

The transport reacts quickly to your commands and shuttles tape much faster than the ADAT. You can, however, hear the gears whining during shuttle mode.

Overall, I think the DA-88 sounds just great: clean and easy on your ears. To test its sound quality, I recorded a CD on the DA-88, then compared the DA-88 playback to the CD. They sounded virtually the same. The CD might have been just a little more "open" or "effortless" on cymbals, but the difference was very subtle. You'll like the DA-88 for on-location recordings because the tape runs so long. And it is ideal for radio production with its speed, ruggedness and ease of use. The Tascam DA-88 offers excellent sound and features at an affordable price.

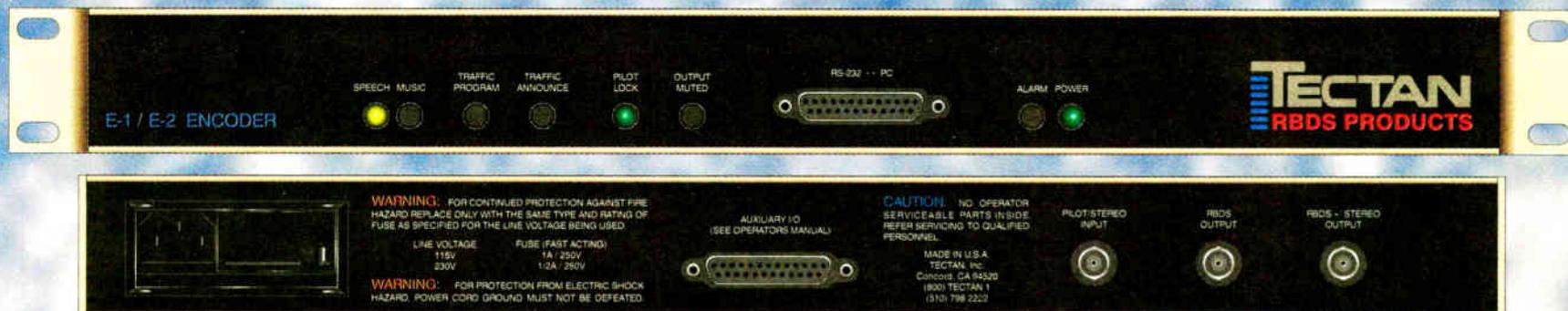
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Bruce Bartlett is a microphone engineer and technical writer for Crown International. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.

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DAWs Make Mixing Documentaries Easier

Last in a series

by Steve Rowland

NEW YORK Mixing your radio documentary is the last step in your production. Equipment choices are: use multiple two-track machines, patched into a board, and recorded onto a master two-track machine; use an analog multitrack recorder—an eight-track is adequate for most productions, and the Otari 5050 has been used for many great productions, or use a multitrack digital audio workstation (DAW).

The multiple two-track system sounds a little out of date, and it is. However, this system is still being used in many of the studios at National Public Radio, and the programs, while often simple in construction, are some of the strongest pieces being done in contemporary radio. Personally, I couldn't work that way, but some producer/engineer teams make magic.

Working in an analog eight track studio gives a level of precision and complexity that really is hard to get in two-track system. Cues can be dropped in more easily and the backtiming of music and sound effects is much more precise.

The old way

With both of these systems you must build your mix up linearly from beginning to end. Some producers try to time out their programs exactly before they go into the studio. They will time each edited actuality, each narration bit, and each piece of music, then add the total. Very few changes are made during the mix. I did a program that way once, and hope to never do it again.

While you are putting the program together, you need to be able to stop and listen to it and change the sequence of things, cut down an overwritten narration and add a little more music.

But what if your show gets to long? You are mixing down to two-track. Well, one thing we do is to leave places in the mix that will be easy to edit. Leave some voices that are good, but that could still be cut down some—without any music behind them.

Mark down the locations as you go along, and when you get to the end of your show, you'll have a list of places where you can make easy edits. This way you can wait till the end of the show is laid in and still go back and tighten things up, and end up with exactly the length of the show that you need.

The third option, and the best, is to mix on a multi-track digital audio workstation. Working in this environment provides extraordinary flexibility. Sections of the program can be added or deleted, and the rest of the show rippled up or down to accommodate the changes. Back-timing is simple, and adjusting the relationship of two elements is as simple as dragging one past the other.

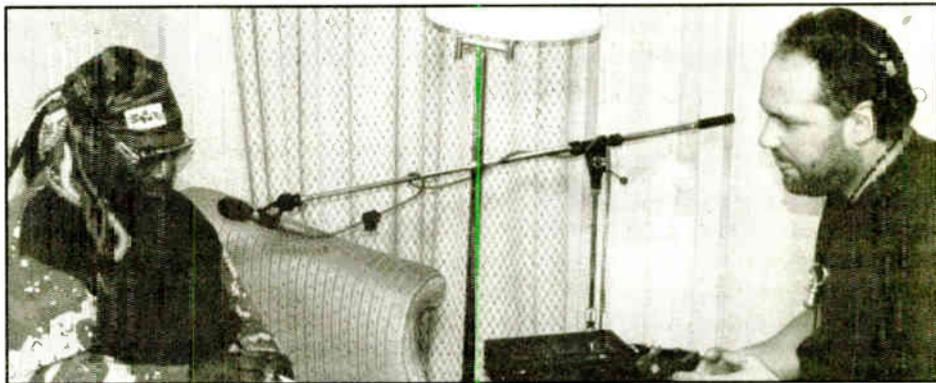
Multitrack DAWs

The past year has seen the introduction of a number of true multitrack DAWs. For the first time, these machines are full-featured, reliable and reasonably affordable. It is my opinion that we are watching a revolution in the audio industry that will have at least as much impact as the introduction of multitrack machines. At

the moment, they already present an extraordinary advance in audio technology and ways in which we can work with recorded sound.

Over the next few years these machines will become even more flexible, more nimble, capable of a great variety of tasks, and even more affordable.

The most exciting thing about these systems is that they extend the creative possibilities of any project. You are no longer required to work in a linear fashion. More options for each idea you have can be explored in a short amount of time. Fade ups, cross-fades, backtiming, continued on page 25 ▶



A recent interview with funk legend George Clinton (L), will become part of a documentary mix.

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Our mixers have also covered hundreds of thousands of miles with acts like Peter Gabriel, Madonna, Whitney Houston, Paula Abdul, Bruce Springsteen, Reba McEntyre, Alabama and Michael Jackson². Compared to the relative security of a station production room, a six-month world tour is about the most brutal test that any electronic component can go through. Our mixers have a reputation for being bullet-proof on the road — even when loading dock mishaps and power surges have taken out everything else in the same rack.

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

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

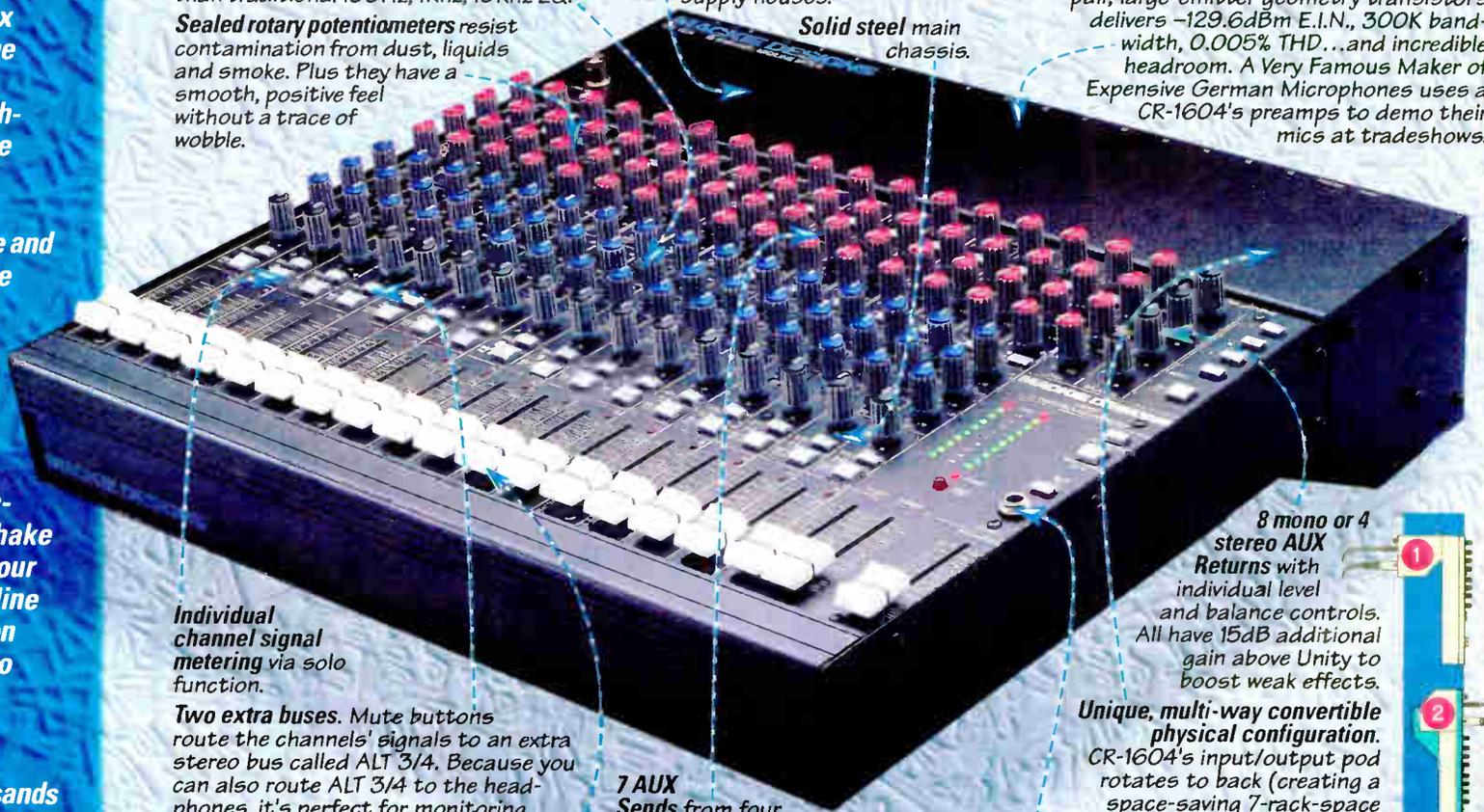
If you are conservative, keep an eye on us, anyway. We want your business even if we have to wait five years.

3-band equalization done right: $\pm 15\text{dB}$ at 80Hz, $\pm 12\text{dB}$ at 2.5kHz (perfect for voices), $\pm 15\text{dB}$ at 12kHz. Far more useful than traditional 100Hz, 1kHz, 10kHz EQ.

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

The Mackie Designs 16x2 CR-1604 Mic/Line Mixer. Suggested retail price, \$1095¹. Available at America's top broadcast supply houses.

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



Solid steel main chassis.

Individual channel signal metering via solo function.

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

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

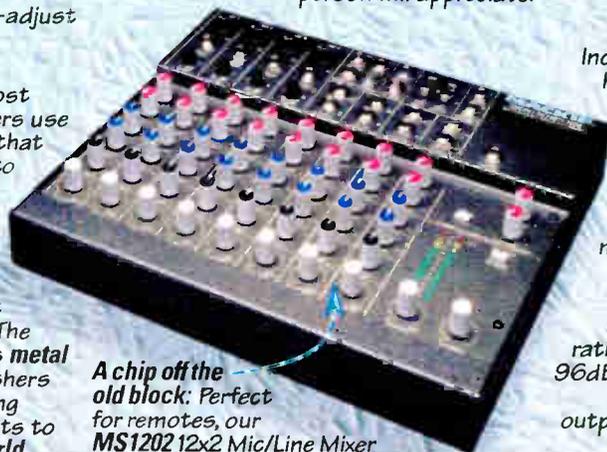


Maximum RF protection. Most compact mixers use plastic jacks that transmit RF to the main circuit board where it's re-radiated and picked up by anything that rectifies (A). The CR-1604 uses metal jacks and washers plus a shunting capacitor to de-rail RF before it gets to any circuit traces (B). A Radio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

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

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

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



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

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

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

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

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

¹ Mention in this ad denotes documented usage only. Mention is not intended to infer endorsement by any of the television shows listed.
² Price is slightly higher in Canada.

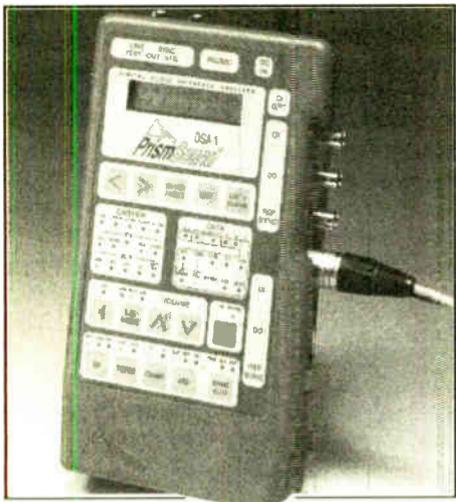
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World Radio History

PRODUCT GUIDE

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



PrismSound Hand-Held Analyzer

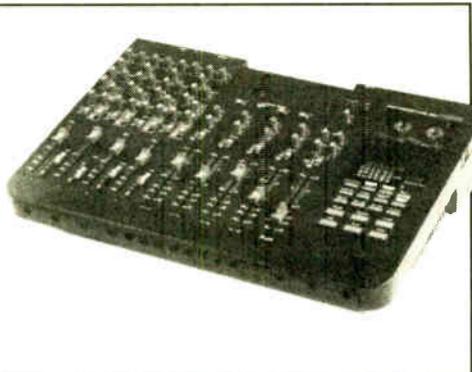
The PrismSound AES-EBU analyzer enables trouble shooting in the digital chain, including channel status, data and sample jitter, cable related high frequency loss and carrier amplitude diagnosis. The portable package features battery and external DC operation.

For more information, contact Sprocket Digital at 818-566-7700; or circle Reader Service 35.

Fostex 380S Multitracker

The Fostex 380S Multitracker is a high performance Dolby S analog cassette recorder with four-track capability. The unit features sweepable midrange EQ, integrated mixer, and XLR mic inputs.

For more information, contact Fostex at 310-921-1112; or circle Reader Service 81.



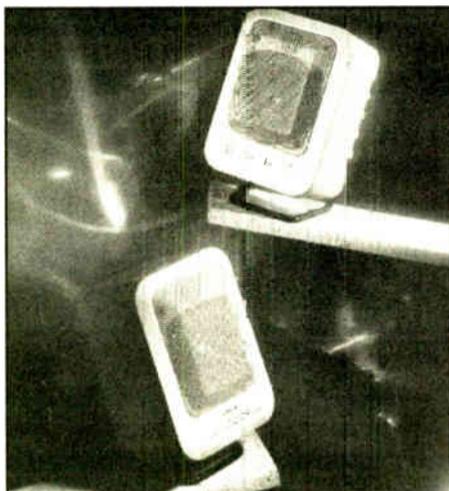
Audio Technica Multimedia Loudspeakers

Audio Technica has introduced two models of multimedia speakers, the MMS557 and MMS337, that are said to be well suited for computer audio editing when the user has limited space for larger nearfield monitors.

The MMS557 is a magnetically shielded speaker with built-in 10 watt per speaker amplifier. The bass reflex enclosure features a four-inch woofer, a soft dome tweeter, and tone controls. Frequency response is listed at 80 hz to 20 kHz. The MMS337 is similar, but with only a three-inch full range driver

and 18 kHz treble response. Both models have internal AC power supplies instead of the usual "wall warts," and come with cables and desk stands.

For more information, contact Peter Sabin at Audio Technica, 216-686-2600.

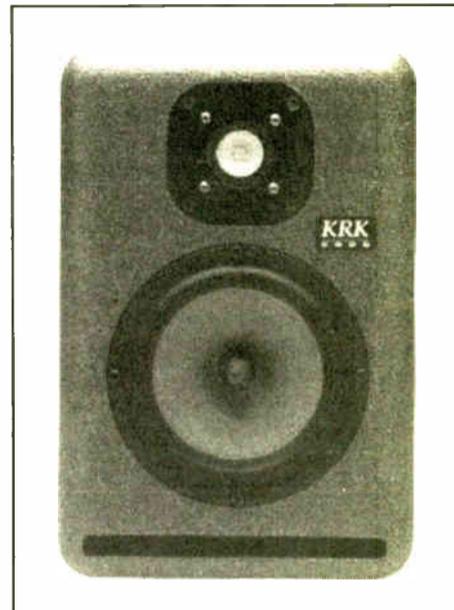


KRK Model 6000 Close-Field Monitors

The KRK Model 6000 is the smallest in the company's "close-field" (near field) monitor line.

The 13-inch by 9-inch by 10-inch speaker has a six-inch polyglass woofer, and one-inch kevlar tweeter. Frequency response is rated 62 hz to 15 khz within 3 dB.

For more information, contact KRK Monitoring Systems at 714-841-1600; or circle Reader Service 92.



continued on page 23 ▶



Eventide H3500-B Ultra Harmonizer

The H3500-B features all the control and effects of the H3500, plus tools designed for broadcasters, according to the company.

Features include up to 95 seconds of sampling, and a Mod Factory algorithm that adds dynamics, gating, ducking and compression. Special broadcast features include TimeSqueeze, Stutter and Patch Factory, which are said to be ideal for on-air radio use.

For more information, contact Eventide at 201-641-1200; or circle Reader Service 163.

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READER SERVICE 60

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PRODUCT EVALUATION

Giving Your Carts the Dolby S Edge

by Ed Bukont

GREENBELT, Md. As source material has improved through the use of digital technology, the product available for radio airplay has generally become of better quality, of a consistent sound and causes less listener fatigue. That is, until you play the next commercial which you have produced in-house on

grasp.

A system that reduces the noise and correct reproducer phasing without coloring the source or otherwise imparting new noises and distortion can extend the usability of cart machines. Such a system must be reasonably priced and user-friendly to be acceptable to the broadcasters.

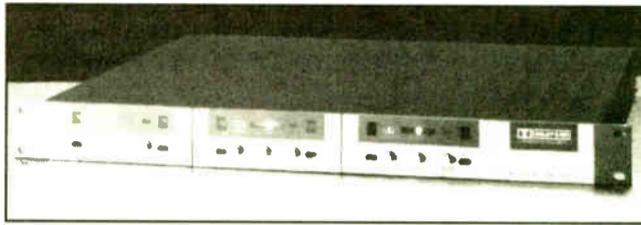
Dolby S technology

Dolby Labs and Radio Systems have married the technology of Dolby's Spectral Response (SR) and the needs of cartridge noise reduction into the Radio Systems RS² "Dolby S-type" noise reduction system. This product, has come along at the right time; I have seen few stations abandoning carts after installing digital gear. The use of noise reduction and proper maintenance may keep your sound competitive and protect your equipment investment during the next five to 10 years before carts go the way of the eight-track tape.

Radio Systems said that a complete production room RS² unit with a main module, encode and decode cards should cost about \$1,200. A complete playback system for a typical station's three cart machine playback setup would consist of the main module and three-decode cards—about \$1,600. The Radio Systems RS² Dolby S unit

that I tested also incorporated a phase correction circuitry option.

(Besides cart machine improvement, Radio Systems Sales Manager Garrett Conover said the company has sold numerous units to stations that want to improve the performance of discrete STLs and RPU's.)



Radio Systems' RS²

In conventional noise reduction, the signal is treated with a fixed amount of processing controlled by preset parameters. Such processing is constant, without regard for program content and may be restricted to only certain portions of the signal which limits the effectiveness of the processing. Conventional noise reduction usually requires proper decoding on playback to render a listenable signal.

Full spectrum

The S system, now employed in consumer cassette decks, treats the entire

signal as five bands of audio and tailors the companding of each band—depending upon the audio information presented in the encode phase. As such, Dolby SR monitors the entire spectrum, not just pre-determined center frequencies and fixed bandwidths as in other systems, including earlier Dolby products.

In the S-box, the operating parameters have been modified from the full SR products to reflect the performance limitations of cart machines. While SR uses 10 bands of audio processing to achieve a maximum improvement of 36 dB in signal-noise ratio, the S process achieves only 24 dB of improvement which is sufficient for broadcast use. But Radio Systems has taken a further step. The encoded audio is monitored on playback for evidence of reproducer azimuth error that causes phase problems.

Electronic delay is used to shift one channel as required to return it to a properly phased signal before decoding. Because the phase circuitry operates on the difference in reproducer performance, the RS² can correct for error in reproducing a mono source which has been recorded on both channels of a stereo machine.

Other noise reduction systems often have been too complex, too expensive or required constant alignment and special test apparatus, thus making such

continued on page 26 ▶

Product Capsule: **Radio Systems RS²**

 Thumbs Up	 Thumbs Down
<ul style="list-style-type: none"> ✓ reduced noise, improved sound ✓ lessens cart obsolescence ✓ moderate cost 	<ul style="list-style-type: none"> ✓ manual not always clear

For more information, circle **Reader Service 168**; or call Radio Systems at 609-467-8000

an analog cart machine.

Although it can do the job in the production studio, the decades-old analog cart machine technology lacks the clarity of today's digital production equipment. When using analog carts, the background noise and phase anomalies inherent in this system seem to jump out at you when changing between digital and analog sources. While you may be aware of the latest digital cartridge replacement systems, such an option may not be within your budgetary

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EQ Magazine, October 1993



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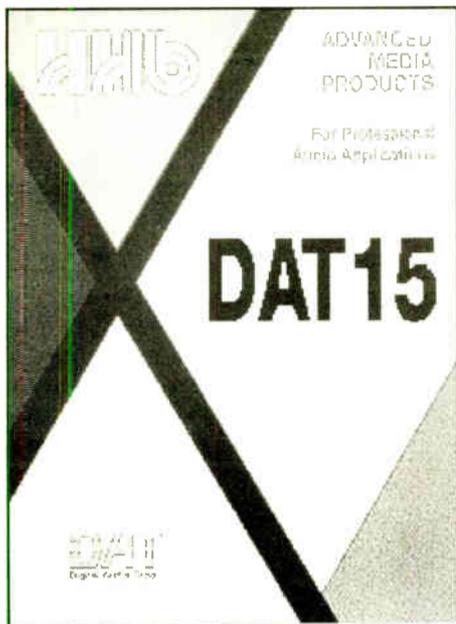
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**50
DIGITAL
STEREO
TRACKS
UNDER
\$4,000!**

PRODUCT GUIDE

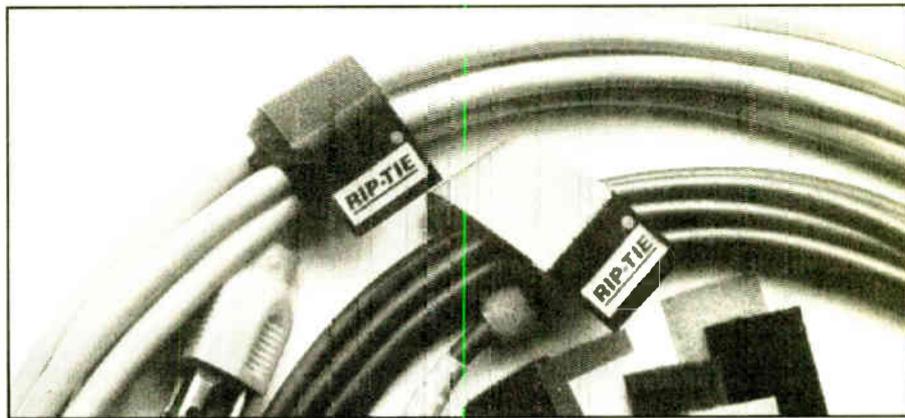
Companies with new product announcements for Studio Sessions Product Guide should send them to Radio World, c/o Studio Sessions Editor, 5827 Columbia Pike, Suite 310, Falls Church, Va. 22041



Rip-Tie Velcro Wraps

Cable organization can be much tidier using Rip-Tie velcro wraps. The reusable (up to 10,000 closures) wraps come in an assortment of sizes and colors. The product can also be customized with your company name.

For more information, contact Michael Paul Fennell at 415-543-0170; or circle Reader Service 152.



HHB Professional DAT

HHB has developed a professional line of DAT tapes, ranging in time from 15 minutes to 122 minutes.

The tapes feature Ultrafine metal particle formulation, anti-corrosion treatment for improved archiving capability, increased binding strength, anti-static lid and heat-resistant shell.

For more information, contact Fraser Jones at Independent Audio 207-773-2424; or circle Reader Service 50.



Valley Audio Model 730 DYNAMAP

The Model 730 DYNAMAP offers not only stereo compression, keybale expansion, gating, and limiting, but also the DYNAMAP feature—which is a multiple threshold, multiple segment ratio digital dynamics processor.

The Model 730 can support all digital and or analog inputs and outputs at any level or protocol. It will even mix analog and digital inputs together, and feed both analog and digital outputs simultaneously.

For more information, contact Mike Joseph at Valley Audio, 800-800-4345; or circle Reader Service 192.

PR&E ADX Workstations

Pacific Recorders and Engineering now has two models of the ADX workstations, the ADX Basic and the ADX Workstation.

The Basic is a streamlined version of the Workstation oriented to small market stations and budget-minded users. The system includes a Macintosh Quadra 610, 16-inch monitor, keyboard, mouse and eight channel processing unit. The unit features a 1.2 GB hard drive and similar control panel software as the ADX Workstation.

The ADX Workstation is a more sophisticated, hard disk-based system designed specifically for the demands of radio production. It includes Macintosh Quadra 650, 16-inch monitor, 2.4 GB hard drive good for six hours of eight-track audio. Both the Basic and the Workstation are compatible with the ADX Mixstation, an automated eight track mixdown module.

For more information, contact PR&E at 619-438-3911; or circle Reader Service 203.



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Are you thinking about replacing your old cart machines with 'Digital Carts' such as floppies, flopticals, Bernoullis, or Optical?? Well, think about it a little more! Add up the list price for a digital cartridge recorder, just a single player, AND the floppy disks—and you will find that you could have bought a Digilink workstation for \$7,995 that gave you 'Live' -AND- 'Automation' capabilities!!!

A Digilink workstation stores audio on an internal hard disk and comes out of the box with a capacity of 547 one minute, stereo carts for only \$7,995. Even better, the Digilink hard disk has an average 15 year life. Imagine how many floppies you will break, wear out, lose, and replace over 15 years. That doesn't count all of the floppy disk mechanisms that will jam, break, and simply fail...

Consoles
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Digilink
Modulink

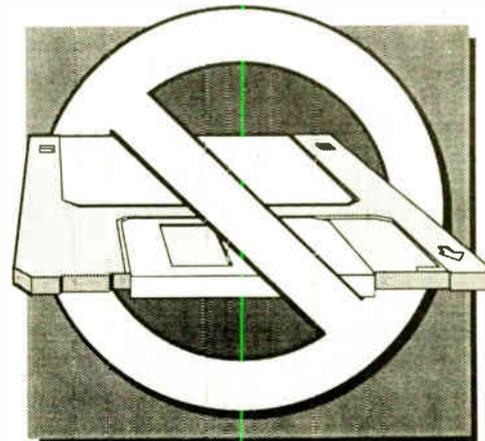
Also with a Digilink, you get much more! You can stack up hundreds of 'carts' in the play list and just walk away. You get satellite automation in the Digilink workstation and can optionally add CD players. A digital audio cut and splice editor even comes standard with Digilink. Because Digilink will play and record at the same time, you can play a spot to air while it starts a scheduled network autorecord. You can even network delay with Digilink.

With all of these features, it is easy to see why there are more than 500 Digilink workstations around the world from Paris to Moscow to Taiwan to Jamaica and in your own backyard. Don't suddenly come to the realization that you could have bought a Digilink!

Call Arrakis now...

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ARRAKIS



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Products & Services Showcase

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

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The TeleRadio features include:

Ten random memory presets

Remote scanning, tuning, band change & memory set.

Remote controlled external audio jack lets TeleRadio double as a standard coupler for IFB, etc.

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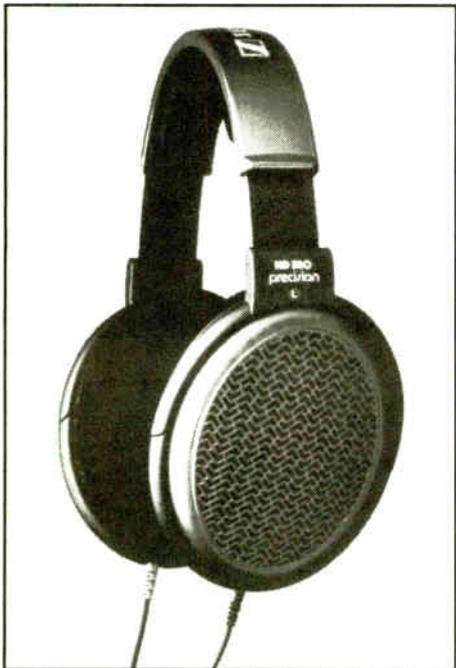
by Frank Beacham

NEW YORK When a truly breakthrough product hits the audio market, the "buzz" usually starts right away. Such is the case with Sennheiser's new HD 580 dynamic open-air headphones, introduced in January and already on the way to becoming an audio classic.

User word-of-mouth has it that these "cans" are the new king of the hill. Better yet, they are affordable (\$349 list) with a street price of under \$300. After spending a week glued to a pair of 580s, I now understand what all the excitement is about.

My "tests" were all subjective. Just casual listening to a range of CDs and the digital audio tracks of some laser video discs of movies. In all cases, I auditioned the phones with a Headroom Supreme headphone amplifier connected directly to output of the CD or laser disc player.

The 580s surpassed all expectations. They are very natural and open with crisp, clean highs and deep, tight bass. I found myself listening for hours without a trace of fatigue. With their black velvet-covered



Sennheiser HD 580

ear cushions, padded headband and precise adjustability, these headphones are so comfortable that one night I fell asleep while listening and woke up three hours later not even realizing I was wearing them.

Headphone amp essential

One caveat. The 580s (300 ohms, 97 dB efficiency) demand a good headphone amplifier for suitable performance. Don't even think of plugging them into the headphone output of a CD player or Walkman. If you do, they will simply sound awful. The Headroom amp is highly recommend and a model especially optimized for the 580 headphones is available for \$399.

Sennheiser's John Bevier said the 580 design breakthrough is the result of lessons his company learned during a four-year project to design and build the limited-production \$13,000 Orpheus headphone system.

"We learned that polycarbonate diaphragm materials (used in most headphones) have melting points," Bevier said. "As the diaphragm oscillates at higher and higher frequencies, it starts to liquefy,

causing a loss of the linear motion of the diaphragm pistoning back and forth. So you would tend to get high frequency colorations that would mask even lower fundamentals down into the mid range."

The 580s, on the other hand, use a new "duofol" diaphragm that combines polycarbonate and polyurethane materials to create a composite structure impervious to heat. According to the

company, the resulting reduction in unwanted vibration enables more accurate frequency response to be achieved.

Mated with the new diaphragm is a computer-optimized Neodymium-ferrous magnet assembly capable of reproducing much deeper bass frequencies than in previous designs.

How big a leap are the 580s? "Our studies found that in the higher frequency

range we have a full logarithmic power less distortion in the 580 Duofol diaphragm than even in our best dynamic, the 560, from 10 months ago," Bevier said.

"Suitcase" audio

Looking for a high quality sound playback system that's so portable it can travel with you anywhere? Check out the Model 11-A "suitcase" system from Cambridge Soundworks. Another invention of audio design legend Henry Kloss (of KLH, continued on page 28 ▶

The headphones surpassed all audio quality expectations.

ALL DAT TAPES ARE NOT THE SAME BUT DON'T TAKE OUR WORD FOR IT

Ask Studio Sound, one of the world's most highly respected professional audio publications.

They recently subjected eight leading DAT tape brands to an exhaustive series of tests and the results should be of interest to everyone serious about audio.

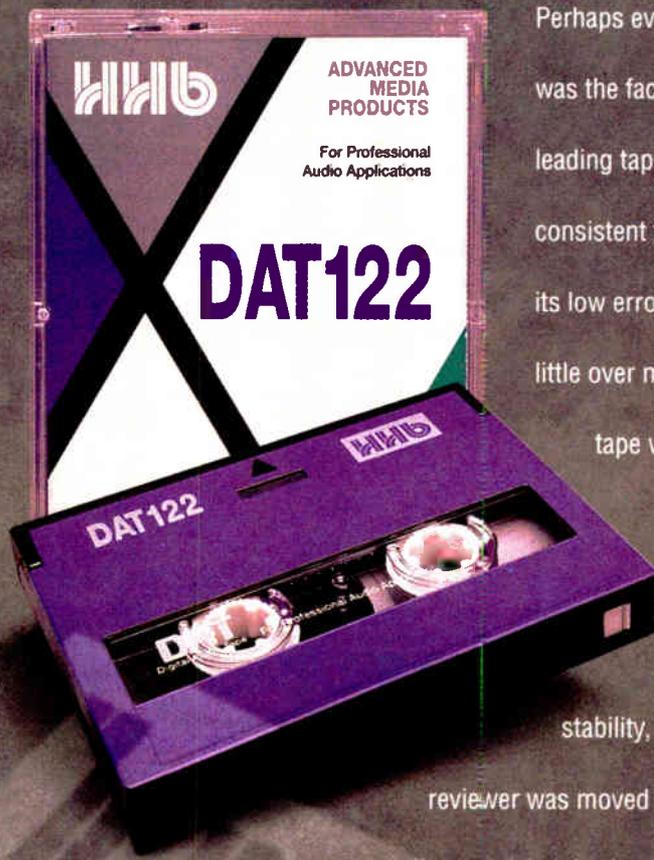
In the critical area of block errors, the tapes fell into two distinct categories of performance.

Three exhibited similarly low error rates with the others presenting error levels considerably higher. HHB DAT Tape was one of the leading three.

Perhaps even more significant was the fact that one of these leading tapes was clearly more consistent than the others, with its low error rates changing very little over multiple passes. That tape was HHB.

And when it came to archiving stability, Studio Sound's

reviewer was moved to write: "If it were my recordings at risk, it is clear which choice I would make". His choice? You guessed it - HHB. HHB DAT Tape. Would you trust your recordings to anything less?



Call Independent Audio today for your free copy of Studio Sound's "DAT On Trial".



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Okay, say you meet the right girl, take her home to meet your family, get down on your knee in front of everyone and plead with her to elope and spend an eternity together fraught with romance, passion, and lifelong commitment, and suddenly she says:

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Circle (111) On Reader Service Card

World Radio History

NASA Prescribes Telos Hybrids to Ensure Health of Telemedicine Spacebridge

Space medicine – the latest frontier of U.S.-Russian cooperation. Nearly 40 years after Sputnik launched the Cold War space race, these former rivals are using satellites and terrestrial telephone links to connect Moscow, Russia with several U.S. medical centers in an experiment aimed at improving patient care on earth and ultimately in space. And because lives are literally on the line, NASA prescribed Telos hybrids to guarantee high-quality, full-duplex communication that is reliable and economical.

NASA's Lewis Research Center acts as the gateway or "hub" of the telemedicine spacebridge system. Applications Technology Satellite Project Manager Michael Cauley notes that all audio and video signals are routed through the Cleveland facility. A double hop on two satellites takes care of the space segment. Back on earth, NASA relies on Telos digital hybrid technology to assure continuous communication over ordinary phone lines.



During each session, one U.S. medical center serves as the primary site, actively uplinking video and audio. Primary site audio is transmitted via satellite to take advantage of the high fidelity needed to monitor heartbeats and other vital signs. The physicians at this site and their counterparts in Moscow conduct grand rounds, where they present their respective patients to colleagues at four additional participating institutions in the U.S. These medical centers simultaneously receive video and audio via satellite from both Moscow and the primary US site.

At the four secondary sites, medical personnel inject their comments into the session via dial-up phone lines routed through the Cleveland hub. While the doctors observe, discuss, and interpret patient signs and symptoms, the engineers maintain a parallel communication link to handle any technical glitches that may arise. A combination of Telos ONE hybrids and Telos Link interfaces at each remote U.S. site plus five Telos 100 Deltas at the NASA gateway assure that neither physicians nor engineers miss a single syllable.

Remote site engineers are outfitted with a Telos Link (which provides the necessary gain in the intercom-to-telco path), an RTS belt-pack, and a Beyer headset. Cauley says that one of the reasons NASA chose the Link is its ability to provide power to the belt packs and function as a stand-alone intercom system. This "wet" mode, intended for field use, is one of the Link's signature features.

continued on back page Direct Connection

Turn The Page...

- **No one offers more choices for call-in and talk-show systems than Telos. We present four of our most popular configurations.**
- **Zephyr will put you on the Information Superhighway with 15kHz stereo on a single dial-up ISDN line. Learn how one network has already put Zephyr to work.**

Direct Connection is provided by Telos Systems to keep our customers up-to-date on using the dial-up telephone network in broadcast and recording applications.
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The most natural-sounding, two-way talk...

All over the world, radio stations are programming more talk shows and call-in segments. And those who are most serious about the sound of their stations and their ratings are installing Telos.

Telos digital hybrid telephone interfaces have earned their reputation for exceptional performance. In addition to superior trans-hybrid loss for full-duplex audio, they achieve consistent output level and the ability to monitor callers through open speakers without feedback.

All Telos models share these unique features:

- True digital, with all processing performed in the digital domain, including hybrid functions, gain control, and filtering.
- Advanced digital auto-nulling hybrid, with excellent send audio rejection, that automatically adapts to each new call. Very pure caller audio appears at the output.
- Sophisticated output gain processor which provides level control and smart, fast downward expansion. This section is cross-coupled to the input section so that telephone line noise and residual hybrid leakage are carefully and cleanly attenuated without low level callers being gated off.
- A selectable override function to reduce the caller level. This allows the talent's voice to have more presence when speaking at the same time as the caller.
- Digital Echo Elimination™ to allow significant gain-before-feedback when used with open monitor speakers.
- Switchable mic/line input.
- Second output with either caller output or a mix of caller and input signals. Dual outputs assist in creating multiple mix-minuses in multi-hybrid installations.
- Metering of input and output levels and gain reduction.
- Auto-answer accessories available for installation flexibility.

The Telos ONE hybrid, our most popular, comes in three versions:

A single hybrid, in a standard rack mounting chassis.



A single hybrid in a compact modem case with optional single and dual rack mount kits.



The ONE plus ONE with two hybrids and a built-in mix minus matrix is a single rack enclosure. The matrix cross couples the outputs of the two hybrids so that you need to send the ONE plus ONE only one mix-minus to feed both hybrid. For only a few dollars more than analog, you can experience great phones with the Telos ONE. The modem case version has a suggested list price of \$890, the rack mount version lists for \$1050, and the ONE plus ONE lists for \$2180.



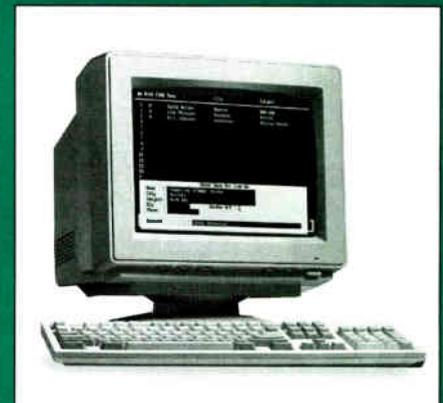
Our top of the line Telos 100 Delta has our exclusive digital dynamic equalizer to improve the quality of caller voices in a way never before possible. The equalizer is so advanced, you won't find it in any other broadcast audio product. 100 Delta also boasts two, mixable inputs; logarithmic (dB linear) automatic gain control; fully adjustable dynamics processing; and two, fully adjustable caller override controls. The Telos 100 Delta has a suggested list price of \$2180.

ONE-x-Six Talk Show System

Just add talent! The ONE-x-Six has a Telos ONE digital hybrid and six line broadcast phone system in a single unit. And it comes complete with a Switch Console for line selection and screening. The ONE-x-Six offers caller conferencing, program-on-hold, and features that allow automatic selection of the next caller, control of external audio recorders, and more. The total system is only \$2180. Expand the system with an additional Switch Console, for a second control point, for only \$650 more.



Call Screen Mana



...and the widest range of complete talk show systems.

Single Hybrid, Ten Phone Line System

The Direct Interface Module allows connection of up to ten phone lines and two hybrids. It's a complete phone system for broadcast that includes program-on-hold and caller conferencing. Features accessible through the Switch Console include tone/pulse dialing, automatic next-caller indication, external page, and control of external devices, such as audio recorders. In this system, we include a top of the line Telos 100 Delta hybrid, Mitel Screener Phone (not pictured) and Switch Console. The complete package is \$5020. Configurations with the Telos ONE hybrid start at just \$ 3630.



Dual Hybrid, Ten Phone Line System

The ONE plus ONE has two Telos digital hybrids and a built-in mix-minus matrix. When paired with the Direct Interface Module, Mitel Screener Phone (not pictured) and Switch Console, you have a system that is ideal for conferencing and is easy to install and use. The complete package is only \$5020.



Systems Using 1A2 Key Telephone Systems

Key systems remain popular because of their high reliability, zero noise and distortion, and moderate price. If you have a key system or want to use one as the "back-end" of your talk show system, Telos' 1A2 Interface Module is for you. Full-featured systems can be configured to handle 10, 20, or 30 phone lines. The basic ten-line, single hybrid system pictured has a list price of \$2750 plus the cost of the key system.



These are just a few of the possibilities. Call us, fax us, or see us at the NAB for details on a systems that meets your requirements and budget.

nger™ Talk Show Software

Call Screen Manager is a highly recommended accessory for serious talk show programming. Using economical IBM-compatible PCs and peripherals, it complements your Telos hardware by allowing the screener/director to provide the talent with information on each caller, and additional messages to the talent, and control the status of telephone lines. Telephone line and caller status are updated in real time to indicate callers who are ON-AIR, part of a conference, and on HOLD. Each line has a call timer and programmable duration alarm. Call Screen Manager includes a caller information database module, Database Tools, to store and manipulate caller data. Built-in and custom reports can be used to analyze your caller information. Optional Remote Software allows two-way communications between your studio and talent located at a remote site via modem, enabling your talent to conduct his/her program from virtually anywhere.

- Caller data and messages entered by the screener are clearly viewed on the talent's display.
- Flash Messages and a Full Page Message may be sent from the screener to the talent with a single keystroke.
- Caller information database stores data entered by the screener, along with date and time of call, hold duration, and call duration.
- The Database Tools module allows modification of data fields and includes report and export features.
- Multiple language support for worldwide use.
- Call Screen Manager provides computer keyboard control of selected Telos Hardware functions. This allows most critical screener functions to be accomplished from the keyboard.
- Telos desktop Switch Console can control selected Call Screen Manager functions.
- When using Remote Software, a Switch Console may be used at the remote PC for control of studio equipment.
- Host Software module has a list price of \$349. The Host and Remote modules together list for \$449.

I DB Communications Taps Telos Zephyr™ for Digital Sports Network

The ability of the IDB Communication's Group to provide quick response and customized end-to-end solutions to broadcasters' specialized needs just got a high-tech boost thanks to Telos Zephyr, the centerpiece of IDB's new digital audio network.

Initial acquisition of 120 Telos Zephyr digital audio network transceivers will enable IDB to carry sports transmissions for radio rights holders of the National Hockey League (NHL) as well as Major League Baseball (MLB), all via switched-digital telephony.



"After spending two years working with numerous vendors, IDB determined that only Telos could meet our stringent requirements for this service application, calling for enhanced frequency response using only 56 kilobits," says Dave Anderson, Vice President, Operations and Engineering for IDB. "Additionally, the Telos Zephyr is unique in its ability to operate either in a discrete stereo mode or in a dual-mono mode, using only two switched-56 or one basic-rate ISDN line."

The state-of-the-art Telos Zephyr will provide 15kHz backhaul and 15kHz return/cue audio channels and will be placed at each of the NHL and MLB venues, with companion equipment located at subscribing radio rights holder's locations. This network, when completed, will serve popular venues nationwide, and will replace IDB's original analog satellite network for audio backhaul applications.



IDB Communications Group, Inc. is a global telecommunications company that operates a domestic and international communications network. Since its founding in 1983, IDB has built a reputation for supplying high-quality audio signals from remote locations using its satellite and fiber optic network. With Zephyr, the dial-up telephone network is now a viable pathway for the discriminating client. The capabilities of the cost-effective, public switched-digital network can now benefit IDB's customers with dial-up convenience. "Performance of the Telos Zephyr at low bit rates is outstanding," says Anderson, noting the superior audio quality of the Zephyr's ISO/MPEG Layer III coding technology.

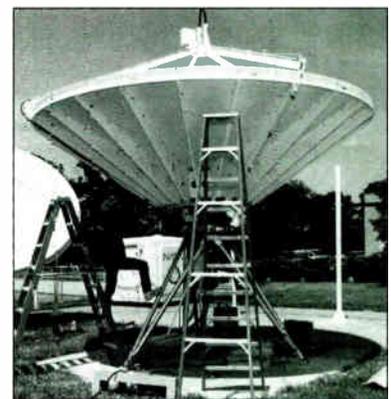
"Telemedicine Spacebridge" continued from front page

The medical experts participate in the consultation simply by talking into a microphone which goes into a mixer feeding a Telos ONE. At the other end, the doctors' comments are picked up by a 100 Delta. Using a custom Telos mix-minus matrix, the telco audio returned to each secondary site consists of only the audio of the other secondary sites. In addition, these "second opinions" are included in the audio mix uplinked to the primary sites.

Cauley praised the 100 Delta's logarithmic automatic gain control, digital dynamic equalization, and front panel LED metering which functions as a status indicator. During the spacebridge, "our attention is primarily focused on video and wave-form monitors," he says. "But if we hear a crackle we can just glance at our rack of five 100 Deltas and instantly know

which line has developed a problem." NASA's 100 Deltas have Telos Basic Auto-Answer cards installed, so "When a participant hangs up, the Delta drops it automatically so we can go about our business."

NASA expects these experiments will influence telemedicine's applications to delivering medical care in space, especially with the advent of such joint missions as construction of an international space station. On Planet Earth, the results of these pioneering efforts could revolutionize the way medical services are delivered around the world, making cosmic house calls a real possibility.



Satellite antenna at NASA's Lewis Research Center, Cleveland, Ohio

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PRODUCT EVALUATION

Big Sound from ATUS Mini-Speakers

by Bruce Bartlett
with Jenny Bartlett

ELKHART, Ind. The A.T.U.S. MMS557 (by Audio Technica U.S.) is a well-designed, convenient multimedia speaker system that makes monitoring quick and easy with little expense.

Set these little guys next to your computer screen, and you've got some good-sounding, powered mini-monitors for digital editing. You also could take them on the road for monitoring at remotes, or play a DAT recording of a spot to a client.

They also work great with multimedia, CD-ROM, and portable CD, MD, or DCC players. The system includes an honest 10 watts per channel stereo amplifier built into each speaker. The drivers are a ported, four inch woofer and a 3/4-inch tweeter, which sound better than the usual single-driver system.

Hookup is intuitive. Just plug in the AC power cord, connect one speaker to the other, and connect the line-level audio signal you want to monitor. Audio Technica supplies everything you need, including a stereo RCA patch cord and desk stands.

There are no batteries or wall transformers ("warts") to bother with. The setup is easy, so you may not need the user's manual, but it's clearly written and helpful. Price is only \$149.95 a pair with a year limited warranty

Construction and specs

The attractive speaker cabinet is made of sculpted, ribbed plastic and a perforated metal grille. When you knock on the cabinet walls, they ring a little because they are underdamped. A metal desk stand can be pressed into each speaker to tilt it up at you.

a floppy disk on the speaker without losing data.

I like the bass and treble controls; they let you tailor the sound to your taste. In my tests, I preferred a setting of -2 in the treble and +2.5 in the bass. Those are the settings I used when measuring the frequency response. Audio Technica rates the response as 80 Hz to 20 kHz (no tolerance). A signal of 400 mV drives the



Multimedia speakers from Audio Technica

power amp to full output. Sensitivity is listed at 89 dB/W/m, which is high for such a small speaker.

Measurements and sound

I measured the anechoic frequency response of the MMS557 with the treble set to -2 and bass set to +2.5. Neglecting a 13 dB notch at 4 kHz, the speaker

the deep bass is absent in speakers this small. When you turn up the bass tone control to hear more bass, the sound becomes puffy or bloated because the mid-bass is boosted.

The MMS557 sounds fairly smooth, not too colored, and not irritating. On classical music, it sounds pleasant. But on vocals, the MMS557 lends a slightly tubby or boxy tone quality, partly because of cabinet vibrations. Not a serious problem (again consider the price).

The MMS557s have surprising dynamic range and powerful impact with rock

music. They can play more than loud enough for editing. Their stereo imaging is very sharp.

While the MMS557s may lack the finesse and smoothness of nearfield monitors, they are definitely a cut above most other multimedia speakers I have heard. They are not meant for critical EQ or mixing decisions. But they tell you what you need to know for computer editing, and they sound good enough to live with for long editing sessions. I'd also recommend them for MIDI composing. Of course, they are superior for multimedia work as well.

□□□

For more information, contact Peter Sabin at Audio Technica 216-686-2600; or circle Reader Service 174.

Radio Documentaries Are Easier Using Digital Audio Workstations

► continued from page 17

cut and paste, looping, and hosts of DSP functions are available. Mixes can be completely automated and all data can be backed up to DAT or to optical drives.

Examples of multitrack DAW systems that I am familiar with include the Roland DM-80, Sonic Solutions, Digidesign's Pro-Tools and Studer's Dyaxis II. Each of these systems has its own strengths. There also are others out there that I have not used.

The DM-80 and Pro-Tools cost about \$10,000. The DM-80 is the only one of this group that wasn't built around a MAC interface. The advantage there is that it is a self contained unit, which offers a lot of features for the money and it sounds great.

The downside is that the interface is an extension of Roland's keyboard samplers. Roland has recently released Mac software to control the DM-80.

What's out there

Pro-Tools is the one of the most popular systems—it is mainly intended for music editing, and has lots of features for home recording. The Sonic Solutions and the Dyaxis II are more expensive, at about \$30,000. They each offer greater depth than the DM-80, or the Pro-Tools, but the advantages may be things you don't need. Each of these systems was designed primarily for doing video and film audio post.

Sonic Solutions is a good system. It is very capable and has many fans. Its language is a bit arcane, and I think it is a little too hard to learn. To me, it doesn't make the best use of the MAC interface. You have a choice of software packages (which can be pricey) for particular jobs—one is designed for video post, one for music editing, one for noise reduction (NoNoise).

I use the Dyaxis II. It uses a very intuitive interface. Everything happens in one application, it sounds great, and works for many projects. Although initially targeted at the film and video post market, features needed for music production are being added. But it also works well as a

radio production tool.

The Dyaxis II has some drawbacks, mainly that the software is evolving a bit slowly, and some important features are yet to be implemented. But some of the software already has been updated.

Mixing Tips

Regardless of the system you are using or the personal style you adopt, there are just a few basic things that should remain consistent in your mix.

You should have every audio element available that you might need. They should be labeled, timed and edited before you begin to mix.

You should add up the time of each element and have a pretty good idea of what your total program time is going to be. On one hand, it is a lot easier to cut things out ahead of time. On the other hand, if you are a glutton for work and you want to hear how everything sounds, you can cut things out once you are in the middle of the mix—it just takes longer to make all of the changes.

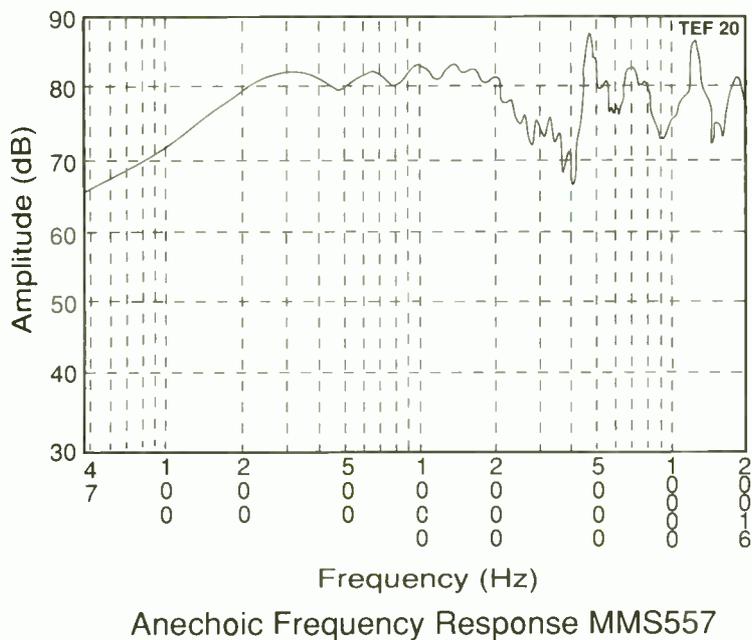
(Of course, making changes in a workstation environment by sliding elements past one another is one of the real beauties of that medium and why I recommend it so highly.)

You should keep everything that is cut cleanly and go for the clearest, most "intelligible" audio you can. Try to stay away from things that only you can make out. Pay keen attention to the rhythms that your program creates. Go over the timing of each element in relationship to the one before and after.

The transitions should be clean. If not, use ambience beds and run very quick fade-ins and fade-outs on the elements so new sounds don't come in too abruptly. Go for the content—let the audio breathe emotion and passion into your program. You have been working on this project a long time, and you have something important to share with others.

□□□

Steve Rowland is a partner in the production company, The Music Makers, located in Philadelphia. He can be reached at 215-843-4388.



When the speakers are placed next to a computer, their beige finish looks good, but a black finish might be preferable for pros. The MMS557s fit easily in a crowded computer setup, because they measure only 9-inches (height) x 5 1/2-inches (width) x 6-inches (depth).

Magnetic shielding is essential for any computer work, and the shielding in this product really works. I touched the speaker to my monitor screen and saw no distortion of the image. I even placed

measures 100 Hz to 20 kHz +/- 7 dB. The overall response trend is uniform across the audio band, but there are sharp peaks and dips above 2 kHz. The Energy Time Curve is only fair, showing delayed signal spikes at 6, 9, and 14 dB below the direct-sound level.

While the specs are not audiophile quality, the MMS557 sounds good for its price. The treble is clear and extended, and there's enough bass to keep the speakers from sounding thin. Of course,

Upgrading Your Analog Using Dolby S

► continued from page 20

systems impractical for radio. The RS² appears to not have these problems. However, any system, including the RS², will require some basic alignment and assumes that other parts of the chain are also properly aligned.

For the Radio Systems unit to work properly, your cart recorders and reproducers should be set for flat response. Overbiasing, a common practice in radio, will cause poor RS² performance. I tested the unit

using the following setup: ITC Cart IIs were recorded on a refurbished ITC 99B recorder which was aligned to ITC specifications using an appropriate Standard Tape Labs reproducer alignment tape. Incidentally, when aligning any type of record/playback device, it is usually best to align the playback system first, using a known standard, and to then align the record section.

On the bench

Audio sources included a

Potomac Instruments AG-51 audio generator, a QEI modulation monitor, and a Denon 951FA CD player. Audio measurements were made on a Potomac Instruments AA-51 Audio Analyzer with input transformers. All equipment was interconnected using shielded, balanced lines and alignment per manufacturer directions. Use of the QEI was to provide a highly processed audio source to see how the S-box responded to such demanding material. CD selections

included tones and music from Denon and NAB test CDs. The results, both as heard and as measured, showed a repeatable improvement in signal-to-noise ratio of 10-15 dB with a typical measurement of -65 dB. The improvement was, as expected, especially noticeable at the high end. The high end is a bit cleaner with more faithful reproduction of the source.

But the biggest improvement will be found in the extended wear life of carts which will continue to sound good for a

longer period of time—even after they begin deteriorating. With proper alignment, no coloration of audio was noticed. As expected, if the record deck was intentionally misaligned to simulate typical wear, the audio quality suffered and was not correctable. On a poorly aligned player, some phase correction was noted, but overall audio quality still suffered.

As this system is complementary, meaning we process in record (encode) and in playback (decode), you will need to equip every machine as necessary for encode and decode. A standard unit, with two channels of record and two channels of reproduction takes up one

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World Radio History

The high end is a bit cleaner with more faithful reproduction of the source.

rack space including the internal power supply.

In addition to the usual stereo pair of audio paths between the cart machine, the RS² and the console, the unit has several useful control features. To facilitate use of the system without having to re-record an entire cart library, the S-box records a 500 Hz tone on the carts cue track to provide automatic bypass switching. This automatic switching of course requires that your cart machine provide access to the cue audio track, often found on the remote control connector. All interconnection of control, logic and tally is done through the cart machines existing remote control connector.

On the minus side, the manual does leave something to be desired, especially in describing the operation of front panels switches and related indicators. It was hard to determine if a function was engaged with the switch In or with the switch Out.

Overall, however, I am pleased with the concept, design and function of the S-box. The RS² system may prove costly for larger facilities that would need to have several of them per recording/playback device. But for small and medium stations with less resources, the Radio Systems RS² may be the answer to squeezing better audio from analog carts.

□ □ □

Ed Bukont is a contract engineer for Multiphase Consulting and a contributing writer to RW.

Products & Services Showcase

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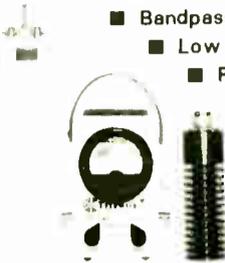
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Take the SAP (Standard Al Peterson) Examination

Dear Luci,
I spent time recently talking with guys 'n' gals I used to work with. The discussion turned to a legendary trip we all took to Noo Yawk City ages ago for the Third Class license test.

Burning in our hearts was a desire for the big trophy—the salmon-colored certificate proclaiming victory over the dreaded Element 9. We were cocky as new corporals, ready for anything the commission would throw our way.

Today's means of getting the Third ticket lacks romance. Even the actual license looks cheesy. Shouldn't there still be some sort of process where the prize is earned, not simply handed out for sending in ten Bazooka bubble gum comics?

As my contribution for the good of the industry, I propose such a process here. For beginners, as well as veterans who remember when a "test" didn't involve medical technicians with bottles, this is the new Peterson version of the Restricted

FROM THE TRENCHES

by Alan Peterson



Radiotelephone License Exam, completely updated to reflect modern technology and the attitudes of many contemporary broadcasters.

No calculators please. Work out your math on the back of the RW subscription card. Ready... begin.

ELEMENTS 1 & 2

Bells go off in the newsroom. The printer says a tornado warning has been initiated for your area. Your response:

- A) Notify the jock and fire the EBS tones.
- B) Notify the EBS tones and fire the jock.
- C) Nothing. You're in the middle of a 40 minute music sweep.
- D) Trick question...printers don't have bells anymore.

Your monitors collapse into mono. The chief engineer says the stereo pilot is gone. You should:

Technology and deregulation have made many traditional engineering jobs obsolete.

- A) Call the gas company to relight the pilot.
- B) Create pseudo-stereo by playing two copies of the same CD simultaneously.
- C) Ignore it. You're an FM stereo station and nobody can hear 19 kHz anyway.
- D) Ignore it. You're an AM stereo and the receivers aren't out there yet.

You hear indecent and/or profane language on your station. What do you do?

- A) Suspend transmission until the language has stopped.
- B) Fill out FCC Form BW-150 and place it in the public file.
- C) Hire the guy for morning drive.
- D) Call the studio live on-air and demand to know what the @#\$\$ is going on.

Very good. Let's move on to...

ELEMENT 9

Plate voltage is 1.4 kV, plate current is 0.9 A, transmitter efficiency is 51 percent. Which of the following is true?

- A) You're on the air, OK? Just fake the readings.
- B) That's a pretty crappy transmitter.
- C) Your power output is 642,600 watts.
- D) Knowing the indirect method always impresses cute college interns.

Your directional monitor indicates a 137-degree error between towers #1 and #2. You should:

- A) Shunt around the phasor and go low power through only one tower.
- B) Set the phasor on stun and arm the photon torpedoes.
- C) Fill out FCC Form BW-150 and

place it in the engineering file.

- D) Open a window—it's 137 degrees in here.

Define SWR:

A) Standish Wave Ratio, named for a famous historical figure (with wavelengths that could theoretically extend for Myles).

B) Sisters Wid Radishes, a female group that's into gardening.

C) Surf Waves Radical, an engineering term developed by a Malibu, Calif.. CE.

D) Salami with the Works on Rye, the mystery sandwich that has been in the back of the station fridge since 1979 is finally identified.

What determines a good FM tower location?

A) Declination to the horizon, proportional to the cube root of the zenith/nadir ratio.

B) Parameters as defined on FCC Form

BW-150.

C) Anyplace you can hang your HAAT.

D) The number of \$9 telephones you can screw up once it's radiating.

Bonus question: Name the fundamental waveform seen on your scope during proofs of performance conducted annually at 11:59 p.m., Dec. 31.

So how did you do? Take your overall score, multiply it by .707 to find the RMS value, square the product and write the result on line 10 of FCC Form BW-150. Fold the form five times and stuff into the fluorescent light in the newsroom to keep the ballast from buzzing.

Technology and deregulation have made many traditional engineering jobs obsolete. Would you have believed me 10 years ago if I said a remote control would phone you every two hours and tell you the readings in plain English?

It has never been easier for a personality to obtain a restricted ticket. But, Luci, it's still up to us to educate the folks whose voices represent our product.

When the man with the briefcase comes to the station and says, "Take readings and run an EBS test after this song," we'd better be able to do it, test or no test.

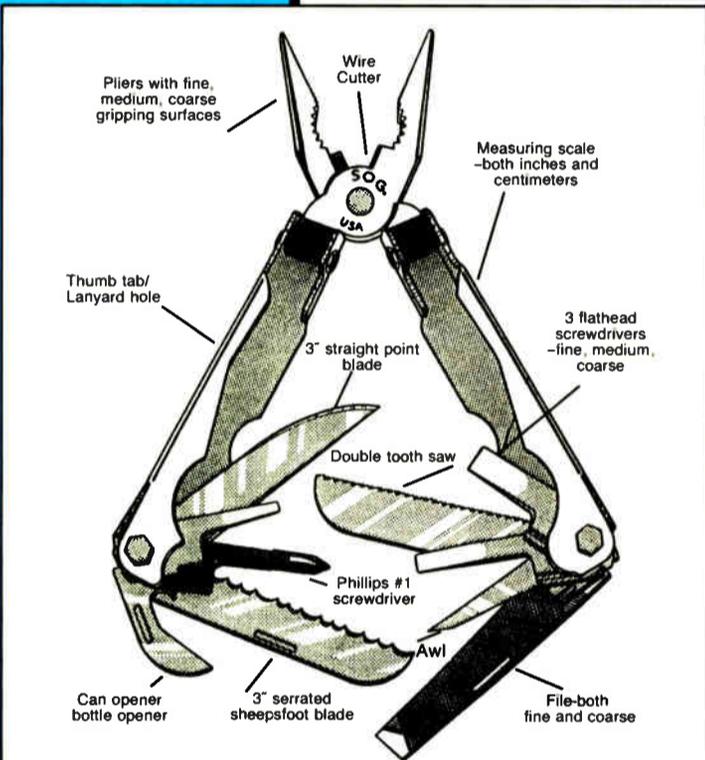
This test was only for fun. The real one is coming someday.

-Al

□□□

Alan Peterson is production director for WTCY(AM)-WNNK-FM Harrisburg, PA 17110, and really doesn't know what Form BW-150 is for. Give yourself an extra 50 points if you answered the bonus question correctly: Auld Lang's Sine.

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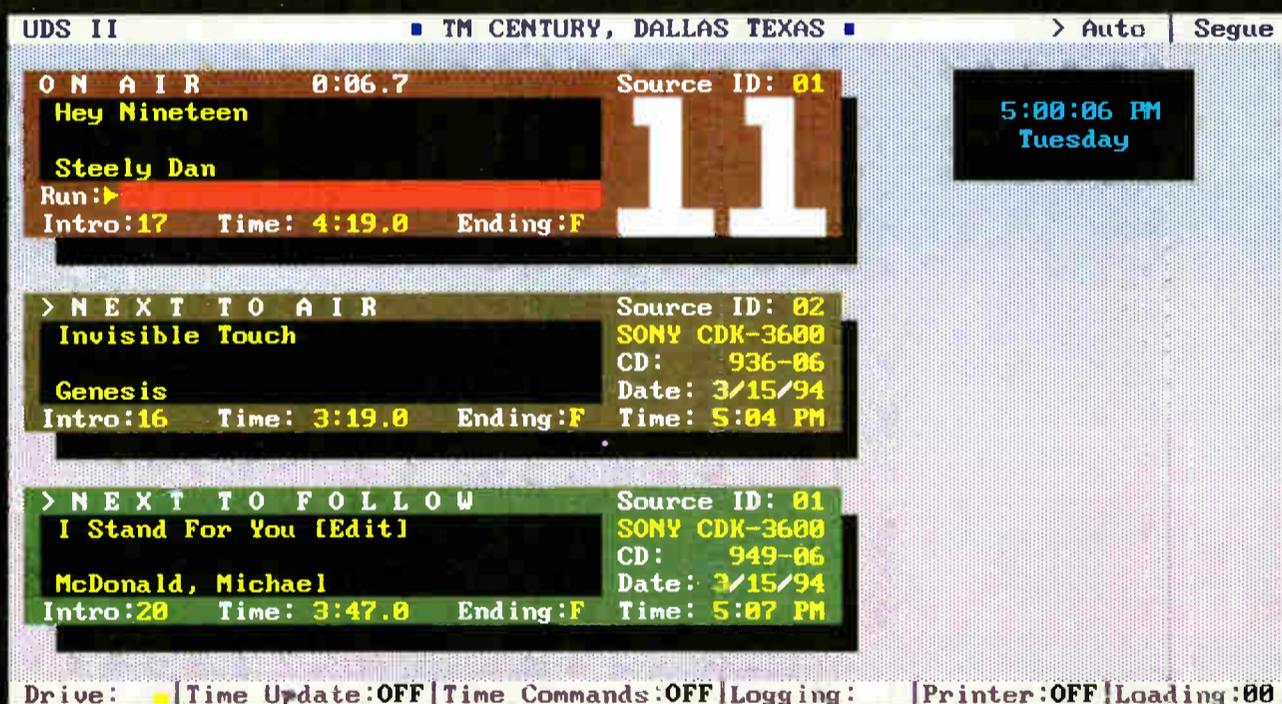
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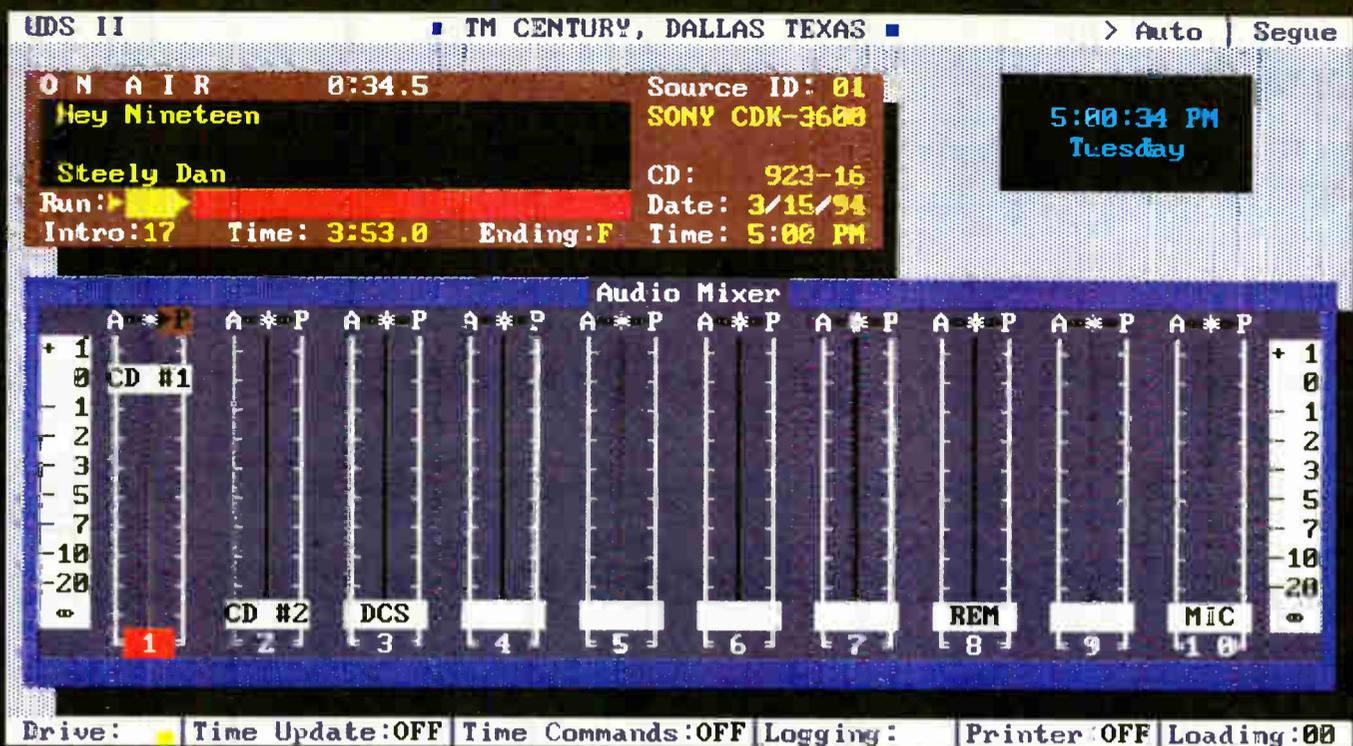
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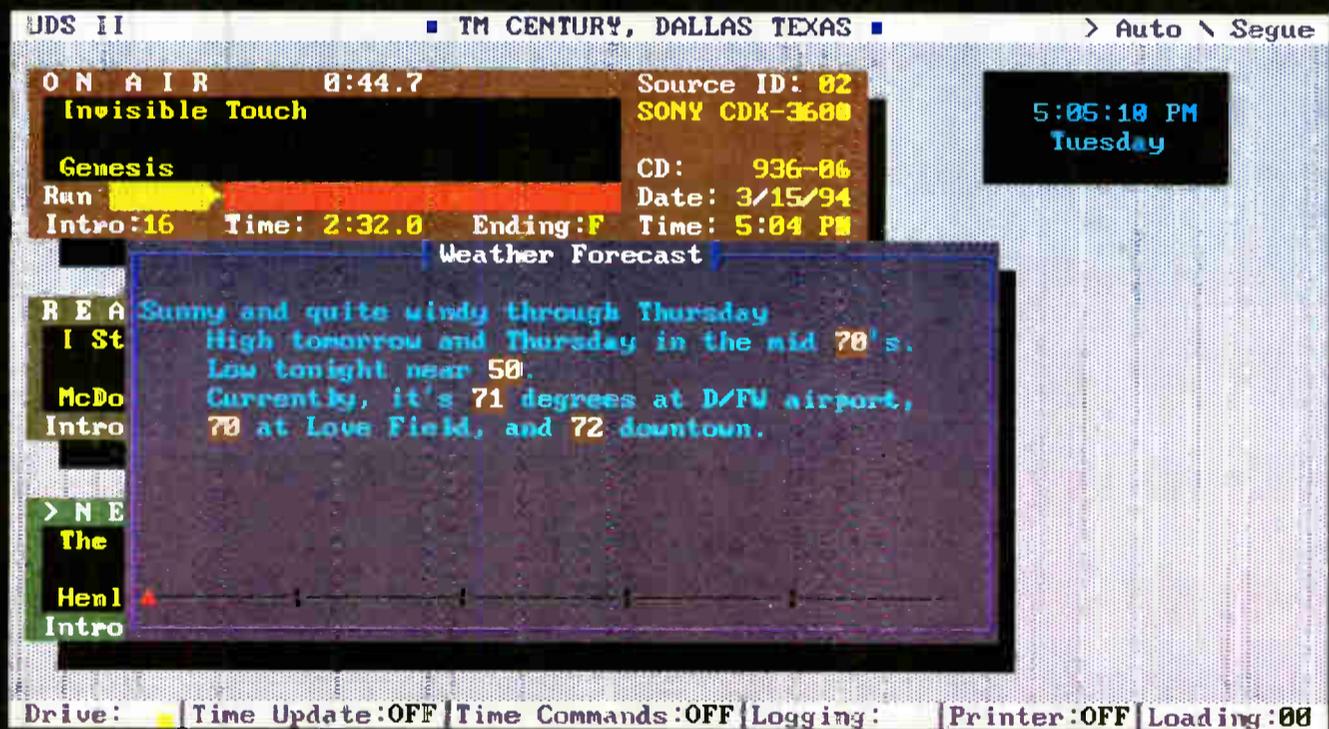


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COLE'S LAW

Splatter Shoe Set to Drop in July

by Harry Cole

WASHINGTON Pop quiz: Which of the following most accurately defines "splatter monitor"?

(a) A guy who keeps track of TV violence.

(b) Something many AM licensees should have been worrying about, but probably haven't.

The answer, of course, is (b), and if you're an AM licensee who didn't have a clue, you only have a couple of months to get with the program. A June 30, 1994, deadline is closing in rapidly.

All of this goes back about five years, to an FCC proceeding that took on the daunting project of improving AM quality by reducing adjacent-channel interference.

Grace period

In 1989 the FCC adopted a set of emission limitations developed by the National Radio Systems Committee (NRSC). Those limitations—generally referred to as "NRSC-2"—were designed to reduce the current occupied RF bandwidth of AM transmitters from 30 kHz to a nominal 20 kHz in order to reduce

interference levels and improve reception quality.

The FCC's rules were certainly laudable, and it's hard (as least for a non-technical geek lawyer such as myself) to quarrel with the particulars of the NRSC-2 standard. But how is your average AM licensee supposed to scrape together the money for equipment to comply with the new standards?

As it was adopting the new standards in 1989, the commission was concerned about implementation and compliance costs imposed on an AM industry that was not an especially growth-oriented,

money-is-no-object kind of place to work.

Bear in mind that five years ago, we were still smack in the middle of the "Administration That Never Met Any Kind Of Deregulation It Didn't Like." So the commission resolved the question of implementation and compliance with a two-step approach.

First, it decided that, until June 30, 1994, if you complied with the NRSC-1 voluntary standards (regarding audio pre-emphasis), you would be presumed to be in compliance with NRSC-2. That took the immediate load off AM.

Second, the commission decided to take a deregulatory dive similar to the one it had taken regarding compliance with modulation limits on the FM side.

That is, the FCC said that it was not imposing any specific monitoring requirement, and licensees would not necessarily have to buy this piece of equipment or that piece of equipment. All the FCC required was that its AM stations guarantee that their operations comply with NRSC-2. How they choose to verify the guarantee is their own business.

That is where things stand right now. If you're an AM licensee, as of July 1, 1994, you will be required to measure splatter at least once every 14 months (in connection with your normal equipment performance measurements required by Section 73.1590 of the rules) to demonstrate compliance.

Monitor choices

Of course, taking the measurements just once a year could cause problems if the FCC concludes you are not in compliance with NRSC-2 sometime between measurements. Bear in mind that there are several factors (occasional fluctuation of power supply, defective parts, environmental changes and others) that could lead to non-compliance. It's not clear that just measuring compliance once a year is necessarily a smart way to do things.

Nor is it clear exactly what measurements are necessary to assure compliance. There are a variety of ways to measure. The commission seems to prefer measuring with a "properly operated and suitable swept-frequency RF spectrum analyzer using a peak hold duration of 10 minutes, no video filtering and a 300 Hz resolution bandwidth, except that a wider resolution bandwidth may be employed above 11.5 kHz to detect transient emissions."

Alternatively, the FCC says it's all right to rely on "other specialized receivers or monitors with appropriate characteristics," although the calibrated spectrum analyzer will prevail in any disputes over measurement accuracy that crop up.

Basically, you can use any equipment you think will do the trick and you can refer to that equipment as often or seldom as you like, as long as you do your regular equipment performance measurements every 12-14 months and the result is that you are in compliance with NRSC-2.

Given this rather broad range of choices, what do you do?

The best advice is probably to discuss the matter with your consulting engineer or some other qualified person familiar with the FCC's rules and with your facilities and resources. In some cases, depending on the equipment you have installed and other such factors, a once-a-year spectrum analysis by your consulting engineer, your chief engineer or

continued on page 41 ►

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STATION SKETCHES

IPM Damaging to Hi-Fi AM Broadcasting

by Tom Vernon

HARRISBURG, Pa. The FCC's recent selection of an AM stereo standard has brought with it renewed interest in high-fidelity AM broadcasting. Splatter, particularly incidental phase modulation (IPM), is an important problem for engineers converting to stereo or merely improving overall quality.

There are no qualitative or quantitative definitions for splatter, but it is usually referred to as the unwanted byproducts of amplitude modulation, most notable is

adjacent-channel interference, the annoying "steam-locomotive" effect you sometimes hear while trying to tune in a weak station at night.

Splatter is also inefficient. It wastes energy in the sidebands, harming AM signal quality. It raises the overall noise level in the band, making neighboring signals more difficult to receive.

Splatter sometimes exceeds bandwidth limitations, leading to an unwanted visit from the FCC.

Splatter can be caused by excessive high-frequency audio input to the modulator,

overmodulation, improper adjustment of clippers on processing amps, modulator noise and distortion and IPM.

IPM issues

IPM's existence was virtually unknown by most engineers for many years because the wideband detector on modulation monitors could not demodulate IPM signals. Unfortunately, inexpensive narrowband receivers respond all too well to IPM's presence.

When a properly adjusted AM transmitter with minimal harmonic distortion is modulated with a 7.5 kHz tone, it produces a main carrier and two sidebands, 7.5 kHz above and below the carrier, as shown in Figure 1.

A transmitter with IPM produces a main carrier and an infinite number

of sidebands spaced 7.5 kHz apart, as shown in Figure 2. IPM sidebands are not a problem by themselves, but anything that disturbs the relationship between the main carrier and sidebands converts IPM into AM, resulting in distortion.

Skywave signals are one of the most common causes of IPM noise. When a skywave signal reflects off the ionosphere, the phase relationship between the carrier

receiver and further distortion.

IPM is especially detrimental to AM stereo transmissions. The now-approved Motorola standard transmits L-R information as a form of phase modulation. IPM corrupts the signal and degrades separation.

Theoretically, anything in the AM trans-

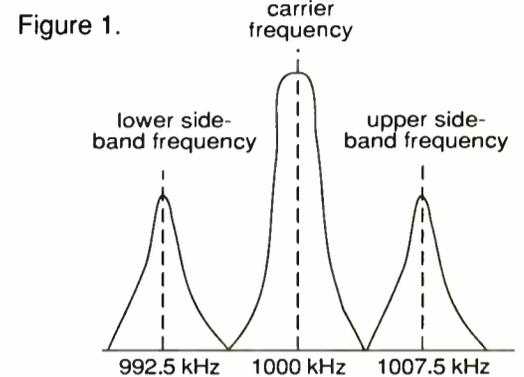


Figure 1. This shows the relationship of sidebands to carrier frequency in an ideal AM transmitter with no harmonic or IPM distortion. A 1000 kHz carrier modulated by a 7500 Hz tone produces sidebands at 992.5 and 1007.5 kHz.

mitter that affects the phase of the carrier can cause IPM. It is usually traced to improper neutralization of the PA stage, off-resonant adjustment of the PA grid tuning or a narrowband antenna tuning unit.

The prescribed adjustments for transmitter usually set it up for maximum efficiency. Depending on the unit, peak efficiency may produce a narrow bandpass condition

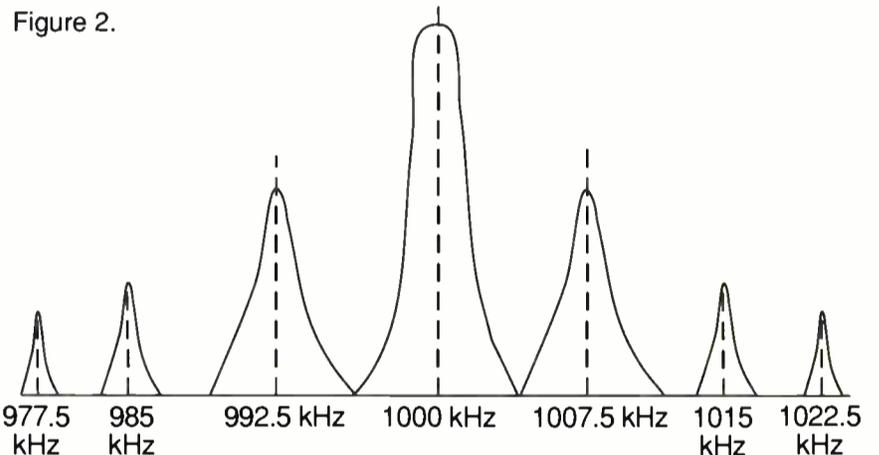


Figure 2. A transmitter with IPM will have an infinite number of sidebands. Incidental phase modulation may also produce asymmetry in sideband pairs.

and sidebands may be disturbed. If a skywave signal returns to Earth in an area of groundwave propagation, the two signals add and subtract from each other to cause fading.

Even when there is no IPM in the signal, the skywave disturbance to the modulated sidebands is often enough to create distortion. IPM compounds the problem, often making the signal unlistenable in the primary coverage area, especially in the upper half of the AM band, where skywave and groundwave signals are most likely to combine in the main coverage area. Figure 3 illustrates this condition.

Receiver flaws

Narrowband AM receivers are also severely affected by IPM. They receive when the dial is not tuned directly on the station and asymmetrical IF bandpass curves through slope detection. An IPM-infested signal is often deformed by the ionosphere before reaching a narrowband

leading to IPM. Some compromise between high efficiency and broad bandwidth must be realized.

The traditional method for neutralizing a triode stage is to remove plate voltage and adjust the neutralizing capacitor until grid current variations cease during plate tank tuning. This method usually does not yield a precise neutralization point and can leave significant IPM. Adjusting the transmitter for minimum IPM results in full neutralization of the PA stage.

Tuning

A spectrum analyzer is often used to tune for minimum incidental phase modulation. The transmitter is adjusted for minimum second order and higher sidebands, as shown in Figure 2. Before this procedure begins, however, the transmitter is tweaked for minimum harmonic distortion, which will look like IPM on the spectrum analyzer. Distortion must be

continued on page 41 ▶

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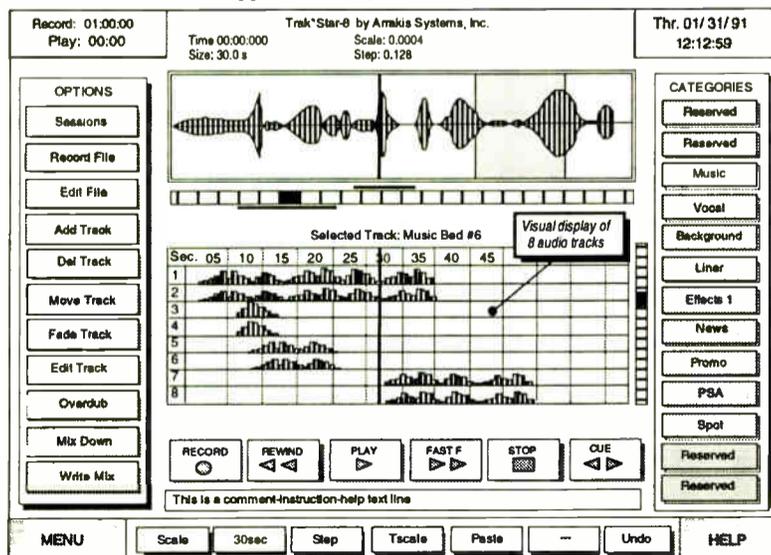
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by Ed Montgomery

Part VI

ANNANDALE, Va. A new style of transistor was developed in the late 1960s, the field-effect transistor (FET), that did not depend on current flow to operate.

The FET is voltage-controlled, like vacuum tubes, and has several advantages over its relative, the bipolar transistor. FETs (also known as unipolar transistors) work in radio frequencies up to the microwave region.

It is called a "field-effect" transistor because of the varying electric fields that control the current flowing through it. An FET is made of one crystal that is doped at various locations.

Figure 1 illustrates FET construction and an FET schematic diagram.

FETs consist of a source, where current carriers are emitted, and a drain, where

they are collected. The source and drain are part of the channel, which can be doped positive or negative.

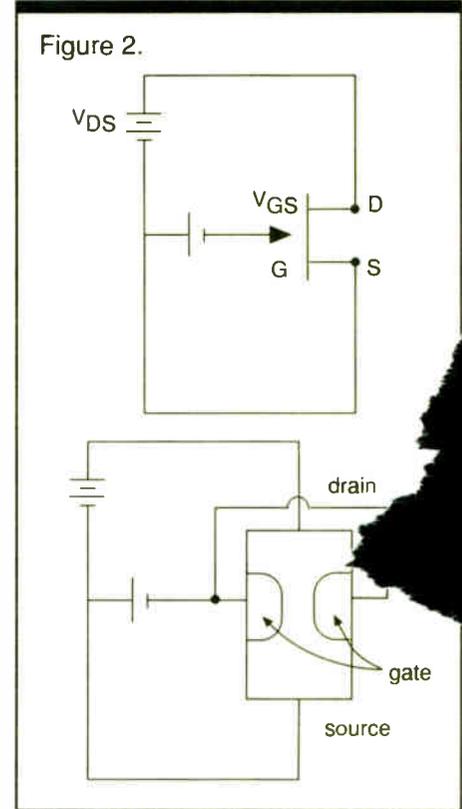
Figure 1 is an example of an "N-channel" FET. The gate is doped opposite to the channel. The voltage applied to the gate creates a field, limiting the amount of current flowing from the source to the drain.

One type of FET, the Junction FET (JFET), is similar to the bipolar transistor because it has no insulation between the "P" and "N" material. MOSFETs (Metal Oxide Semiconductor FETs) have a thin layer of oxide between the junctions.

An FET operates quite differently from a bipolar transistor. Two bias voltages are required. V_{DS} is connected from the drain to the source, allowing current to flow through the channel. The current flowing through the channel is I_D . V_{GS}

Figure 2 illustrates the proper biasing of an N-channel FET.

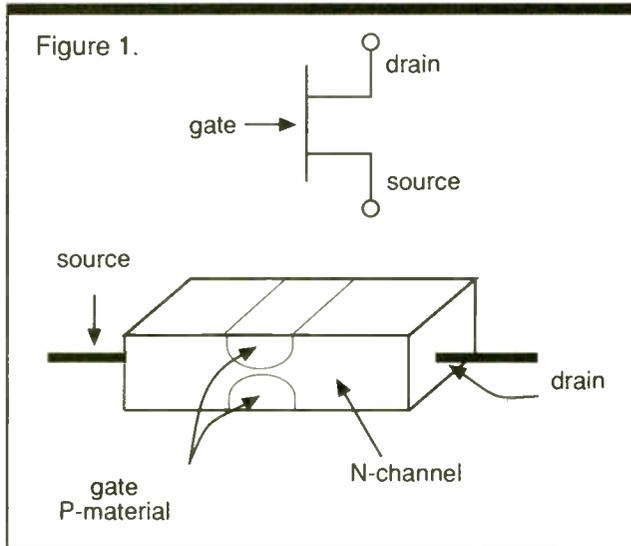
V_{GS} is used to control I_D . As V_{GS} increases in value, the field around the channel expands, reducing the area where current can flow from the source



to the drain. $V_{GS(OFF)}$ is the gate-source voltage required to cut off all current flow from the source to the drain.

The $V_{GS(OFF)}$ is important information when looking for replacement FETs. Manufacturers specify the $V_{GS(OFF)}$ for each FET and publish it. Those figures can also be found in cross-reference books.

Figure 3 illustrates a family of characteristic curves for an FET. The drain current is on the vertical axis while drain

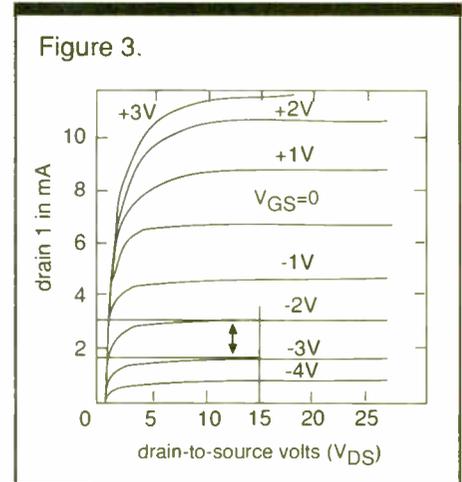


is the second voltage applied between the gate and the source.

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to source voltage (V_{DS}) is illustrated on the horizontal axis.

The "family" of curves are various examples of V_{GS} . For example, if V_{DS} is 15 volts and V_{GS} varies from 3 to 2 volts, there will be an I_D change of 2.1 milliamperes.

It is good to know the ratio of input to output signals when the FET is used as an amplifier, which is known as transconductance or g_m . It is measured in "siemens" and is also listed in cross-reference manuals.

Microcomputer integrated circuits consist of arrays of thousands of MOSFETs.

continued on page 43 ▶

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Useful IPM Antidotes

► continued from page 36

1 percent or less prior to these adjustments.

Once the preliminary steps are out of the way, the actual procedure is quite simple. Modulate the transmitter with a 1 kHz tone at about 95 percent modulation, and observe the display on a spectrum analyzer. You should be able to reduce second-order harmonics to at least 50 dB below first-order harmonics.

If you are successful, you can congratulate yourself and drive around enjoying improved sound. If not, more work remains.

The RF driver stages are another common IPM source. Any problems here are passed on to the PA grid where they contribute to overall IPM. Readjust the driver tuning, loading or drive and you may find surprising improvements.

Remember that the optimum point for IPM may not correspond exactly to peaks and nulls on the transmitter's meters. Be sure that your final adjustments to the driver do not compromise modulation capability or efficiency.

Constant monitoring

Maintaining a transmission system with minimal IPM is not a one-shot deal. Adjustments have to be rechecked when the PA or driver tubes are changed. The replacements are likely to have a different value of interelectrode capacitance. Seasonal changes, especially with a directional system, also can be disruptive.

A spectrum analyzer for regular monitoring and tuning is often prohibitively expensive for small-market stations to buy or rent. The AM Splatter Monitor from

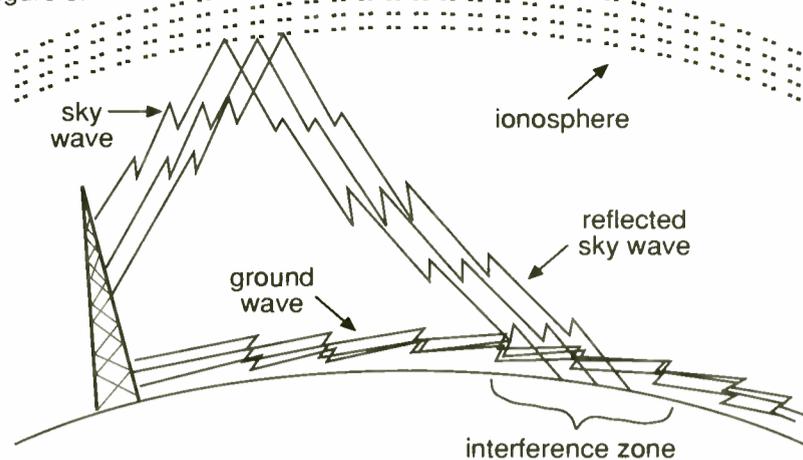
Delta Electronics is an affordable alternative. It may be used to eliminate IPM and other forms of splatter by adjusting for nulls on the front panel meter. The Splatter Monitor's built-in alarm circuit triggers when splatter exceeds a predetermined level.

(Special thanks to Tom Wright of Delta Electronics for sharing his insight on IPM. Delta's "Application Bulletin No. 10" has more useful information on splatter and the Splatter Monitor.)

□□□

Tom Vernon divides his time between consulting and completion of a Ph.D. He is occasionally sighted at WXPN(FM) Philadelphia. Call him at 717-367-5595.

Figure 3.



Distortion and fading can result when skywave is reflected back to earth in the area of the ground wave. A signal distorted by IPM may be unlistenable in the main coverage area.

Deadline for NRSC-2 Near

► continued from page 34

someone else may be enough.

Stations that prefer on-going monitoring for NRSC-2 compliance, may want to get a Delta splatter monitor, which appears to fall within the FCC's definition of "other specialized monitors with appropriate characteristics."

Of course, if you install one, you have to make sure you know how to run it and how to react to what it tells you about your operation (RW, Feb. 9).

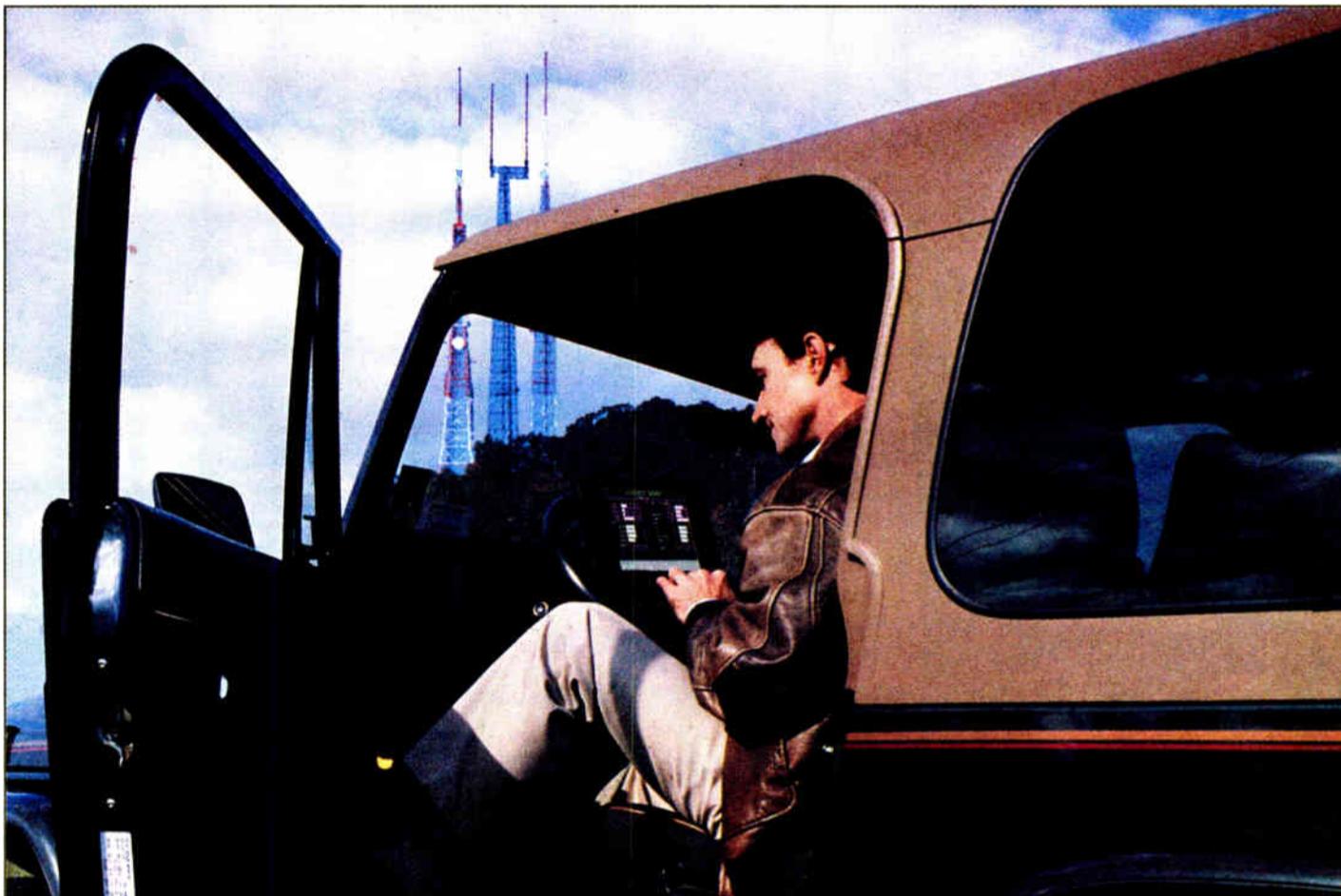
One way or another, though, you must have a workable solution by July 1, 1994. After that, the commission will be able to issue fines for failure to comply with NRSC-2.

There is no indication that the FCC will start issuing fines like crazy right away. The FCC is certainly in a position to tell AM licensees that they had several years to get themselves in compliance by the deadline. It will probably not be eager to cut anybody any slack.

Check with your consulting engineer and get ready for the new rules or, more accurately, the new effective date for the old rules.

□□□

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



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Circle 183 On Reader Service Card
World Radio History

WORKBENCH

Ideas to Eliminate Fussing with Fuses

by John Bisset

FALLS CHURCH, Va. Randy Aldous, an engineer from Minnesota, wrote to expand on the replacement of "telco-type" fuses using standard glass fuses with soldered buss-wire pigtails ("Workbench," Jan. 12).

Randy's alternative is an in-line fuse holder such as the Radio Shack 270-1281, with crimp-on spade connectors on the wire leads. This will allow a quick change should the fuse need to be replaced again. It also eliminates the hassle of soldering wire to a fuse, which is a pain in the best of circumstances, let alone in an emergency.

One of these emergency kits in the phone closet along with a box of spare fuses can be a lifesaver.

I once saw the same concept used with a Radio Systems console. Tiny "pico fuses" were incorporated into each of the system to protect each channel. Younger engineers may be unfamiliar with these little components, which look like resistors, but are hard to find.

You usually cannot tell whether a pico fuse has blown because it is not see-through like traditional glass fuses. About the only way to visually determine a failure is when one vaporizes.

This idea evolved from a station engineer who ran out of pico fuses and lost another module. Rather than risking the power supply by replacing the pico fuse with something other than a fuse, the Radio Shack fuseholder and companion glass fuse were used as a temporary fix, which successfully kept the console on the air.

It looks wrong at first glance when you

replace a component the size of a quarter-watt resistor with a big, bulky fuse hold. But when faced with an on-air console that cannot be down in the middle of the afternoon drive, this approach certainly has merit.

★ ★ ★

An ideal way to manage that roll of solder that gets misplaced, dropped on the floor or unravels all over your workbench is to use a plastic wire guide used in phone closets to route cross-contact wire or telco cables. The width is just right for a spool of solder and can also hold a roll of buss or hookup wire or even solder wick.

★ ★ ★

You've read in this column and elsewhere in *RW* that the Dolby DSTL digital STL is a strong performer on long hops and over difficult terrain, using just one watt of power. Dolby has announced that for the same price, the DSTL is available with a two-watt power output. Older one-watt DSTLs can be upgraded easily.

For more information, circle Reader Service 100.

★ ★ ★

Speaking of STLs, Mike Patton of Mike Patton and Associates, Baton Rouge, is providing repair and alignment services for owners of the old Marti STL-8. Mike says Marti no longer provides factory service for this model.

Something to do for a common STL-8 problems, Mike says, is check the operating frequency first if audio starts to worsen. The unit's crystals sometimes go bad and part of the signal drifts outside the passband.

Attach your counter to the crystal test

points to be sure the frequency has not drifted. If you have to replace the local oscillator crystals, you can order them directly from ICM Corp. in Oklahoma City for about \$20. ICM's number is 405-236-3741.

For more information on services provided by Mike Patton and Associates, circle Reader Service 18, or call Mike at 504-292-4189.

★ ★ ★

Burkhardt Monitoring provides a frequency measuring service for several Middle Atlantic stations, and Ed Burkhardt's frequent client memos always

include some insightful tip. A recent tip from Ed is to reduce FM and TV aural system hum by insuring that all audio and exciter equipment is wired to the same electrical phase. The tower lights should then be wired to a separate power company leg.

Ed Burkhardt can be reached at 804-261-1800.

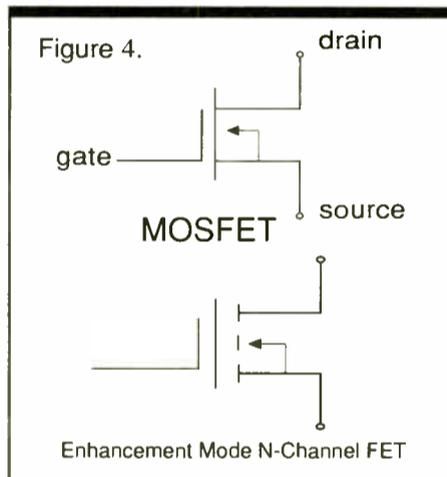
□ □ □

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

Different FET Varieties

► continued from page 38

They have become the heart of the com-



puter industry because they are easy to manufacture and operate at very low power. MOSFETs also have a high

switching speed, with an almost infinite input resistance.

FETs come in two major groups, enhancement-mode and depletion-mode. The enhancement-mode FET, which has no channel, is formed when V_{GS} is applied.

Depletion-mode FETs have a channel present regardless of whether V_{GS} is applied. Current will flow with or without V_{GS} present.

Figure 4 is the schematic diagram of a MOSFET and an enhancement-mode FET.

□ □ □

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

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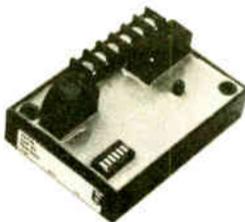
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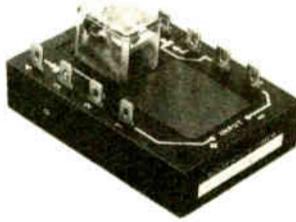
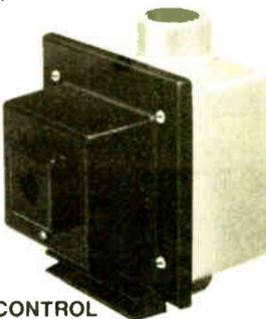


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READER SERVICE NO. 181

USER REPORT

BE AM-1 Gives Station an Edge

by Eric Hoehn
Chief Engineer
Contemporary Media

TERRE HAUTE, Ind. Contemporary Media recently installed a new Broadcast Electronics (BE) AM-1 stereo transmitter at WBFX(AM), one of our AM stations in Terre Haute. The installation went flawlessly, and the transmitter has performed without failure since it went on the air.

This transmitter replaced a tube-type transmitter, which was installed in the early 1960s when class IV stations were given 1 kW daytime power levels.

Requirements

The old rig had given us its all, and we were ready for a new transmitter. We did not want to do a stereo conversion on our old transmitter, which had difficulty modulating fully and had significant carrier shift. Given the cost of power and tubes, we decided to shop for a new solid state transmitter.

A requirement of our installation was a power output of almost 1,200 W, due to a very long (over 500 feet) run of trans-

mission line to the base of the tower. While running at 1,200 W we wanted to be sure the transmitter would continue to modulate fully and remain reliable.

After reviewing the products of all the major solid state 1 kW manufacturers, we decided to purchase the BE AM-1. We also decided to pick up the transmitter ourselves at BE's plant, where we met the people who put our AM-1 together.

We visited the test line where our transmitter and several others were being tested. The technicians showed us the transmitter's features and guided us through all of the unit's parts and sub-assemblies.

The first unusual thing you notice is the lack of transformer taps to be set for the line voltage. The transmitter uses a switching power supply similar to those found in computers, and it accepts from 196 to 252 VAC 50/60 Hz.

The AM-1 uses two RF power modules, which slide in from the front panel. Although you can remove and insert the modules while the transmitter is on—and no "dummy" shorting modules are required to operate the transmitter when the modules are removed—the service

people suggest pushing the Off button, pulling the module and then restarting the transmitter. It takes less than a second. Why take a chance on a problem when preventing it is so easy?

The RF modules each have a modulator stage and a Class E RF stage. The switching power supply allows for any reduced power levels to be achieved by cutting back the supply voltage rather than the modulator duty cycle. This assures low distortion even at low power levels.

The controller allows for five power levels, so your license requirements can be met. The transmitter also has five adjustable levels to drive the modulation monitor with the correct level.

Built-in C-QUAM

The BE AM line comes with built in C-QUAM stereo. The exciter is a single board in the controller, and because there is no separate power supply and cabinet—and the transmitter's characteristics are known—the stereo exciter does not add much to the complexity of the transmitter. Of course if your station is not

ready for stereo, the transmitter can run in mono, and the stereo is there for when you are ready.

Installing the AM-1 took less than a day, including connecting and interlocking it to our antenna switching system and setting up the stereo generator. The front panel modulation indicator helps you get set quickly. We found the accuracy of the modulation indicator to be very close to our modulation monitor.

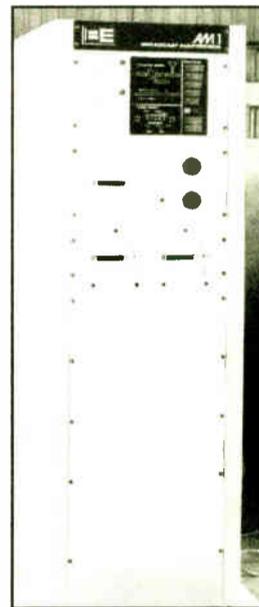
The AM-1 performed wonderfully, with S/N coming in below -61 dBm for both stereo channels, THD less than 1.1 percent at 50 percent modulation and IMD less than 0.8 percent at 85 percent modulation. Stereo separation was better than 35 dB.

We immediately noticed, in addition to the improved audio quality, a lack of carrier shift. Even with 1,200 W output and full +125

percent modulation, the transmitter does not run out of RF like our old rig did. We believe this has improved our coverage area some because the transmitter helps us fight off the interference on our crowded channel.

Just after installation, a major thunderstorm passed through, which tested the power supply and the RF section of the

continued on page 49 ►



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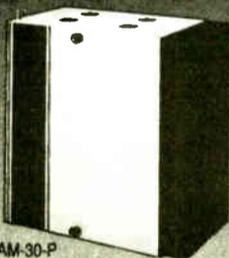
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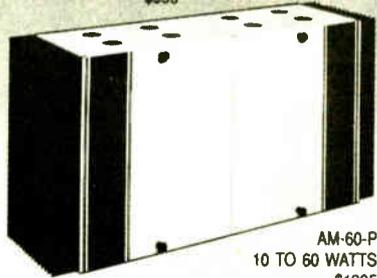
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USER REPORT

After the Floods, LPB AM-100P Saves the Day

by Roy Roberts
General Manager
KDJI(AM)-KZUA(FM)

HOLBROOK, Ariz. Last year, a "50-year" flood hit Arizona, raising waters to previously unimaginable levels. Our KDJI(AM) offices, studios and transmitter site in Holbrook were overcome by walls of water that reached as high as 10 feet. With only about two hours advance notice, we were unable to protect our transmitter building.

The Bauer 5 kW AM transmitter we used for years suffered major damage, beyond reasonable repair. Without a backup transmitter, and with major studio flood damage as well, our mission was to get on the air as quickly as possible. The LPB Broadcast Transmitter Model AM-100P saved the day.

John Devecka at LPB responded to our situation immediately, arranging for construction of the unit and shipping in record time. By the time we literally hosed out the transmitter building, rebuilt the ATU and prepared a standby studio, the LPB AM-100P arrived.

With a simple coax connector hookup and straight 110 V power plug, we were

back on air in 30 minutes. We used four bolts to put the transmitter on a block wall. However, we could have set it just about anywhere in the building, because the transmitter is only 24 inches by 24 inches by 6.5 inches. The unit operates with very minimal fan noise and generates little heat.

The amazing part is that our coverage with the LPB AM-100P was a strong 30 miles in every direction, more than adequate to continue our regular programming, local sports broadcasts, etc., with only a minimal loss of revenue. Further, the 80 percent reduction in our normal electric bill helped soften the blow.

We now operate with a Harris SX-5 transmitter, and have the LPB AM-100P ready as a backup unit in case of repair or other need. I know that many daytime AM stations use these handy, reasonably priced transmitters for post-sunset authorizations, but for KDJI, when the flood waters hit, the LPB AM-100P saved the day

□ □ □

For information from LPB, contact John Devecka in Pennsylvania at 610-644-1123; fax: 610-644-8651; or circle Reader Service 105.

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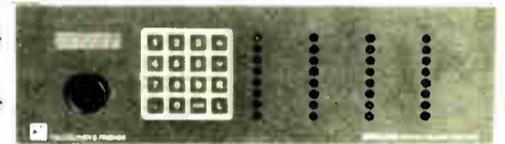
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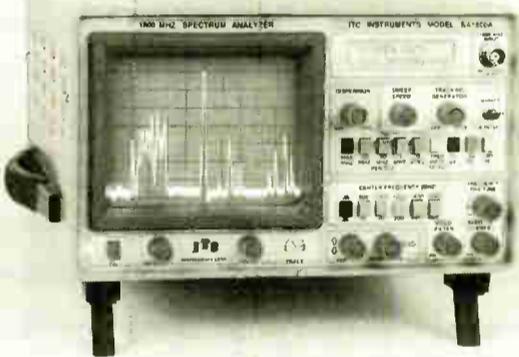
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READER SERVICE NO. 8

USER REPORT

Nautel Proves Reliable for Radio AAHS

by **Charlie W. Rohde III**
Director of Engineering
Radio AAHS

DALLAS Since 1990, I have been chief engineer of KNRB(AM) (now KAHZ) Dallas-Fort Worth. When KNRB was purchased by Children's Broadcasting Corp. (CBC), I became the director of engineering for Radio AAHS.

Broadcasting children's programming 24 hours a day is quite a change from KNRB's Christian format. With our old format, we were one of 12 Christian outlets in the area. But our new format has a captive audience of 250,000 listeners.

We are the only station in town programming kid's music, which has taken us from obscurity to "Oh, neat! ... Radio AAHS!"

Ultimately, I am responsible for a national network and eight AM stations all over the country. With that much inherited hardware, each complete with its unique problems, I have a lot on my plate.

Quite reliable

The last thing I need is transmitter problems, and at KAHZ(AM), we do not have any. We operate a Nautel AMFET 5 that we purchased in 1985. The only

problem I had, other than the way it was originally installed, was our set of FET spares that some engineer had checked with an ohm meter in a high RF field. Replacements were purchased and set aside in case I ever have a problem.

The AMFET series is quite reliable, and like its successor the ND-5, has no user variable output tuning and loading, unlike other solid state transmitters. Some engineers are dissatisfied with this, but I have to ask, "Why?" The solid state two-way I used to work with did not have or need variable output tuning.

If you are working into a properly designed antenna array, it is going to match the transmitter and tweaking is not necessary. One engineer told me that if his array drifted, he could compensate by tuning and loading. If the array drifts, there is a problem with it that needs to be fixed. I am thankful for a design that alerts me to an antenna problem before it goes too far to fix easily. The fewer the knobs to twiddle, the better.

To be fair, we have had a couple of transmitter failures in the past four years during lightning storms or power line anomalies, but the Nautels are modular and the transmitter is repaired while still on air. I can then repair the module myself, or send it to Nautel, if I am too busy.

Solid state systems

By comparison, our transmitter at KTEK(AM) Houston is not modular, but gives little trouble. The backup at KTEK is also modular, but it cannot be serviced on the air.

I am sometimes surprised by some engineers' reluctance to deal with tube technology. I worked with one engineer who did not understand bottles: He could work with 100 W solid state 2 GHz transmitters with their CMOS CPUs, but not with tubes. Conversely, an engineer who preceded me at KNRB did not like the Nautel. He wanted tubes for RF.

During my predecessor's tenure, the array had a problem. Every time it rained, the STL coax would arc over to the ground cap and the transmitter would begin to trip. On really cold mornings, below 32 degrees Fahrenheit, the transmitter would not come on.

This was due to the array control phaser circuits, designed with fair weather NE-555 timers, which just would not work. The Nautel was fine. Properly designed solid state systems work quite well at lower temperatures. I now use a 60 W light bulb to keep the switcher unit warm.

These reliable Nautel units create a remarkably stable system that keeps our engineering costs low.

Another plus in using efficient solid state transmitters is the minimal amount of heat the apparatus generates. This makes it possible to use captive inside air for cooling, instead of bringing in outside air full of dust and pollutants. As a result, my stations and equipment stay a whole lot cleaner.

These reliable Nautel units—mated to our Gentner VRC-2000 remote controls, for auto logging, power change and alarm reporting (and so I can monitor my stations from Dallas-Fort Worth)—create a remarkably stable system that keeps our engineering costs low. It now costs more to maintain the studio than the transmitter.

Solid state has been a real money-saver for us. Maybe not on the initial price tag, but on operational and maintenance costs, and certainly on late night "red-eye" parties.

□ □ □

For information from Nautel, contact Bruce MacKenzie in Nova Scotia at 902-823-2233; fax: 902-823-3183; or circle Reader Service 70.

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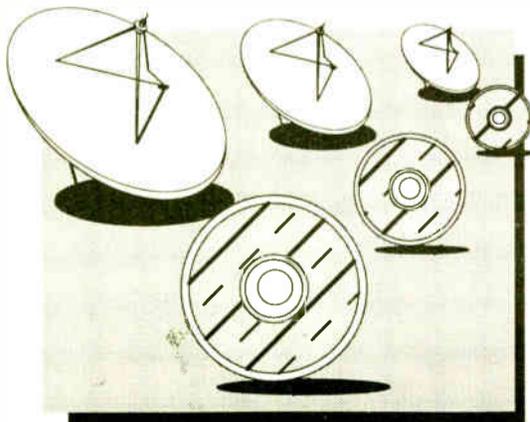
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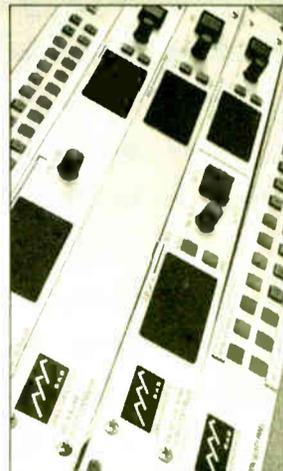
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SPECIAL REPORT

Harris DX 50 Passes User's Tests

by T. Carter Ross

WASHINGTON Three and a half years ago, KCWW(AM)-KNIX-FM in Phoenix, installed a Harris DX 50, after a fire at KCWW's transmitter site destroyed the existing Harris MW 50.

Elliott K. Klein, who has worked with KCWW since 1971, first as director of engineering for Buck Owens Broadcasting Inc., and, since 1983, as an independent consulting engineer, oversaw the rebuilding of KCWW's transmitter site.

Klein's initial inclination was to install another MW 50, but Ron Frillman at Harris suggested the DX 50, which incorporated both digital and solid state technology. "It was the best decision I've ever made regarding a major purchase," Klein said.

Twelve tests

Klein wanted to be certain that the DX 50 would provide the sort of service that he'd grown accustomed to with his MW 50. So he visited Harris' factory to examine and test the DX 50.

"I developed a list of 12 extremely difficult tests for the transmitter to be put through, and thus armed went to the factory to see what the DX 50 could do. At the factory, a DX 50 was put on a test bed and we ran through my tests. It passed with flying colors," he said.

The DX 50 passed all of Klein's durability tests, and "wildly" exceeded his expectations in audio performance. KCWW broadcasts in AM stereo with the C-QUAM standard,

and in some aspects of audio distortion, it exceeds the performance of its sister station KNIX-FM. "The transmitter is basically transparent: What you put in, you get out of it with no audible artifacts and coloring of the audio."

Phoenix is a very competitive market which forces KCWW to push signal modulation to the FCC-established limits.

"We modulate our signal very densely and very hard, yet the DX 50 just sits there and plays as if it were just a 1 kW transmitter," he said.

Harris points to solid state technology as one of the selling points of the DX line of transmitters, but initially Klein was concerned about how a solid state transmitter would handle Arizona's harsh weather.

Monsoon season

"We have a monsoon season that lasts from mid-July to mid-September each year. Every evening, a thunderstorm roars through our valley. Since the DX 50 is a solid state transmitter, I was worried that it would be prone to lightning damage. But the protection circuits that Harris designed into the unit work well. Over the past three and a half years, we have

blown, at most, one or two fuses and maybe a transistor, but the transmitter has consistently operated at its rated power."

The desert heat was also a concern.

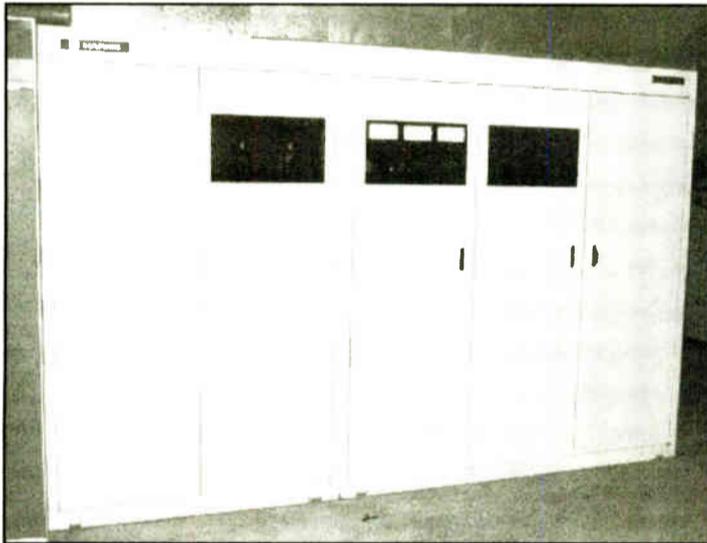
"We like to keep the transmitter building at an ambient air temperature of 78 degrees Fahrenheit. Since Phoenix tends to get quite warm—two years ago, we had a record high of 123 degrees Fahrenheit—we have to keep 22 tons of refrigeration on the building. Since the DX 50 is solid state it radiates much less heat than tube transmitters, which helps to keep our cooling costs down."

All in all, between the increased efficiency of solid state over tube technology and the decreased cooling bills have helped reduce KCWW's power consumption at the transmitter site by almost 40 percent.

When asked what he likes most about the DX 50, Klein points to its abundance of control and metering options.

"It is easy to look at all of the operating parameters of the transmitter through multi-meters," he said.

The unit is operated by remote control and the interface supplied with the transmitter is adequate in status, metering and control of power levels.



The DX 50, minus lizards, on site at KCWW.

The front panel of the transmitter is a signal flow chart that is designed to indicate the transmitter's internal operations with green and red LEDs. When everything is green, nothing's wrong inside.

"In my experience, there have not been any failures beyond the aforementioned fuses and output module," Klein said. "There are something like 143 output modules in the transmitter, each of which has green and red LED indicators. When a red LED is on, there is a problem with the module."

"In fact, that was how we knew when a fuse was blown or we had lost an output module, a red LED was on. We didn't have to run around with a scope or a meter to find the problem. And spare parts were always on hand, making the problem easy to fix.

"When the power module failed, the DX 50 continued with full modulation capability at full power. If we hadn't been inspecting the transmitter regularly, we probably wouldn't have even known there was a problem."

Since the DX 50 was installed, KCWW has suffered no downtime attributable to the transmitter. In fact, were it not for periodic cleanings, the back-up transmitter would almost never be used.

"The only time the back-up transmitter goes on air is when we need to clean the DX 50—vacuum out the dust, bugs and lizards. We do have a lizard problem, but that goes with operating in a desert.

Dust storms

"Our transmitter building is in the middle of 27 acre site, an old wheat field. When the wind starts to blow, quite a lot of dust is blown up, but the air filtering is more than adequate and it has not created any arc overs or other problems," Klein said.

KCWW operates as a rather complicated six-tower directional station at night, but the DX 50 apparently has no trouble in switch-

ing from daytime to nighttime operation.

"We operate our transmitter as a 50 kW non-directional during the day and as a 50 kW six-tower directional at night. The six-tower nighttime operation is extremely broadband and has a very flat response," he said.

"Switching between daytime and nighttime operation is through a control interface in the unit; a Harris antenna phaser we originally installed with the MW 50 does the actual switching. It is a fairly complex directional system, but the transmitter performs flawlessly in both directional and non-directional modes."

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For information from Harris Allied, contact John Delay, AM product manager, in Illinois at 217-222-8200, ext. 3103; fax: 217-224-1439; or circle Reader Service 110.

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USER REPORT

CCA Transmitter Simplifies Rebuild

by Robert F. Ritchey
Engineering Consultant
KDRY(AM)

SAN ANTONIO In the summer of 1992, KDRY(AM) in San Antonio hired me to rebuild the station's transmitting plant and antenna system. The scope of the project convinced me that CCA AM transmitters are a viable alternative to the products from the big-name companies that dominate the industry.

During the early 1980s, KDRY's owner upgraded power a number of times, from 1 kW eventually to 11 kW. The station also added 1 kW at night

with a directional antenna system.

The rapid succession of upgrades stretched the capacity of the station's two 30-year-old Collins Radio E series transmitters. In an attempt to reach the 11 kW power authorization, one transmitter was field modified. At best, it was able to generate only about 9 kW, and no further modifications were possible without raising the costs too much.

Maze of relays

To further complicate matters, a second Collins E series transmitter was used for directional nighttime operation. A maze of RF relays was used to switch between

transmitters when the station changed power and pattern.

I recommended replacing the main transmitter immediately. A single unit could perform both daytime and nighttime power functions, eliminating some of the RF relays and the switching network. Also, a new transmitter could achieve higher levels of modulation with a distortion-free, clear audio signal.

KDRY's need for a medium power transmitter coincided with a shift in technology at the major manufacturers. Solid state RF stages were coming on-line and older designs were being "built-to-order" with long delivery dates. Good, late-model used

transmitters were non-existent.

Steve McElroy at the CCA plant in Fairburn, Ga., had a 10,000 D series unit in stock and ready for shipment. At first, I had reservations about purchasing an unfamiliar transmitter. But a visit to the Fairburn plant to see the transmitter in operation allayed my concerns about product design and durability.

Convenient features

The transmitter is well built, with easy access to major components. Most parts are standard and are readily available through commercial parts dealers. Interconnecting cables are clearly marked and easy to access. Opening the rear doors allows visual inspection of the power supply, chokes, transformers and caps. The modulator feedback ladder is mounted at eye level on the rear of the modulator cavity.

An important consideration in deciding on the CCA transmitter was an impedance difference between the KDRY daytime and nighttime patterns. Many of the solid state transmitters available at the time were experiencing problems with rapid changes in load impedance.

The transmitter is well built, with easy access to major components.

KDRY programs a religious talk format and down time, for any reason, is a serious matter. The CCA transmitter copes with the impedance change and requires only a modest amount of remote adjustment by the operator on duty to maintain proper tuning.

Once uncrated, less than 30 minutes were needed for visual inspection and to complete the necessary internal connections before AC power could be applied.

CCA recommended a closed delta, AC configuration, for the 10,000 series transmitters; however, we ran the unit for several months in an open delta arrangement. There was no appreciable difference between the two configurations.

Flat audio response

Audio response for the CCA transmitter is essentially flat. Two proofs performed over an 18-month interval indicated a variance of less than 1 dB from 50 to 10,000 Hz. Overall distortion was less than 1 percent.

The RF final employs a 4CX15000 tube operating as a plate modulated class C amplifier. The size of the tube affords the CCA 10,000 the capability to sustain a full 11 kW output at or close to 100 percent modulation.

I am delighted with the performance of the CCA 10,000 series transmitter. My only concern is the anticipated cost of replacing the final. So far, the final delivered with the unit has logged more than 9,000 hours of stable emission without any appreciable sign of wear.

I recommended serious consideration of the CCA AM transmitters. They are stable, simple-to-maintain and cost effective to operate in difficult environments, such as the changing load impedance in the KDRY directional system.

□ □ □

For information from CCA, contact Steve McElroy in Georgia at 404-964-3530; fax: 404-964-2222; or circle Reader Service 216.



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USER REPORT

Dataworld Offers Valuable Service

by **Bill Sitzman**
President
Independent Broadcast
Consultants

TRUMANSBURG, N.Y. Independent Broadcast Consultants works regularly with AM, FM and TV clients, but specializes in AM radio. **Dataworld** is always there with a helping hand.

Dataworld Inc. was founded in 1971, offering computer printouts of both AM and FM databases, as well as nighttime protection constraints. In 1984, John L. Neff purchased the firm and moved it to Bethesda, Md., adding many new computer services.

Useful tool

While many consultants have used the Canadian AM allocation maps for years, one of the most useful tools Dataworld has created is the AM allocation book, with one page showing daytime service/interference contours and another depicting the nighttime pattern shape and size, for each AM frequency.

When a client authorizes a study for a new full time AM facility. Our staff

scans the AM allocation book and, once a likely channel is found, orders a "Within Study" from a reliable set of coordinates.

This provides us a printout of AM facilities/allocations spanning the pertinent cochannels and adjacent channels out to at least 320 km (198.4 miles). The up-to-date Within Study identifies stations critical to the daytime portion of the project which must be measured or researched for existing field strength measurements. Dataworld now includes antenna parameters in the Within Study.

Dataworld also gives us the option of feeding our measured and M-3/Canadian conductivity data into a daytime protection requirements program and then they can plot the results.

Once we design the daytime pattern, Dataworld gives us the option of an AM groundwave calculation program, from which our draftsman plots the allocation and service contours. We also make use of the population enumeration program to get the total number of people served by each contour. Dataworld even has a flag service that keeps us apprised of any new filings or facility changes on frequencies pertinent to our client's projects.

The nighttime allocation study for a client's project runs pretty much concurrent with the daytime study. The Dataworld nighttime protection requirements are usually 150 pages in length, but give us a wealth of data. The first 12 pages form a detailed nighttime limit study with both 50 percent RRS and 25 percent RRS exclusions listed, followed by stations below the 25 percent RRS in descending order.

The zero-percent exclusion section lists Class D (low-power nighttime) stations. While these stations may not enter the official 50 percent and 25 percent calculations, an existing client of ours identified four Class D stations exceeding his 25 percent RSS and causing interference.

The next 35 pages show the detailed limit makeup of co- and adjacent-channel stations with resulting permissible nighttime radiation from our client's site. Of special value is the tabulation of permissible nighttime radiation from 0 to 359 degrees azimuth. Our staff plots this on a polar graph, noting pertinent vertical angles as well.

Antenna parameters

This plot helps identify stations needing a peripheral or clipping study, and also gives the engineer a picture of the constraints we must deal with during nighttime pattern design. The final 102 pages are a listing of nighttime antenna parameters, including augmentations for directional operations. This includes all pertinent stations in Region II, which includes stations in Latin America.

There is a lot of data to keep straight and sorted, but a challenge that Dataworld takes in stride. Our firm also enters the picture as a watchdog by verifying the status of an individual station or construction permit (CP) or by checking parameter accuracy against our files, if it is one of our clients. The results are fed back to Dataworld's headquarters in Maryland.

Dataworld also offers a skywave contour protection program when we work on a clear channel. Although we print all horizontal, vertical and conical radiation data in house, these services are available at a reasonable cost.

Also, operating (driving point) characteristics are offered by Dataworld to help flag a sour pattern design that could make a stability headache. Clients can even commission a callcheck to aid in choosing call letters.

For information from Dataworld, contact Claude Greche in Maryland at 800-368-5754; fax: 301-656-5341; or circle Reader Service 158.

AM-1 Gives An Edge to WBFX

► continued from page 44

AM-1. The transmitter ran perfectly through an intense storm and when we returned to the site the next morning, all was normal except the "Lightning" LED on the controller was on. The transmitter had seen voltage on its output and had protected itself.

Maintenance

Our old transmitter required regular maintenance to keep running, including modulator tube changes. The new AM-1 requires the air filters to be changed regularly and once a year the 9 V battery that holds the controller memory in case of a power interruption needs to be replaced. That is the only regular maintenance the AM-1 requires.

Even mono listeners have let us know that they hear an improvement, and of course the stereo is a big boost. Both of our AM stations now broadcast with C-QUAM.

The transmitter has been running non-stop for several months now without a failure. A few weeks ago we were showing the AM-1 to another engineer and I decided to show him an RF module. We removed one, and the transmitter continued to operate at just under half power. What surprised me most was that after running at full output for months, the heat sinks on the RF module were room temperature.

The AM-1 will pay for itself in savings on power and tubes in just a few years, so the quality and C-QUAM stereo are just added pluses to a decision that was already easy to make. The AM-1 is the transmitter to have for 1 kW AM.

□□□

For information from Broadcast Electronics, contact David White in Illinois at 217-224-9600; fax: 217-224-9607; or circle Reader Service 54.

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and displays are on a backlit LCD screen.

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For information, contact Gary Clarkson in Arizona at 800-535-7648; fax: 602-438-8227, or circle **Reader Service 44**.

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For information, contact Bud Brown in Minnesota at 218-765-3151; fax: 218-765-3900; or circle **Reader Service 128**.

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Geary Yelton, Electronic Musician Magazine*

If you're involved in production for radio, then you're aware of the increasing demand for digital audio quality. So your next multitrack recorder should be digital, but which format: tape or hard disk? You've heard about the great editing tricks offered by disk-based systems, but there's a problem.... don't all hard disk systems require expensive add-in hardware and software, to already expensive computers? Not anymore!

The DR4d is the solution for those looking for an alternative to expensive, complex computer-based systems, or the limitations and mechanical uncertainty of tape recorders. It offers a perfect combination of hard disk recording benefits with an easy-to-use interface.

The DR4d can record up to four tracks simultaneously to standard SCSI hard disks, either internal or external drives. An optional 213MB internal disk offers 40 track minutes of recording (44.1k-Hz) right out of the box. To expand your recording time, simply connect external drives to the DR4d's supplied SCSI port.

With standard tape machine-style controls the DR4d is by far the easiest hard disk recorder to operate, which means that you can get to work immediately, rather than setting up and operating a computer system. Punch ins/outs can be performed manually or automatically from the front panel, or by footswitch, just like you'd expect.

Now you can start to take advantage of the power of random access editing. You can cut, copy, and paste sections of audio with ease. Our Jog/Shuttle wheel lets you scrub through the audio at various speeds, forwards or backwards. Try out different arrangements. Create perfect tracks by combining the best sections from multiple takes. Whatever. And you can edit with confidence, be-

cause if you change your mind you can instantly Undo your last edit - even after the power is turned off and on again! Imagine it. Do it. It's that simple.

Another DR4d advantage is not having to wait for tape to shuttle back and forth. You can instantly move to 108 memorized locations at the touch of a button, and these locate points may be entered manually or on-the-fly. It's also simple to set up seamlessly looping repeat sections, so it's easy to jam over tracks. No more wasting time on rewinding tape!

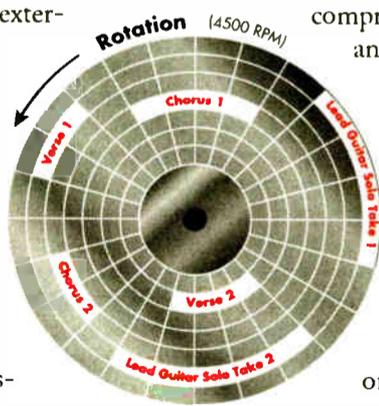
Of course, how the DR4d sounds is as important as how it works. Advanced 18-bit oversampling A/D and D/A converters insure crystal clear sound, and with a full 96dB dynamic range, the DR4d offers no-compromise specs. The four balanced 1/4" input and output jacks are switchable between -10 and +4 operation, and 2-channel digital I/O is included (XLR and RCA).

Backups can be made to a standard DAT machine.

Need more than four tracks? Four DR4d's can be linked to create a 16-track system. And for synchronization to other gear, just add the optional MIDI or SMPTE interfaces.

And best of all, the DR4d is an affordable reality: suggested list is only \$2495.00 (or \$1995.00 w/o hard disk)!

Multitrack disk recording is within your reach! Please call or write for further information.



On a spinning hard disk, the various sections of music can be accessed almost instantaneously by the moving heads of the drive mechanism. This allows you to seamlessly output different parts in any order, with no time spent rewinding. Audio can be moved and rearranged in ways not possible with tape!

DR4d **AKAI**
DIGITAL

P.O. Box 2344 Ft. Worth, TX 76102
(817) 336-5114 Fax 870-1271

New FM Transmitter

Ditel SRL, based in Córdoba, Argentina, presents the Excel line of FM broadcast transmitters. Fully solid state up to 10 kW, the transmitters are manufactured to meet CCIR and FCC standards.

The transmitters include switching power supply, stereo encoder and output low pass filter. Excellent performance, high reliability, modular configuration and low operating costs are features and benefits of the Excel transmitters.

Output amplifier modules are interchangeable, even during operation.

For information, contact Walter Almada in Argentina at 54-51-556-121; fax: 54-51-552-851, or circle **Reader Service 141**.

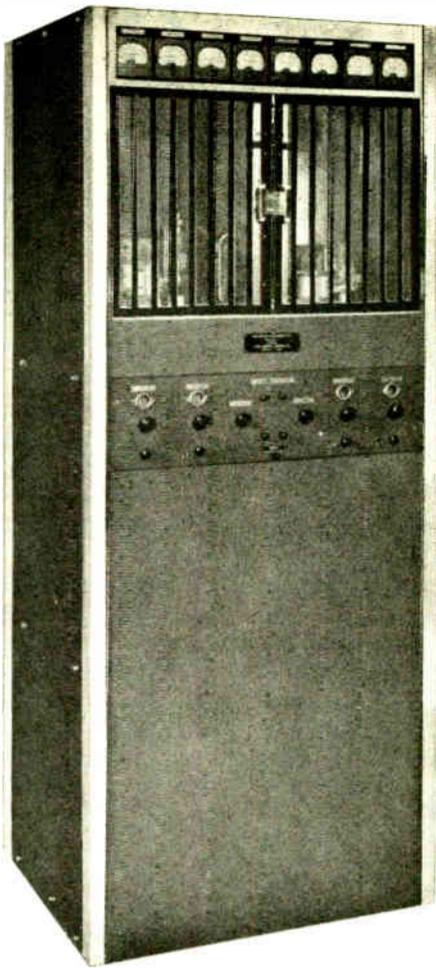
New Boundary Files

SoftWright LLC, developers of the Terrain Analysis Package (TAP) software used to design radio system coverage, offers many new boundary and location data files ("BNA" files) to be used with the Boundary Line Module of the TAP system. MapViewer, Surfer or other software packages that can import ASCII files containing name and geographic coordinates.

The files include high-resolution county boundaries, principal roads and highways, railroads, bodies of water, principal cities, airport locations, air hazards, administrative boundaries, telephone area codes and three-digit state ZIP codes.

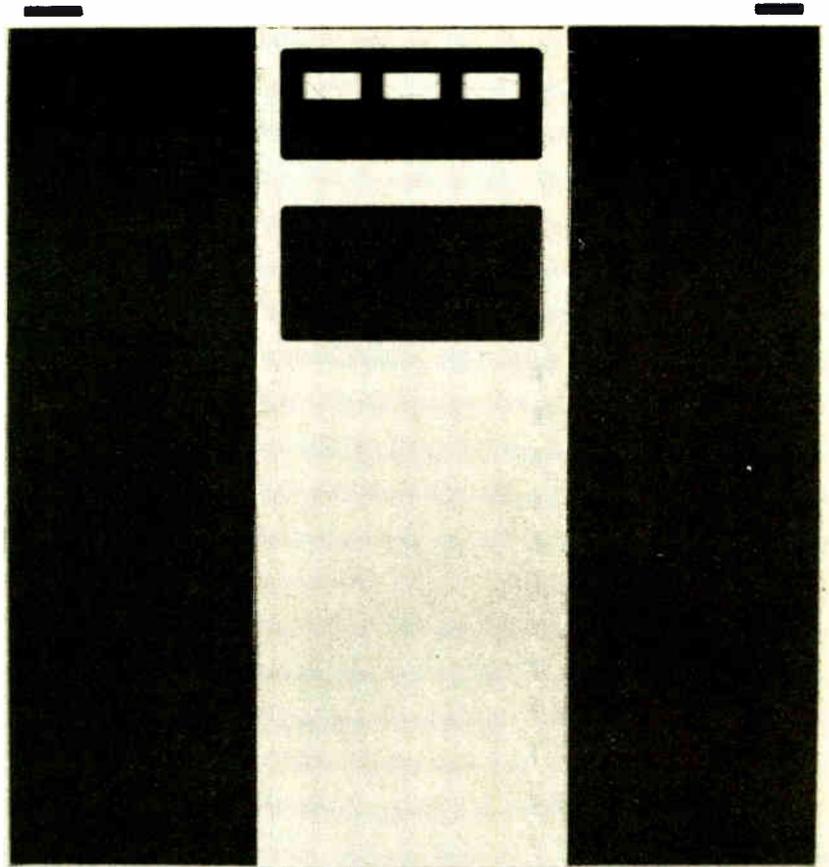
They are available by state and are supplied on floppy disk. The entire library of all 50 states and a number of international boundary files as well as search and view software are available on CD-ROM.

For information, contact Larry Ellis in Colorado at 303-344-5486; fax: 303-344-2811, or circle **Reader Service 210**.



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- *Low-cost tube complement*
- *100% peak modulation capability*



HARRIS DX 10 (c. 1987)

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Harris breakthroughs such as PSM, PDM, PPDM and the first

solid state transmitters have progressively expanded limits of reliability, performance and efficiency. And, as world standards, they've benefitted virtually every MW broadcaster—regardless of who manufactured their transmitters.

Our latest MW advance—Digital Amplitude Modulation—is again redefining customer expectations. Just ask the more than 400 users of Harris DX Series transmitters worldwide.

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FAX: 217-224-1439

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Telephone: 217-222-8290

FAX: 217-224-2764



TECHNOLOGY UPDATES

DELTA ELECTRONICS

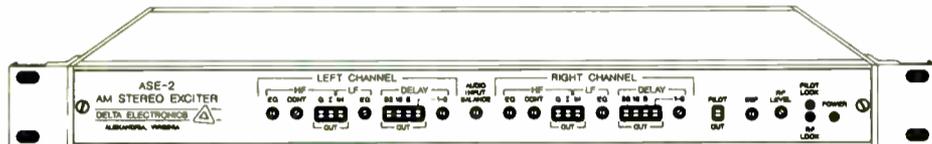
AM Stereo Exciter from Delta Electronics Helps Make Station Sound More Competitive

ALEXANDRIA, Va. Unlike the early days of FM stereo broadcasting, when stereo sound was an exciting new development, today's listeners expect to hear stereo. The Model ASE-2 AM stereo exciter from Delta Electronics converts your monophonic AM station into a more competitive, better sounding AM stereo station.

ohms audio input and output. Options for high level RF output and synchronous transmitter operation are available too.

All controls are front panel accessible, and all switches and controls are clearly labeled. The ASE-2 mounts in a single rack unit and is FCC type accepted.

The ASE-2 technical manual contains



The Model ASE-2 AM Stereo Exciter converts a station's AM transmitter to AM stereo operation as easily as possible. It provides high-performance C-QUAM stereo signals with superior separation and extremely low distortion.

Features of the ASE-2 include crystal controlled carrier frequency, standard TTL RF output and balanced 600

a thorough description of installation procedures and adjustments to assist broadcast engineers. Conservative design practices insure that the ASE-2 will provide many years of trouble-free operation.

For information, contact Joseph Novak in Virginia at 800-833-5828; fax: 703-354-0216, or circle Reader Service 62.

ADVERTISEMENT

Putting All Your Eggs In One Basket With Digital Automation

By John Schad

President, SMARTS Broadcast Systems

One thing that we have come to realize about digital automation is how important the system is to the station. It's kind of a "heart and lung" question—its hard to say if the SMARTCASTER or the transmitter is more important, because if either dies the station is off the air.

We at SMARTS Broadcast Systems have addressed that issue primarily by an extensive support system, for hardware, software, and general user problems. Our 24 hour a day support is important to our customers, who know they are only a phone call away from help.

Now SMARTS has developed a series of redundant systems that goes a step further. We have re-engineered many of our products so that a failure does not mean an off air emergency. Redundancy can range from full duplicate systems, to duplication of hard drives, to simple yet effective duplication of program and setup files.

Every full SMARTCASTER system we sell, for example, now has at least drives. A small drive that has all the programs, data, and other files needed to operate the system. The second drive is used for audio, but, it also has duplicates of the files on the first drive.

That means that if the audio drive should die, the station is still on the air with limited recording capacity. Often the audio drive can be repaired over the phone using utility programs on the system drive.

If the system drive fails, the audio drive is already set up to be a system drive. No audio files are lost, and it's often possible to use the utility programs on the audio drive to bring the system back on line.

This dual drive concept did add somewhat to our costs, but it makes for happier customers. With dual drive, the system is rarely totally down. We've built the unit with broadcasters in mind so it can be up and running fast.

Here's another exclusive from SMARTS. Digital audio was often seen as the recording of spots,

liners, and other short audio files. In fact, one of our competitors can only record about 16 minutes, there are no provisions for longer record times.

SMARTCASTER can record continuously, for the entire capacity of the drive. And we can even insert spots in the recorded material on playback! You won't find another company with these capabilities.

Here's yet another big plus from SMARTS. Our standard unit is delivered now with at least a 1 gigabyte drive. That unit can hold well over 12 hundred 30 second spots, or fewer spots and some longer programs as well. The single most expensive element in digital automation is the hard drive, and less expensive systems are often quoted with drives far too small for the average station. At SMARTS, we have increased the size of our drives many times over the years, so that stations have plenty of record time. This also helps increase reliability, because drives that are not filled to capacity are much less prone to failure.

I think these are some of the reasons that our small company continues to grow. We were neck and neck with another company in the initial development of digital audio, and the first to bring a station on line with digital automation, back in 1989. Since that time we have seen a lot of competitors spring up, but we continue to have the biggest install base in the industry, we are also selling more units each month today than ever, despite the fact that we are now one of many!

Why not find out more about how SMARTS and SMARTCASTER can be put to work in your station. We have everything to computerize your operation, including logging, billing, accounting, music selection, and of course, digital audio and automation. One great system can be put to work at your station to handle all these tasks and many more.

Contact us for more information.

SMARTS Broadcast Systems
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Emmetsburg, IA 50536
(800) 747-6278
Fax (712) 852-3061
International +1 712 852-4047



Circle (164) On Reader Service Card

ALTRONIC RESEARCH

Air-Cooled Dummy Load from Altronic Research Includes Many Features

YELLVILLE, Ark. The Altronic Research Model 6775 meets the needs of high-power transmitters through 110 MHz. This 75 kW air-cooled dummy load is designed primarily for AM transmitters and for sites that do not have water. But even for sites with water, the 6775 has significant advantages over water-cooled loads.

The load operates on stand-by. When RF is applied to the load, thermostats located in the load automatically switch on the fans when temperatures exceed their settings, preventing the load from overheating.

The load also has a built-in interlock to the transmitter, providing a direct connection to the transmitter in case the load loses AC voltage. Once the interlock has been flipped, the load signals the transmitter and prevents the load from burning itself up.

A nice feature of the 6775 is dependable VSWR while RF is applied. A slight moderation of

VSWR might be seen, but the rise should not be greater than 0.01 to 0.02. At lower frequencies, the VSWR will be at 1.1:1 or lower and at the higher end, no more than 1.15:1. In most situations, the load starts at 1.07:1, rising to 1.09:1 during full modulation.

Silver contacts on special film resistors and clips eliminate failure due to contact resistance, making superior RF performance possible.

All Altronic Research air-cooled dummy loads operate quietly. A normal conversation can be held next to the 6775 while it operates. This is made possible by a blower configuration that pressurizes the resistor chamber rather than forcing air directly over the resistors.

If space in the transmitter room is tight, the 6775 can be modified at the factory for outside operation. Louvers and a roof are installed to keep the weather out. For hostile environments, Altronic offers an extreme environment option.

For information, contact Doug Starkey in Arkansas at 501-449-4093; fax: 501-449-6000; or circle Reader Service 48.

INDUSTRY ROUNDUP

Future Strong for AM

by T. Carter Ross

WASHINGTON If Mark Twain thought reports of his death were "greatly exaggerated," it would be interesting to see what witticism he would use to describe the past few years of AM broadcasting.

"We still see AM as a viable medium in the 10-to-20-year term."

—Jorgen Jensen

Despite having FM radio steal away the limelight, much of the revenue and 77 percent of the audience, AM radio is still going strong.

Very strong

"AM just won't die and go away," said Steve McElroy at CCA Electronics. "It still is very strong."

Ron Frillman at Harris Allied points to the FCC's decision to expand the AM band, and the nearly 1,000 stations that applied for space in it, as a sign of AM's strength. He also notes the strong sales that AM stations are reporting.

"A lot of people don't want to talk about their cash cows. Look at all the top markets and the top revenue producers are AM stations," said Frillman.

David White at Broadcast Electronics would also like to see the expanded AM band take off, and more broadcasters put AM stereo into use.

"I'd like to see the receiver manufactur-

ers take more heart in the U.S. public. If it's available I think people will buy it. But even with the surge of interest in Japan, receiver manufacturers haven't caught on to AM stereo units here."

Even with the possibility of digital audio broadcasting (DAB) taking over at some point in the future, manufacturers doubted that DAB could do away with the need for AM broadcasting.

Alternative use

"Medium wave AM broadcasting may offer a low cost alternative in more remote or less densely populated areas than DAB or even FM. We still see AM as a viable medium in the 10-to-20-year term, particularly in the Third World, island areas, remote areas, etc.," said Jorgen Jensen at Nautel.

Outside of the United States, AM is an inexpensive and popular medium, and many manufacturers see the international market as critical to their marketing plans.

"Internationally, people are looking for simplicity and ruggedness, and our AM transmitters give them that," said McElroy.

For the most part, changes in AM appear to be reflecting changes in the market.

"It's not a dead medium at all in my book. I see continued interest in talk radio and growth in the AM market," said White.

"We are seeing a weeding of the industry and there's also a weeding of the manufactures in the industry—a thinning of the industry," said Frillman. "But I don't foresee a growth of new stations in North America, because there isn't a lot more space to put new stations—AM or FM."

KINTRONIC LABS

Durable and Reliable Model DL-50 AM Dummy Load Manufactured by Kintronic Labs

BLUFF CITY, Tenn. The Kintronic Labs Model DL-50 dummy load is a forced-air cooled, AM transmitter, 50-ohm terminating load capable of continuous dissipation of 50 kW plus 125 percent modulation.

The DL-50 consists of a network of

inductor-less, wire-wound resistors each of which has a thermal coefficient of ± 50 parts per million per degree Centigrade. This results in excellent impedance stability with thermal cycling.

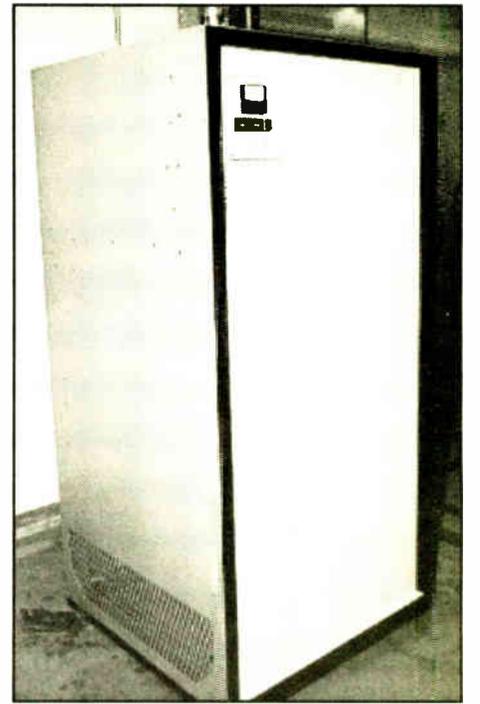
The input VSWR is less than 1.15:1 over the AM band of 530 to 1705 kHz

for the standard DL-50. The VSWR can be adjusted to 1:1 over the AM band with an optional network. The resistor network is rated to dissipate half of the 50 kW RMS power with no air flow and is capable of dissipating 62 kW for five minutes with no air flow.

An air interlock is supplied with the DL-50 to confirm air flow prior to the application of transmitter power. Also a Delta Electronics toroidally-sampled current meter with remote output is installed on a hinged, drop-down front panel to monitor the input power. Several input termination fan and motor voltage options are available.

Kintronic Labs offers convection-cooled dummy loads for 1 to 20 kW plus 125 percent modulation and air-cooled models for 25 to 600 kW plus 125 percent modulation. Kintronic loads are in use worldwide.

For information, contact Tom King in Tennessee at 615-878-3141; fax: 615-878-4224, or circle Reader Service 179.



SVETLANA

Russian Technology Is Svetlana's Secret

HUNTSVILLE, Ala. Svetlana Electron Devices of St. Petersburg, Russia, introduces a new 4CX15000A tube with significant improvements. It is a plug compatible replacement for 4CX15000A tubes manufactured in the United States, England and elsewhere.

The 4CX15000A power tetrode is used in pairs as class B modulators and as the class C high level modulated RF power amplifier stage in many AM broadcast transmitters throughout the world.

The new Svetlana 4CX15000A features a modern mesh filament, replacing the old-fashioned hairpin construction. The improved mesh filament design insures better mechanical rigidity and long lasting concentricity of the filament, providing enhanced linearity, less noise, reduced warm-up variation and longer life.

Modern mesh filament technology is used in all new, thoriated-tungsten power grid tubes. This new technology brings improved performance to the 4CX15000A.

The Russians achieved this improvement without compromising the goal of a plug-compatible, drop-in replacement, making the Svetlana 4CX15000A an exact replacement in both AM and FM broadcast equipment.

The Svetlana 4CX15000A is manufactured at the Svetlana Electron Devices complex in St. Petersburg, the largest power grid tube facility in the world. High-quality manufacturing at this factory allows the company to offer a 12,000-hour/three-year extended warranty.

For information, contact Svetlana in Alabama at 800-239-6900; fax: 205-880-8077, or circle Reader Service 166.

EEV

EEV Offers a Range of Broadcast Tetrodes To Increase Tube Life and Performance

ELMSFORD, N.Y. EEV's range of broadcast tetrodes are designed to increase tube longevity and enhance audio performance.

Every EEV 4CX broadcast tetrode is manufactured with an improved mesh filament design for long-lasting concentricity of the filament, which consequently provides better linearity and less noise. It also eliminates warm-up variations, which adds to the tube's lifespan.

EEV currently manufactures the following tetrodes for AM/FM radio: 4CX5000A, 4CX10000D, 4CX10000J, 4CX15000A, 4CX35000C, 4CW25000A and 4CV100000C.

EEV also offers direct technical assistance on a toll-free line, direct interface with the manufacturer and a 10,000-hour warranty.

For information, contact Greg Morton in New York at 914-592-6050; fax: 914-682-8922, or circle Reader Service 15.

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relentless play and extreme conditions while delivering the industry's finest cassette performance day after day. Choose the 122 MKIII. It not only cures tension headaches, but may eliminate your heartburn, as well.

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Contact John Harter at
Phone: **800-854-1999**
FAX: **619-566-0140**

Chrontrol Corp.

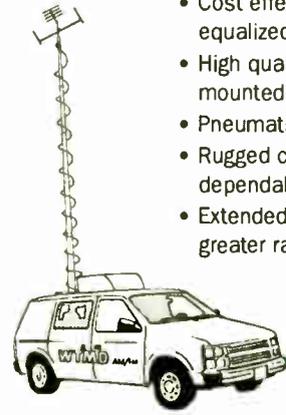
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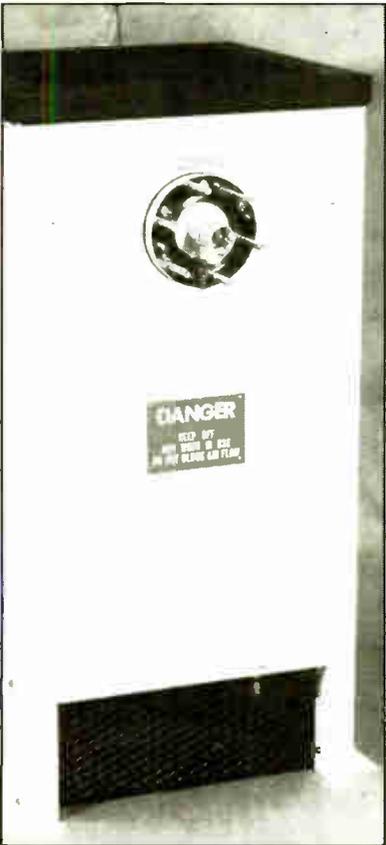
READER SERVICE NO. 147

ELECTRO IMPULSE

Conservatively Rated AM Dummy Load from Electro Impulse Requires No Tuning

NEPTUNE, N.J. Dummy loads for AM transmitters involve special considerations for proper selection.

Power rating is of utmost importance. AM transmitters are normally rated in terms of carrier output, but dummy loads must be rated for the full carrier plus 100 percent modulation. **Electro Impulse Laboratory Inc.** loads are conservatively rated so no further upgrade of the power rating is necessary.



Power measurement techniques normally associated with coaxial line and higher frequencies cannot be used on AM. For example, most directional coupler type wattmeters are not normally rated for use below 1750 kHz.

For power measurement in the AM band, a voltage divider type circuit is available as an optional feature on many Electro Impulse loads. In this circuit, a part of the signal is attenuated by a voltage divider network and then rectified with a diode. Then a meter circuit is carefully matched and calibrated to the network impedance. This type of power measurement circuit is FCC type accepted.

AM loads are available with many different types of cooling including convection, forced air cooled and liquid cooled. Convection and forced air cooled are generally preferred for AM service and are readily available.

Electro Impulse loads for AM service use broadband matching techniques and do not utilize expensive tuned circuits—no tuning is required.

For information, contact Mark Rubin in New Jersey at 908-776-5800; fax: 908-776-6793, or circle Reader Service 119.

CHRONTROL

ChronTrol XT Timers Provide Accurate Switching for Antenna Pattern Changes

SAN DIEGO Originally designed to meet the stringent requirements of scientific laboratories—accuracy to the second, programmability and dependability—ChronTrol XT Rack-Mount Timer provides accurate, error-free switching for FCC-mandated AM antenna pattern changes.

Many timers automatically switch a relay at two specific times each day all year long. The ChronTrol XT automatically switches a relay twice a day at two specific times and automatically changes those times each month. As many as four pattern changes can be performed per day, and the two to 16 20-amp relays can be switched with either latching or

momentary contact.

The XT's clock achieves its accuracy by referencing either the line frequency or an internal crystal, depending upon the accuracy and reliability of the power source.

All XT models can be operated manually or via programs. The 24-key keyboard provides on-site programming and an RS-232 serial communications port facilitates remote programming using standard communications software and modems.

In models equipped with the "input" option, relays can be opened and closed,

and programs executed, in response to switch closures from external signal devices. A locking keyboard uses a four-digit code to prevent unauthorized access or accidental entries that might disturb critical operations. A battery backup protects the internal clock and system memory for up to 14 days.

All XT timers are backed by a one-year, unconditional

warranty and free technical support. ChronTrol also offers free programming of your timer at the factory to your FCC-mandated change timetable.

For information, contact John Harter in California at 800-854-1999; fax: 619-566-0140, or circle Reader Service 77.



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Robert Reymont, KVMY, Phoenix, AZ

"It's truly amazing to drive 120 miles from the studio, hear an FM broadcasting with a totally quiet signal, and know it originated five hops back."

Jim Travis, Family Life Network, Bath NY

"The DSP 6000 allowed us to run both our FMs from one studio over one STL. We got cost savings and digital fidelity."

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Econco Rebuilds Power Tubes for Considerable Cost Savings

WOODLAND, Calif. The 4CX5000A, 3CX2500F3 and 3CX3000A1 power tubes can be rebuilt to new tube specifications for considerable savings.

Econco Broadcast Service provides power tube rebuilding for first-generation tubes used by many AM broadcast transmitters. These tubes and transmitters are still in wide use due to their reliability and efficient output.

Throughout its existence, Econco has tested and evaluated the failure modes of every tube sent in for rebuilding. The extensive data base of information collected allows us to incorporate the latest improvements into every tube rebuild.

Econco's advanced rebuilding techniques provide tubes that equal or exceed the performance and life of newly manufactured tubes.

Econco purchases dud tubes of all types from stations.

For information, contact Econco in California at 800-532-6626; fax: 916-666-7760, or circle Reader Service 6.

PENTA

Penta Laboratories Tubes Make Use of New Process of Power Grid Development

CHATSWORTH, Calif. Penta Laboratories manufactures and distributes all types of electron tubes used in broadcasting worldwide.

Recently, Penta has participated in improving the standard AM broadcast tube types. New advancements for extending transmitter tube life have been developed, such as the graphite anode of the 3-500Z and 4-400A, a new process of developing grid wire where platinum

is applied to reduce secondary grid emission, as well as new vacuum pump down techniques. Increased tube life saves valuable time and money.

New developmental tube types ranging up from 3CX1000A7 will be introduced this year with warranties exceeding the current industry standards.

For information, contact Penta in California at 800-421-421-19; fax: 818-882-3968, or circle Reader Service 74.

People, Promotions and Appointments

CBSI/Custom Business Systems Inc. expanded its staff. **Joe McDonald** joined CBSI as division manager of its digital audio division. The division is developing a digital broadcast management product called Digital Universe.

Karen O'Rourke joined CBSI in the newly created controller position.

Crown International named **Terry Hammond** its president and chief operating officer. **Clyde Moore** was appointed chairman of the board and chief executive officer.

Digital Cable Radio (DCR) promoted **Valerie J. Nay** to affiliate marketing manager. Her responsibilities include managing marketing and training activities for large DCR affiliates located throughout the western U.S.

Galaxy Audio appointed **Marc Chover** to the newly created post of national sales manager.

Company News

Audio-Technica recently named **JAMM Distributing** as its representative of the year for 1993. JAMM won the Samurai award for selling the largest percentage over quota in its Minnesota territory.

Broadcast Data Systems (BDS) opened new offices in Los Angeles and Chicago. The Los Angeles office is supervised by John Ferrari while Jeffery Swanberg heads the Chicago office. BDS offers media intelligence and airplay recognition services.

The Los Angeles office is located at 5055 Wilshire Boulevard, Los Angeles, CA 90036; phone: (213) 525-2257.

The Chicago office is located at 936 Merchandise Mart, Chicago, IL 60654; phone: (312) 464-0880.

Sharp Communications in Huntsville, Ala., expanded its sales efforts to include radio and television broadcasters. Sharp is an official distributor for **RF Industries**, and also offers **Telewave** site management equipment and **Whelen** safety and warning signals.

Digidesign released its financial results for the third quarter of fiscal 1994. In the quarter, net sales of \$7.3 million and a net income of \$951,000 were generated.

By comparison, Digidesign generated \$5.2 million in net sales and \$614,000 in net income in the third quarter of 1993. This represents an increase of 40 percent

in net sales and 55 percent in net income.

U S West Inc. contracted to use **MLJ Inc.**'s PathGuard Plus software to design its preliminary PCS systems for pre-PCS auction market evaluation.

Firehouse Productions Inc. was appointed the U.S. distributor for **Garwood Communications'** Radio Station in-ear monitoring system. The Radio Station provides a performer's monitor mix via in-ear headphones plugged into a personal radio receiver.

Scientific-Atlanta Inc. was named the exclusive supplier of satellite earth terminals for **Motorola's** IRIDIUM global communications system project.

Ampex Recording Media Corp.'s Opelika, Ala., tape manufacturing center was approved for registration of its

Quality Assurance system in accordance with the International Organization for Standards (ISO) 9002.

This certification indicates that Ampex has demon-

strated a quality system capable of producing magnetic tape products consistent with the stated specifications and standards.

The **North American Capacitor Co. (NACC)** formed a strategic alliance with **Microelectronics Ltd.**, a capacitor manufacturer located in Rishon Le-Ziyyon, Israel. NACC is the sole selling agent in the U.S. for Microelectronics products, which will be sold as Mallory/Microelectronics.

Best Power Technology Inc. expanded its basic warranty program. The warranty now assures that all Best products are compatible with commercially available computer equipment with enclosed power supplies.

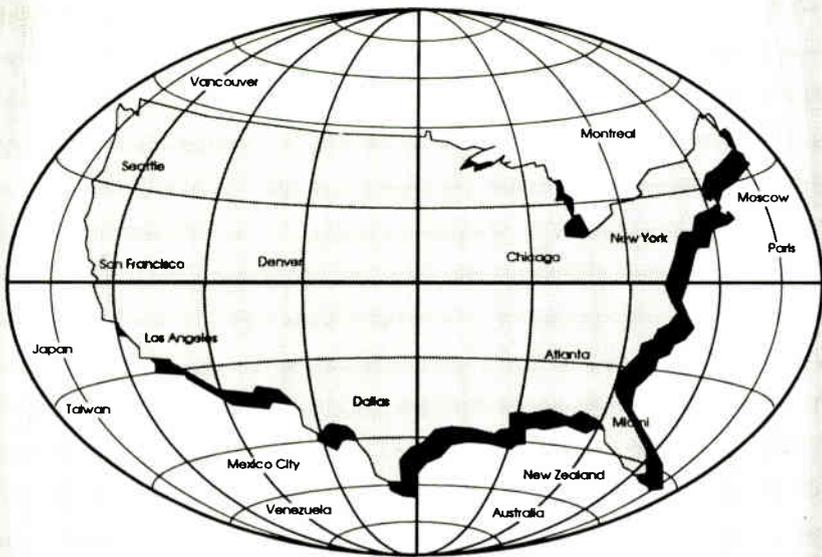
Wegener Communications and **News Datacom** agreed to jointly develop and market encrypted transmission systems. The alliance will result in full encryption capabilities for Wegener audio and video products using News Datacom's smart card-based conditional access system.

CORRECTION

The correct contact information for the Arrakis Track* Star, featured on page 89 of Feb. 23 RW, should have read **Jon Young** in Colorado at 303-224-2248; fax: 303-493-1076.

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AMPLIFIERS

Want To Sell

Crown DC 300A silver face stereo power amp, \$350; Hafler P-30 stereo power amp, \$375; McIntosh MC-60 tube power amp, \$400; Southwest Tech stereo power amp, \$95. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Heidrick KY 40949. 606-546-6650.

McIntosh C-22, MA-230, Scott, Dynaco. K Gutzke, 612-866-6183.

Perma-Power S-102 amp w/S1420 batt pack, mobile/portable PA unit, 12 W out, excel cond, \$100. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

MAP AB-49 power amps (2), \$200; Ramko DA-6BR/E, DA's, recapped \$210; LEL DA's, \$225. M Guthrie, WFNS, 813-620-9100.

Crown D-75 audio power amp, \$500; Gentner routing DA; \$1000, MAP 7822 DA, \$250. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0110.

New 10 kW FM amp under \$24,000. Call for details. Bill Hoffman, 518-743-1601.

Dynaco stereo 120 solid state, rack mt \$229, Dynaco stereo 70 tube amp all new tubes! Dynaco PAT 4 preamps \$59. W Gunn 619-320-0728.

Want To Buy

Western Electric pore amp working or not & output transformers for same. RQ Studio, Larson Rd #4, N Reading MA 01864. 508-664-0174.

ANTENNAS/TOWERS/CABLES

Want To Sell

Jampro 3-bay high gain antenna at 102.1, \$1500. E Seeger, WMXT, 2704 S Irby St, Florence SC 28505. 803-661-5000.

Towers (5) 380', 24" & 30" face, complete w/ights, some addtl hardware, on ground, ready to ship. J McClish, WCRJ, POB 92251, Austin TX 78709. 800-856-5670.

ERI 37CP5 5-bay FM antenna, tuned to 93.7 MHz, recently rebuilt, \$1500; Myat 3" rigid transmission line, 20' lengths, incl bullets, hangers, some elbows avail, 320' avail, \$150/section. C Hudak, WBZZ, 1715 Grandview Ave, Pittsburgh PA 15211. 412-381-8100.

ERI 2CPLFM 2-bay w/radomes tuned to 91.5 MHz, \$2000. KC Hill, AECC, POB 2061, Bristol TN 37621. 615-878-6279.

MCI 61104 3 1/8" motorized coax switch, never arced, great shape, \$1000. C Hudak, WBZZ, 1715 Grandview Ave, Pittsburgh PA 15211. 412-381-8100.

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. **214-335-3425**

ERI FMH-10AC 10 Bay Antenna CP tuned to 105.5, \$35,000 new, will sell for \$19,500. M Wodlinger, WIXI FM, 3337 Tamiami Trail North, Naples FL 33940. 813-282-1000.

Jampro/Cetec 2 bay 10KW FM ant tuned to 102.3 MHz; Ed, WCVF, 802-728-3608.

Andrew A 10R 50507 1 5/8" coax, 275' rolls (5). S Ross, Quinn Broadcasting, 733 N Green St, Brownsburg IN 46112. 317-852-9119.

AM phaser parts (3) 3-pole J-jack, 15 amp, (3) 20 MHz coils w/standoffs & shorting clips, (3) 292 ser mica caps, .0005 w/flanges. R St James, WOBM, 46 Clayton Rd, Howell NJ 07732. 908-269-0827.

Windcharger 200 100' 45G twr on the ground inc guy wire, \$1200. J Kessler, WOBZ TV, POB 220, Livingston KY 40445. 606-843-9999.

Electronics Research SHPX-8 8 bay 100kW xmting antenna, \$10,000; Andrew HJ11-50 50 ohm 4" coaxial line, 900', \$4500. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0110.

Want To Buy

3-bay antenna tuned to 90.7 MHz, no radomes. K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055. 405-658-2556.

4 or more bay antenna tuned to 90.1 MHz needed for educ FM upgrade. KC Hill, AECC, POB 2061, Bristol TN 37621. 615-878-6279.

AUDIO PRODUCTION

Want To Sell

dbx II 140's, 142's, 148's bdct NR, excel cond. M O'Drobinak, 619-758-0888.

Micro-Trak 7216 stereo audio DA, 2 in 12 out in 1-3/4" rack mount, individual output controls for ea output (4), \$150 ea. S West, KMXR, 1 Gaslight Sq, Corpus Christi TX 78404. 512-886-6153.

Pultec HLF-3C filter, \$125. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Heidrick KY 40949. 606-546-6650.

Ashly SG35E 4-chnl noise gates (4), \$225/ea. J Anderson, Regent Univ, 1000 Centerville Tpke, Vir Bch VA 23464. 804-523-7417.

Valley 400 mic processor, like new cond, \$400 plus shpg; Ashley PQ-26 stereo parametric six band EQ, excel cond, \$425 plus shpg; BBE 442 audio enhancer, excel cond, \$150 plus shpg. S Herring, Matt-Mark Audio Prod, 4709 N Cleveland, Kansas City MO 64117. 816-452-7260.

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Eventide BD-941 bdct delay line w/3.6 or 12 second delay, \$850. R Chambers, 916-257-2121.

JVC 4-DD-5 quadrophonic disc demodulator, low hrs, \$50. D Pulwers, 310 N Howard St #103, Alexandria VA 22304. 703-751-9346.

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dbx 180A type I NR (3), \$35 ea; dbx 224X type II NR (2), \$25 ea; CRL CC300A composite controller, \$35; CRL SMC 600A stereo mod controller, \$30. M Everhart, KXYQ, 111 SW 5th #1550, Portland OR 97204. 503-226-6731.

Orban 111B reverb unit, \$480; Orban 245F stereo synthesizer, \$250; Orban 622B stereo parametric equalizer, \$450; Orban 222A stereo spatial enhancer, \$550; Orban 290RX processor, \$1000; Orban 536A sibilance controller, \$550; Valley 400, mic processor, \$340. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0110.

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AKG BX-10 reverb, XLR in & out, \$100; Delta Lab DL-1 delay line, \$95. M Guthrie, WFNS, 813-620-9100.

ADC 96 & 144 Pr TT patchbays, excel cond, 1 rack space, 3 rows of 48, top 2 rows normalled, \$149, 96 is 2 row normalled, \$129 (you remove old wiring) or we totally refurbish w/new front panel, ready to install, \$199-229. TT cords up to 10 per bay at \$9 ea, reg \$13.95, also 1/4" bays. Audio Village, 619-320-0728, or Fax 619-320-2454.

Demeter 4 ch rack mt tube direct box NEW \$795. W Gunn 619-320-0728.

Want To Buy

Audio level control equipment. J Mitchell, CVPI, POB 1046, Alexander City AL 35010. 205-234-0426.

Fairchild 600 conac or 602 Conex high freq limiters. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

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AUTOMATION EQUIPMENT

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Format Sentry FS12 C, 48 tray IGM instacart, (4) ITC R-R plybcks, 1000 SL Tandy computer, DMP Tandy printer, DRS uninterruptible pwr sply, Spotmaster R/P machine w/25Hz tone alert & (2) 6" racks to mount, excel cond, will sacrifice for what is owed on equip, will consider selling all or part of equip. A Terry, 703-647-8493.

Sentry Systems cntrl/interface w/16 Pioneer PD TM3 CD plyrs, XT computer, complete AC CD library & Computer Concepts DCS, all under 1 yr old, \$26K or sep. M Rollings, Rollings Comm, POB 882, Chesterfield MO 63006. 314-458-5595.

SMC automation system, w/SSP 3060 stepper, AS-10 switcher, time clock, (2) 700 Series single play cart decks, (3) Carousels w/(3) RAC-50 random access controllers, (4) Scully 270 tape decks w/outboard tone sensors, all in (4) matching racks, \$1200. B Williams, KOOL 106.1, 918-455-9522.

IGM-SW automation cntrl, IGM update w/4 Go-Cart 24 interfaces, manuals & software, \$1800. E Duellman, WOMT/WQTC, Box 1385, Manitowoc WI 54221. 414-682-0351.

SMC DP-2 complete system. D Barron, KWJM, 113 N Main, Farmerville LA 71341. 318-368-3094.

SMC ESP-1 452 Carousels (4), brain, switchr, clock, 1 rack, 2 vid mon. R Statham, WHLG, 1000 NW Alice Ave, Stuart FL 34994. 407-692-1000.

Scully 100 sm automation sys will run 2 reels & 1 cart mac, gd for non-commercial stn, \$400 B/O. J Kessler, WOBZ TV, POB 220, Livingston KY 40445. 606-843-9999.

Henry Eng Net Commander, GC w/doc-umentation, replaced by hard disk sys. G. Manfroi, WMAY, 502 S Allen St, Spaulding IL 62561. 217-629-7077.

Sentry FS12C automation w/ctrlr interfaces for 16 Pioneer 18 play decks, automation & Pioneer decks less than 1 yr old, priced tog or sep, \$11,500. M Rollings, Rollings Comm, POB 882, St Louis MO 63006. 314-458-5595.

SMC MSP-12 comp automation system, 3 Carousels, 3 decks, DAS-12 switcher, \$6500. M Jarvis, KORC, POB 1419, Waldport OR 97394. 503-563-5100.

Want To Buy

Time announce carts. D Tabor, WLCK, Box 158, Scottsville KY 42164. 502-237-3149.

Complete studio w/(2) R-R, (2) cassette, (2) CDs, mics, console, automation equip, etc, must be in gd cond, missionary station, \$3000 plus donation receipt for the difference. K Leatherwood, Believers Bdctg, POB 1776, Terrell TX 75180. 214-524-1956.

Conex 25 Hz tone gen. Howard, KDAP, Douglas AZ 85609. 602-364-3484.

CART MACHINES

Want To Sell

Quality Reconditions/Repairs w/warranty from Electro Audio/Video. Call Mark O'Drobinak for free estimates. 619-758-0888.

Sparta 300 P mono cart mach with 1 kHz cue PB, home made record electronics, \$150/Best Offer. R Perrine, Imagination Indust, 2475 State Rd Ste 22, Cuyahoga Falls OH 44223.

Audi-Cord DL stereo 2-tone R/P, \$1000; 4 playbacks, \$650/ea. C Binder, WZOS-FM, 38 E Bridge St, Oswego NY 13126. 315-342-9600.

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Sennheiser HD-440 II stereo headphones -	NEW	\$ 1,995
Eventide H-3000B harmonizer - (1 only)	NEW	\$ 399
Marantz PMD-500 stereo cassette deck -	Rebuilt	\$ 995
Valley 610 Stereo Compressor/Limiter	Rebuilt	\$ 395
Harris AM-90 AM MOD Monitor (current model)	NEW	\$ 395
Harris CC-II Mono RP Cart Machine - Closeout -	Rebuilt	\$ 2,995
Otari MTR-10 Reel to Reel	Rebuilt	\$ 259
CRL 'DYNAFEX' DX-2 Stereo Noise Reduction -	Rebuilt	\$ 1,295
Marti MW-500 Microwave booster amp -	NEW	\$ 75
Orban RET-27 Kit. Updates 8100A to 8100A/I -	Rebuilt	\$ 1,195
Tepco J317 10 Watt FM translator -	NEW	\$ 99
Micro-Trak 303 tone arms -	Rebuilt	\$ 1,295
Fidelpak CTR-14 Stereo R/P cart machine -	Rebuilt	\$ 895
Fidelpak CTR-12 Stereo Play cart machine -	Rebuilt	\$ 895
Marti RPT-40 40 Watt RPU transmitter -	Rebuilt	\$ 895



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Fidelipac/Dynamax CTR-12 stereo-play w/all tones, new, never used on air, \$850. D Igou, KCHL, 8435 Twister Oaks, Garden Ridge TX 78266. 210-651-9049.

ITC Erase Splice Finder (2), one gd con, one needs work. R Statham, WHLG, 1000 NW Alice Ave, Stuart FL 34994. 407-692-1000.

ITC PD2 mono PR cart deck, mint condition, \$700. E Finley, Genesis 2000 Std, 4101 W Union Hills Dr, Glendale AZ 85308. 602-978-8092.

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Spotmaster 505-C, good condition, loaded, mic preamp, aux tone, cue edit, R/P, \$125 + s/h. G Gibbs, KMNS/KSEZ, 901 Stueben St, Sioux City IA 51102. 712-239-3966.

Rapid Q mono cart player, \$95. G Dunn, No Cal News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

Spotmaster 500 R/P (2), 1 excellent condition, \$500; 1 good condition, \$300 both mono, lever type, \$700/both. K Stevens, In House Audio, 5354 Cortez Ct, Mobile AL 36609. 203-666-4232.

ITC 3 deck stereo, all tones (2), gd con, 1 ITC st R/P. R Statham, WHLG, 1000 NW Alice Ave, Stuart FL 34994. 407-692-1000.

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ITC 750 clean, \$100; Magnacord 1021 (2), \$100/ea. D Swanson, 712-252-4621.

Want To Buy

ITC Delta stereo P/B machines. D Irwin, KSOL, 55 Green St, #200, San Francisco CA 94111. 415-616-5768.

ITC, BE, Fidelipac cart machines: single, triple, mono, stereo, play & record/play. Call M O'Drobinak @ 619-758-0888.

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Want To Sell

Scully 280 1/2 trk stereo w/motion sensing, in roll-around console, having trouble getting sufficient erase current to erase head, otherwise works fine, \$900. R Stopher, 3600 Kiki Ct, Louisville KY 40219. 502-969-1942.

Metrotech 525P R/R PB deck, stores w/2 preamps, \$300/BO. R Parrine, Imagination Indust, 2475 State Rd Ste 22, Cuyahoga Falls OH 44223.

Tascam 32-2, 7-15 ips, excel cond, \$550/BO; Ampex ATR100 4 speed 1/4" w/extra cards & alignment tapes, \$4000. Z Nicall, Semendria Studio, 6404 Hollywood Blvd #410, Hollywood CA 90028. 213-464-2145.

Studer B67's (2), 3-3/4, 7.5, 15 ips, 1/4", 1/2 trk, excel cond. M O'Drobinak, 619-758-0888.

Otari ARS-1000 (3) w/tone sensor boards in Gates rack, \$1000/all. B Williams, KOOL 106.1, 918-455-9522.

Otari MX 5050 MK III 2 trk, stereo, excel cond, \$1050; MCI JH 110A 2 trk 7.5-15-30 ips console mt, \$750; Scully 280-1 FT MT, \$350. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Heidrick KY 40949. 606-546-6650.

Ampex 440 (4) wrkg mono machines, many spare parts, \$300/ea. D Kannes, KTAR/KKLT, 301 W Osborn Rd, Phoenix AZ 85013. 602-274-6200.

Ampex AG440/350, several units, PB only, great for parts, BO; ITC 770 stereo PG, gd cond, \$650. R LaFore, WSHH, 1459 Crane Ave, Pittsburgh PA 15220. 412-531-9500.

ITC 99B, like new, only used in home, \$4200; (2) ITC SP units, 3 tones modified w/Straight Wire Audio cards & 99 PB heads, like new, \$700 ea. Dave, Capital Cities ABC, Detroit. 313-435-3932.

Revox A77 MK1 original A77 case with speakers, 10" reel adaptors, 3 3/4" - 7 1/2" quarter track, almost new, \$395/Best Offer. D Bisbee, 685 S Roys, Columbus OH 43204. 614-279-6163.

Ampex MM1200 8 trk remote, \$4500; Otari MTR10-2C stereo, \$3500; MCI Sony JH110B in console, \$1595; MCI Sony JH110A in console, gd cond \$1095; MCI JH110B mono, \$595; Ampex AG350 stereo, excel cond, \$495. J Price, 214-321-6576.

Tascam 38 8 trk R/R, 1/2", pitch cntrl, incl dbx NR, remote, rack, more, \$1850 neg. Rich, 404-534-1000.

Akai GX 40000 1/4 track, 3 head R-R (2), \$75 each; Akai GX 9 3 motor 3 head cassette deck, \$50; Toshiba PC G30 2 motor 2 head cassette deck, \$30. G Dunn, No Cal News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

Dictaphone 5600 logging reel machines & controller (2), BO. R LaFore, WSHH, 1459 Crane Ave, Pittsburgh PA 15220. 412-531-9500.

Inovonics 375 R/P amp unit, missing VU meter but checks ok, \$200. L Beigel, On-Cue, POB 85042, Hollywood CA 90072. 800-726-9813.

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Sony S600 (2) 3/4 mac, both in gd shape, \$1000 ea or B/O. J Keeler WOBZ TV, POB 220, Livingston KY 40445. 606-843-9999.

Otari MK-III 8-trk, new-never used, w/new CB116 auto-locator, \$4500. T Hicks, KUGN-FM, 4222 Commerce, Eugene OR 97042. 503-485-5846.

Technics 4 trk R/P (3), exc con, \$2500 for all 3; Otari MX5050, PB only (2) \$1000 for both. S Cohen, KIHX, POB 26523, Prescott Valley AZ 86312. 612-775-5277.

Sealed bid sale of open reel recorders, cart recorders & players, cassette units, carts, reel tape & related mats, bid open May 18, 1994, send SASE w/52 cents postage for bid info to: Sealed Bid Sale 051894, c/o Benchmark Comm Corp, 4700 SW 75 Ave, Miami FL 33155.

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Nashville, TN 37203 (615) 244-6892

Fostex MY250R00 capstan motor for 250 4-track cassette deck, BO/trade. E O'Brien, Imperial Sound, 383 N Studio St, Terra Haute IN 47803. 812-877-4663.

Ampex AG-440C, full track, like new cond, w/manual, \$500 + shipping. M Johnson, Production Masters, 413 Alienberry Dr, Pittsburg PA 15237. 412-487-5513.

Sony PCM 2500 DAT machine, VGC, w/new hds & update mods, \$900; Revox 1/4 trk, VGC w/bit-in spkr con, \$400. H Fair, 312-784-1558.

Marantz vari speed portable cass rec, battery or AC, \$200. R Edwards, 1750 30th Street #222, Boulder CO 80301. 719-630-1452.

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

Exper jock, CHR bkgrd in NY mkt, great voice, quick wit, excel board & prod skills, will relocate, air check avail. Jim, 201-768-3709.

Exper Afro-Caribbean Christian bdrct seeks announcer/prod or PD pos w/serious minded religious station in AK or SE region. Carlos, 305-674-1249.

Hands on Engrn w/over 30 yrs of AM/FM/TV. MF/HF/UHF bkgrnd, desires pos w/mtl SW bdrct facility, FCC Genl SBE Cert, IEEE, AE Degree. Lou, 904-383-8457.

Exp young bdrct seeks sports talk/announcing, ctry, alt, etc, deg in comm. Brian 503-228-1792.

Combo Chief Engrn, announcer, sales, prod, Tampa Bay area or other good coastal Florida location. Bill, 813-844-3823.

Exp Radio Personality seeks PD/Prod for CHR or A/C frmt stn, med or large mkt prof. John, 904-683-9059.

Prod co seeking paid radio, TV narration assignments. R Suraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550. 914-561-5866.

Country music library comes with me, exper GM, PD & DJ in country music radio, I know country music. David, 407-981-0104.

Inside sales coordinator, 4 yrs exper, proven track record, gen new business, past accts, coordinate/ schedule outside reps. Mark, Orange Co NY. 914-344-1118.

Can do it all, experienced xmtr, studio & digital automation engineer seeking contract maintenance engineering work in north central Texas, FCC licensed/EET/certified. Dave, 214-410-1717.

Agree exper isn't only yrs, tapes? F/T announcing, programming aspirations, computer literate, in radio since 1980 P/T announcing, mktg exper, serious only. Janet, 502-895-5888.

Small mkt PD/announcer/news avail, 8 yrs exper, top sound, dependable, hard-working, avail immed, will relocate. S Elliott, 904-757-6397.

Country Only! Current morning AT/MD, topical, humorous, telephone, animal attraction. Mike, 510-988-9005.

12 yr eng/prog/prod looking for exciting new pos in radio, exper at KITS, Live 105 in SF & KFAL classical in LA, will relocate. Bruce, 415-388-9005.

Research specialist seeking paid assignments. R Suraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550. 914-561-5866.

Former Christian grp GM avail, hands-on style, applications, acquisitions, engineering, sales, more. T Sauceman, 3929 Hwy 74, Gonzales LA. 504-647-8907.

Combo Chief Engineer/PD/Announcer/Sales/Prod, Tampa Bay area or other gd coastal FL loc. Bill, 813-844-3823.

CE w/big production voice & over 15 yrs hands-on eng exp seeks CE pos w/prod, strong troubleshooting, RF & computer skills. G Morgan, 704-563-6676.

Help! Enthusiastic annr stuck on mid-nights who way up, 4 yr deg in bdrctng, prod skills, very versatile, fast learner. Paul, 606-473-7622.

Radio Announcer seeks position in CHR or AC format, also expand in talk radio, currently work Sunday AM jazz program for A/C station. John, 904-683-9059.

Broadcasting Graduate seeking on-air position, good production skills, FCC Gen/Ship, Radar End Asst Engineering experience. CD Hamlin, 606-528-5460.

HELP WANTED

CHIEF ENGINEER: Immediate opening for Chief Engineer for 5 Class C FM radio stations in one of the most attractive small cities on the East Coast. Minimum of 5 years experience required; S.B.E. certification and an Associates or Bachelors degree in Electronics would be a plus. Knowledge of high power Continental and Harris FM transmitters is essential, along with the ability to troubleshoot audio and RF equipment to the component level. Stations are currently upgrading from analog to digital in both production and on-air environments. The successful applicant will function as Chief Engineer for three licensees (1-NCE-FM, 2-Commercial FM com-bos), while being retained as a full-time employee of NPR affiliate WHQR-FM. Salary \$30-35,000, full medical package, optional retirement plan. EOE, M/F/H. Please send resume with at least 3 professional references to:

Michael Titterton
General Manager
WHQR
1026 Greenfield Street
Wilmington NC 28401

HELP WANTED

SOFTWARE ENGINEER

A leading manufacturer of Broadcast Live Assist Products has an immediate opening for a Software Engineer to work on the next generation of tools for the radio industry. What we want is someone who knows radio and knows what features should be implemented in live assist, automation, and hard disk systems; and who wants to help build products that meet those needs. Degrees and years of experience are not our most important job requirement. What we look for is someone who loves computers and radio, is always learning and improving, hard working and a team player.

Our products are Windows based, so a strong knowledge of the current generation of programming tools for Windows is required, including Microsoft Visual Basic, Visual C++, Access, and third-party custom controls.

If you think you have what it takes, send your resume and samples of your prior work in confidence to: PO Box 18838, Memphis, TN 38181.

WNNX-FM Atlanta seeks a FT Ass't Engineer. Experience with transmitters, Studio Eq, IBM Compatible PC's and LAN's. Reply in writing with salary requirements to:

Vic Jester, WNNX-FM
3405 Piedmont Road, Ste 500
Atlanta GA 30305 E.O.E.

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CASSETTES/R-R...WTS

Otari MX5050B, 1985 new, 2 trk, gd cond, minor repair needed to headphone jack, sounds incredible, will ship to you, \$750 OBO. L. Ballance, KFI/KOST FM, 8837 Grove Ave #312, Rancho Cucamonga CA 91730. 909-949-1744.

Revox A-77 very gd cond, stereo 7.5 & 3.75 ips, \$225. G Gibbs, KMNS/KSEZ, 901 Stueben St, Sioux City IA 51102. 712-239-3966.

Ampeg AG-440B 2 trk R/R, R/PB (2), 1/4", 7.5/15 ips, in roll around racks, both \$1000. Rich, 404-534-1000.

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Tascam 22-2 (2) 7" R/R, \$150 ea; Akai GX-4000, 7" R/R, \$125; Teac A-450 cass deck, \$100; Otari extender brd ass'y #PB-7JEA, \$125. M Guthrie, WFNS, 813-620-9100.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 4646 Houndshaven Way, San Jose CA 95111. 408-363-1646.

Otari 5050 MK III-8 trk, heads excellent, \$2450. Wayne Gunn 619-320-0728.

16 track 2" \$3450, MCI JH110C-8 \$2800, 110C-8 play only \$500, ATR800 mono or Tascam 7300 or 2502 \$600 ea, MCI Locator III \$1195, Tascam 52 2 trk \$1200, Ampeg AG350 electr \$50/ch. W Gunn 619-320-0728.

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Otari Mark II-IV 1/2" 4-track, multi-track, mint, less than 50 hours, Best Offer. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Recordex 6 cassette rewriter \$100; Tascam 40-4 4 trk 10" in flight case w/free dbx \$750; MRL new short test tapes \$39 for 1/4" to \$199 for 2". W Gunn 619-320-0728

Want To Buy

Any model splice finder-eraser, in working cond. B Sims, KVSF, 1311 Calue Nava, Santa Fe NM 97505. 505-982-2666.

Ampeg ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

Spotmaster TP-60B tape timers from cart tape winders (TP-1A or TP-1B). Mel Crosby, 408-363-1646.

Ampeg tube recorders and mixers. W Gunn, 619-320-0728.

Tascam 58 1/2" 8 trk wanted to buy or trade for Otari 5050 MK III-8 or...? Wayne Gunn 619-320-0728.

CD PLAYERS

Want To Sell

Denon DN-950FA CD cart machines (2), need some work, \$600/BO. C Pace, Evangel College, 417-865-2811 ext 7364.

Denon 950FA, like new, \$975. R Nelson, KKRW, 10333 Richmond, Houston TX 77042. 713-780-0937.

Technics SL-P1200 (3) CD plyrs, all wrkg cond, \$800/ea. C Hudak, WBZZ, 1715 Grandview Ave., Pittsburgh PA 15211. 412-381-8100.

Studer A-727 (2), bdc't quality, 5 yrs old, well maintained w/manual, \$450 ea/\$800 both. M Meyer, WWCK, 3217 Lapeer Rd, Flint MI 48503. 810-744-1570.

Revox 225 CD plyr in GC, \$450. H Fair, 312-784-1558.

COMPUTERS

Want To Sell

Epson FX-100 Mdl P10FA wide carr printer, \$75. M Guthrie, WFNS, 813-620-9100.

Tandy 6000HD w/at least 1 floppy drive. Mel Crosby, 408-363-1646, FAX 408-363-0957.

Exabyte EXP-8505 10 gig 8mm tape backup, int half height, 5 1/4" SCSI-2 drive, \$1495. G Wachter, KFYI Radio, 602-258-6161.

CONSOLES

Want To Sell

Sparta A-16R 5 chnl news console w/cues & mon, excel cond. M O'Drobinak, 619-758-0888.

Audiotronics 110-A 4-track & 2-track mixing console, 18 inputs, EQ modules, power supply, extra modules, manual, \$1200. D Kannes, KTAR/KKLT, 301 W Osborn Rd, Phoenix AZ 85013. 602-274-6200.

Radio Shack disco mixer, 3 mic, 2 line, 2 TT inputs, \$50. G Dunn, No Cal News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

Shure FP-31 3-chnl mono mixer/case, used, gd cond, \$350. Raider Prod, 215-889-9565.

BE 5M150 Series used as prod brd, gd cond w/manual, \$250. K Paul, WKXD, 259 S Willow, Cookeville TN 38501. 615-526-6860.

RCA BC8A dual-chnl, solid state, self contained, plug in modules, 30 inputs, 2 prgm outputs, cue/monitor amps, mono, gd cond, \$350 + s/h; Gates stereo Yard, fair cond, nds clean up, tube type, \$300 + s/h. G Gibbs, KMNS/KSEZ, 901 Stueben St, Sioux City IA 51102. 712-239-3966.

Yamaha 1601 16 chnl mixing bds (2), exc con, lots of features, \$3000 for both. S. Cohen, KIHX, POB 26523, Prescott Valley AZ 86312. 612-775-5277.

Gates Dualux II, refurb, new paint, \$1500. C Porter, WCAZ, POB 498, Carthage IL 62321. 217-357-3128.

Altec 352-A 5 chnl mixer amp, \$125; Ampeg MX-10 6 chnl stereo tube mixer, \$125. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Heidrick KY 40949. 606-546-6650.

Norcom Maxtell (2) remote bdc't mixers, as-is, \$125 ea. M Guthrie, WFNS, 813-620-9100.

Pacific Recorders Radio Mixer 20 console, \$12,000; Tascam M2516 console, \$2100. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0110.

EV/Tapco 100M powered mixer, 10 inputs, 2 built in 150 W amps, phantom pwr monitor send, reverb, 16 band EQ, slide faders, only 36 lbs w/case, \$800 OBO. R Shull, WFAS AM/FM, POB 551, White Plains NY 10602. 914-693-2400.

Want To Buy

Sparta Electronics A-20B, trying to rebuild console, need schematic, service info & parts source, will pay postage. T Wheeler, County Electronics, RR1 Box 215, Carlock IL 61725. 309-376-7721.

LPB Signature series 10 or 12 chnl. J Frew, WYXC, 1410 Hwy 411 NE, Cartersville GA 30120. 404-382-1270.

Gates Stereo Yard hi lvl input panel 992-1268-001. B Bartoli, 414 Adams Dr, Mt Shasta CA 96067. 916-926-3273.

Harris Exec 10 chnl stereo brd, clean. D Swanson, 712-252-4621.

Russco 5055 or 5055R stereo console, state price & cond. E Pacak, WQTV, RD 12 Box 615, Greensburg PA 15601. 412-836-5435.

DISCO-PRO SOUND EQUIP

Want To Sell

Sansui SE88 10 band stereo EQ, \$30; Sansui RA1000 stereo reverb w/built in mic-line mixing, \$30. G Dunn, No Cal News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

Solar Black 102-450 50 yds by 72" speaker, grill cloth, \$300/BO + shpg; McCauly 6284 12" 16 ohm (2) speakers, new, \$150/pr + shpg; Yamaha R1000 digital reverb, works, gd cond, \$100/BO + shpg. F Stadler, Fred Stadler Prod, 3912 Liberty, Westmont IL 60559. 708-960-4545.

UREI 811 Time Align studio monitor speakers, excel cond, \$800/pr. Z Nicall, Samendria Studio, 6404 Hollywood Blvd #410, Hollywood CA 90028. 213-646-2145.

Electrovoice EV100 monitor speakers (2), \$540. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0110.

AKG R-25 remote control w/cable for BX-25 reverb unit; new diaphragm for JBL 2405 slot tweeter; Kenwood D-5 carrying handles; EAB (Gotham) W66A linear motion potentiometers (3), BO/trade. E O'Brien, Imperial Sound, 383 N Studio St, Terra Haute IN 47803. 812-877-4663.

Yamaha DX100 keyboard synthesizer, \$225/BO; Tascam PB 32 patch bay, BO. R Edwards, 1750 30th Street #222, Boulder CO 80301. 719-630-1452.

ART Multi Verb digital single effect processor, new w/manual, \$400/BO. R Edwards, 1750 30th Street #222, Boulder CO 80301. 719-630-1452.

UREI model 539 27 band cut only EQ, as-is, \$50. M Guthrie, WFNS, 813-620-9100.

ARI MDC 2001 stereo compressor, lmt'r, gate, de-esser, exciter, like new, \$300. K Thomas, 5555 Radio Lane, Jacksonville FL 32205. 904-388-7711.

Want To Buy

Altec 604/Western Ele 755's speakers & systems 53, 728, 757 & oth. RQ Studio, Larson Rd #4, N Reading MA 01864. 508-664-0174.

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LIMITERS

Want To Sell

Inovonics TriBand bdc't audio processor MO#255, excel cond. M O'Drobinak, 619-758-0888.

UREI BL-40 Modulimiter, SN 632, \$195. R Chambers, 916-257-2121.

CBS Labs Audimax III (2), \$100/ea or \$175/both. C Binder, WZOS-FM, 38 E Bridge St, Oswego NY 13126. 315-342-9600.

Altec 1591-A compressor, \$175; Fairchild 67% dynamic de-esser, \$75; Fairchild 663 compressor, \$75. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Heidrick KY 40949. 606-546-6650.

Orban Optimod 8000 in great cond, \$2000. D Barron, KWJM, 113 N Main, Farmerville LA 71341. 318-368-3094.

Inovonics 1176 LN, gd cond; Inovonics 222, gd cond. D Barron, KWJM, 113 N Main, Farmerville LA 71341. 318-368-3094.

CRL AGC400 & PMC 450, \$50. C Porter, WCAZ, POB 498, Carthage IL 62321. 217-357-3128.

Valley People Gain Brain II (3), Kepex II (3), Maxi-Q (4) all brn face, \$100 ea; Valley Mdl 440 complim (5), \$425 ea; Comrex AGA AGC for phone couplers, \$125; Gentner Teleprocessor, \$225. M Guthrie, WFNS, 813-620-9100.

Mod Sci comp clipper, \$500; Harris MSP-90 AGC unit, \$200. W King, KQAC/KIXZ, 1703 Avondale St, Amarillo TX 79116. 806-355-9777.

UREI 1176 (4), all VGC, \$450 B/O. Bernie, 818-303-8850.

Gates M6467 stereo limiter, GC, \$150, Volumax 4200, stereo AGC, lmt'r, \$200. W Moring, WITV/WSCI, 2187 Wappoo Dr, Charleston SC 29412. 803-795-9401.

Orban 8100A XT/2 processor/generator w/ACC-022 filter card, \$5300; Aphex aural exciter, \$1000; Aphex Compellor audio processor, \$1000; CRL SEC-800 multi-band processor, CRL SGC-800, multi band AGC, \$1125; CRL SMP-850 FM limiter, \$1175. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0110.

UREI 1176 compressor/lmt'r, \$275; Shure SE-30 mixer, rack mnt, \$75; Lexicon PCM41 dig delay, \$200. J Addie, WLTL, 708-579-3749.

Inovonics 230 multiband processor, works fine, gd AM processor, rack mountable, \$300; Yamaha SC2020B, stereo 2-chnl mono compressor-limiter, works great, rack mounts, \$200. Steve, 214-490-7070.

Want To Buy

CBS Labs Audimax wrkg or not, stereo or mono, also manual or copy for same. T Carroll, 212-967-4800, 9-7 EST.

CBS Volumax 411 service/opertion manuals, will pay cost of reproduction & mailing or will buy outright. GP Brefini, GPs Mobile Jukebox, 12 Bailey St, Foxboro MA 02035. 508-543-4213.

Optimod 8000A for educ FM upgrade. KC Hill, AECC, POB 2061, Bristol TN 37621. 615-878-6279.

RCA or Fairchild 660/670, looking for old tube limiters, Wstn Elec/RCA/Fairchild, call btwn 9am & 5 pm, Mon-Fri. Burton, 601-534-8584.

Fairchild 670 or 660 tube compressor/limiter, Teletronics LA-2A tube compressor/limiter or UREI LA-3A solid state compressor/limiter, call after 3PM CST. 214-271-7625.

MICROPHONES

Want To Sell

Audio Technica 813 mics, \$150 ea. R Suraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550. 914-561-5866.

EV RE10 dynamic cardioid mics (10), \$85/ea. J Anderson, Regent Univ, 1000 Centerville Tpke, Vir Bch VA 23464. 804-523-7417.

HME-WM 252 wireless w/SM58 mic, \$195. J Price, 214-321-6576.

Audio Technica 811 bidirectional mic, \$100; Gitzo 14' fishpole/internally wired w/AT mic mount, used, gd cond, \$80. Raider Prod, 215-889-9565.

Neumann U-67 sev mics w/pwr supplies in gd cond, \$1200/ea OBO. J Boyle, Sound Patrol, 6 E 39th St, NY NY 10016. 212-213-6666.

Altec 639 ribbon/dynamic, \$450 ea; RCA 77DX TV grey, \$1500. L Beigel, On-Cue, POB 85042, Hollywood CA 90072. 800-726-9813.

RCA 77DX-44BX, one of ea, both in exc cond, B/O over \$800 for either. R Burns, 214-271-4386.

EV 625A, EV RE11, EV RE-16, EV DS-35 mics, prices vary, \$500/BO takes all. R Edwards, 1750 30th St #222, Boulder CO 80301. 719-630-1452.

EV 664 gd workhorse mic, built in stand, chrome, sounds great, \$100; AKG 190-E, good sounding, works, \$100. Steve, 214-490-7070.

Telefunken, Sheeps, Neumann, AKG tube mics. Telefunken, Siemens, Tab tube mic pre's. RCA, WE, mics sale or trade. Tracy 615-821-6099, no calls after 10PM EST.

Manley Labs CR3A, new, \$795 w/shock-mount, windscreens & case, no risk trial in your studio. Also have used mics & everything else. Get our catalog! Liberal trade policy too. Audio Village, 619-320-0728.

Want To Buy

Need supplier of custom made microphone flags. HA Bridge, KCUL, Box 1326, Marshall TX 75671. 903-935-1410.

Three studio mics, prefer RE-20's w/mounts for educ FM upgrade. KC Hill, AECC, POB 2061, Bristol TN 37621. 615-878-6279.

Neumanns, AKG, RCA, EV, Sennheiser etc, any cond, for parts, also wireless mics. J Price, 214-321-6576. Neumann U-89 in gd con needed, will pay up to \$1100. H Fair, 312-784-1558.

77-DX's, 44-BX's, WE KU-3A's On-Air lights, recording lights & audition lights. Top price paid. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131, FAX: 615-292-3434.

RCA 77DXs/44BXs ribbon, chrome/TV grey, gd cond, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Neumann U87s, KM84s, AKG 451s, EV RE20s, Sennheiser 421s. W Gunn 619-320-0728.

MISCELLANEOUS

Want To Sell

IBM Quietwriter 14 new ribbons, part #1299790, \$20/all; Apple Mac 825 kB internal drives, 3.5" floppy disc (3), \$10 ea. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Northern Technologies TCS-LAPE surge suppressor, 240 V, 3 phase Delta configuration, 3 yrs old, great cond, \$700 plus shpg. D Morgan, KJYE, 1360 E Sherwood Dr, Grand Jct CO 81501. 303-241-9230.

Altec 1579A equalized transistor amp for magnetic phono pickup, octal 8 pin base, \$25. S Lawson, KAK Products, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Peerless 458116-20 input transformers, 600 ohm input, 60 K ohm output (8), 8 pin octal base, \$15/ea. S Lawson, KAK Products, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Magnatek 223-3212, Jefferson Electric dry transformers (2), input 240 V Delta, out 208 V WYE, \$700 ea plus shpg. D Morgan, KJYE, 1360 E Sherwood Dr, Grand Jct CO 81501. 303-241-9230.

TRW adjust amp loads, 300 W rated, 8 ohms, \$50/pair. R Glenn, WJGR, 1718 Shannadoah Rd, Wimauma FL 33598. 813-634-1940.

Triad A-10-J input transformer (2), 150/600 ohm input, 60K ohm output, \$40/pr. S Lawson, KAK Products, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Andrew trnsmsn line air compressor, 40625 3-8 lbs/sq in, \$450. R Chambers, 3015 Johnstonville Rd, Susanville CA 96130. 916-257-2121.

Color WX radar Sea-Tek 75 mile tran-ceiver, mon, power supply & 200' cable, exc when removed 8/93, \$2500. P Reynolds, KKYX, 8122 Data Point St 500, San Antonio TX 78229. 210-615-5427.

Custom light oak control room cabinets for 2 cntrl rms, lg stand-up style w/over-bridge of 3 rack wide & 12 unit high ea, l/med oak, \$3000. P Reynolds, KKYX, 8122 Data Point St 500, San Antonio TX 78229. 210-615-5427.

Patch Cords ADC Bantam Pro Patch, 6", 12" & 18". Brand new, never used, \$5 ea + shipping. Will talk quantity or trade for stuff. KEES Engineering, 609-859-0994.

Want To Buy

RCA bdc't equip, mics, spkrs, studio xmtr, etc. J Phillips, 414 Washington Ave, Defiance OH 43512.

Tube output transformers by WE, UTC, Triad, or any sideband audio transformer for output, esp UTC LS-40, LS-57, Triad HSM-184, WE 618B, 171A/C. RQ Studio, Larson Rd #4, N Reading MA 01864. 508-664-0174.

UTC CG-109 Driver (interstage) trnsfrmr, swinging choke 500 mA to 1 amp at 5/25 henries or equiv. E Bolton, 4212 Jonestown Rd, Harrisburg PA 17109. 717-545-5030.

WE 111C repeat coils, Gates stereo yard B Bartoli, 414 Adams Dr, Mt Shasta CA 96067. 916-926-3273.

Radio transformers by Chicago, UTC, Triad, Peerless, Freed, Sola, send list. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

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

MONITORS

Want To Sell

Belar AMM-2 AM mod mon, \$250. C Porter, WCAZ, POB 498, Carthage IL 62321. 217-357-3128.

Gates GTMM-88S stereo capable mod mon, tuned to 99.3 MHz, \$75. B Williams, KOOL 106.1, 918-455-9522.

Gorman Redlich EBS encode/decoder, hardly used w/manual, money order/certified check, \$250 plus shpg. B Dickerson, WEAG, 1421 S Water

MONITORS...WTS

TFT 760 rebuilt like new, manuals included. \$300. E Pacek, WQTV, RD 12 Box 615, Greensburg PA 15601. 412-836-5435.

TFT EBS encoder lk new, \$240; 4CX15000A socket, new, complete, \$450. W Moring, WITV/WSCI, 2187 Wappoo Dr, Charleston SC 29412. 803-795-9401.

QE1 7775 w/manual, as is \$200. G Manfroi, WNN5, 502 S Allen St, Spaulding IL 62561. 217-629-7077.

Belar REA-1 FM RF amp, Belar FMM-2 FM mod mon both tuned to 96.7 MHz; Belar FMS-2 stereo mod mon, all 3 \$2700 + s/h. C Binder, WZOS, 38 E Bridge St, Oswego NY 13126. 312-342-9600.

QE1 691 FM mod monitor, \$4300. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0110.

Want To Buy

McMartin or Belar 67 kHz SCA mod monitor. J Pearce, WKRS, 3250 Belvidere Rd, Waukegan IL 60085. 708-336-7900.

Phase monitor at least 5 lower positions. George, WNQM/WWCR, 1300 WWCR Ave, Nashville TN 37218. 615-255-1300.

AM mod monitor in good condition, prefer AMM2B or other Belar at reas price. H Espravnik, WVCP, 1360 Nashville Pike, Gallatin TN 37066. 615-451-1640.

McMartin (buy & sell) any model. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886 or fax 402-493-6821.

Belar FMM-2 & FMS-2. M O'Drobinak, 619-758-0888.

RECEIVERS & TRANSCEIVERS

Want To Sell

GE Exec II 35 W base station, desktop w/mic & PL UHF or VHF, \$125; GE 2 meter repeater for split site, UHF link, 25 W, \$150. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

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Want To Buy

McIntosh, Dynaco tuners, preamp, pwr amps, also need RCA-Tugsol 6550 tubes, Goldion/Genelex, etc. R Gleen, WJGR, 1718 Shannadoah Rd, Wimauma FL 33598. 813-634-1940.

Dymek DR 33C-6, McKay Dymek DA9 indoor antenna/DL-4 ant head. J Hartt, 2418 36th Ave W, Seattle WA 98199. 206-282-0720.

HH Scott rack mount & Marantz FM rcvrs wrking or not. RQ Studio, Larson Rd #4, N Reading MA 01864. 508-664-0174.

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Martl RMC-15 16-chnl digital remote cntrl, excl cond w/manuals, \$450. D Igou, KCHL, 8435 Twister Oaks, Garden Ridge TX 78266. 210-651-9049.

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MCI RSU-10 STL rcvr switcher, automatically selects backup rcvr if main rcvr fails, \$25; GE Master II VHF mobile 2-way radios, 100 W RF out on 170.150, \$100 ea. M Everhart, KXYQ, 111 SW 5th #1550, Portland OR 97204. 503-226-6731.

Moseley MRC 1600 remote ctrl/setup for telco, \$1500. W King, KQAC/KIXZ, 1703 Avondale St, Amarillo TX 79116. 806-355-9777.

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Gentner SPH-3A telephone interface system, excel cond w/manual, \$325. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Integrated Network Corp 1056R switched 56 CSU/DSU, \$695. G Wachter, KFYI Radio, 602-258-6161.

Gentner VRC-200 remote control, \$2400; VRC-1000, \$1650; Symetrix 104 multi-line phone hybrid, \$2000; Radiation Systems P9A120G (3), grid 940-960 MHz STL xmt/rec antennas, \$3300; Radiation Systems P9A72G (2), grid 940-960 MHz STL xmt/rec antennas, \$1950. J Stanley, Colfax Communications, 60 S 6th St, Minneapolis MN 55402. 612-373-0110.

Comrex PTLX 2 line freq ext, encoder & decoder, \$2500 for both units. Rich, 404-534-1000.

Moseley TRC 15 AW remote cntrl in vgc, \$425. E Duellman, WOMT/WQTC, Box 1385, Manitowoc WI 54221. 414-682-0351.

Want To Buy

Moseley 505 rcvr & xmtr, pef on 946.00 Mhz, open. C Cooper, WHLC, POB 1889, Highlands NC 28741. 704-526-1045.

STL, xmtr, rcvr, antenna etc for missionary station in Africa, must be in excel cond, \$1000 plus donation receipt for the difference. K Leatherwood, Believers Bldg, POB 1776, Terrell TX 75160. 214-524-1956.

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Wegener 1601-50 mainframe, 1624, 1645, 1646, 1683-08, 1606-01, 1605-03 cards, BO. R LaFore, WSHH, 1459 Crane Ave, Pittsburgh PA 15220. 412-531-9500.

Wegener 1601 satellite recr for Unistar AM, \$2500. W King, KQAC/KIXZ, 1703 Avondale St, Amarillo TX 79116. 806-355-9777.

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