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Guide**, see p. 36

Vol 17, No 14

Radio's Best Read Newspaper

July 28, 1993

EBS Technology Tests Commence In Colorado

by Randy Sukow

LAKESWOOD, Colo. There is one non-controversial conclusion about the major new technologies developed for a future, upgraded Emergency Broadcast System—they work.

On a simple pass-fail basis, the three leading proposed systems worked as expected most of the time during four days of testing in the Denver area, conducted by the FCC late last month (June 27-30).

The testing was part of the commission's effort to rewrite the EBS rules in the coming months. "We want to make sure that whatever system we come up with in the end is very flexible and will allow other new technologies to come on at a future point to become a part of the new system," said Helena Mitchell, chief of the FCC's EBS office.

"We don't even know what that new system is going to be called. We know it won't be called the Emergency Broadcast System anymore," she said.

Many of the approximately 100 system manufacturers, government officials and volunteer engineers from the Denver tests will meet again in the Baltimore area late this summer or in the fall for another round of tests.

After that, the FCC will be faced with the difficult task of deciding—if at all possible—how the new technologies can be assembled into one automated, user-friendly warning system for more rapid and detailed public alerts. Officials hope this can be done without placing excessive monetary and technical burdens on broadcasters and local emergency authorities.

Distinctive approaches

The commission's chore will be demanding because the proposed emergency sys-

tems attack EBS networking from very different angles. The three major contenders are:

♦ **Information Systems Laboratories (ISL)**, Vienna, Va., developer of the Emergency Broadcast Satellite System (EBSAT), based on personal-computer control of very-small aperture terminal (VSAT) technology for an easy-to-use, low-cost system that can reach any broadcast station or cable headend, regardless of weather or geographic obstacle;

♦ **Sage Alerting Systems**, Stamford, Conn., developer of the SAGE I Emergency Alerting System, which heavily emphasizes radio data service (RDS) applications, such as data transmission of EBS alerts to both stations and the public and new consumer receivers that will replay an EBS alert, even if it is turned off or in a cassette tape or compact-disc playback mode. A main-channel (or in-band) version of the SAGE system, with silent testing, as well as a subcarrier version were tested in Denver.

"We look at the Emergency Broadcast System, not as an individual piece of hardware, but as a systems concept. We like to

continued on page 7 ▶



Brad Miller records the sound of the surf on the Big Island of Hawaii with the MS-4 soundfield microphone, a pre-production model Colossus and a Sony VO-6800 video recorder. See page 15.

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FCC Chair Nominated

by John Gatski

WASHINGTON Telecommunications attorney Reed Hundt has been nominated for the FCC chairmanship.

Hundt, 45, is a well-known Washington lawyer specializing in anti-trust. He is an energetic litigator who has the experience to take on any telecommunication monopolies, according to industry insiders.

A 1974 graduate of Yale University Law School, Hundt is a senior partner in the Washington law firm, Latham & Watkins, and was on President Clinton's short list from the beginning. Hundt also served as an economic adviser to Vice President Al Gore when he was in the Senate.

Hundt was nominated several weeks after the front-runner for the position, Senate Counsel Toni Cook, took herself out of the running for the top FCC post in June. Long-time FCC Commissioner

continued on page 3 ▶

Studio Sessions

Equipment and Applications for Radio Production and Recording, pp. 11-21

NEWSWATCH

FCC Looks Into AM Directionals

WASHINGTON The FCC recently initiated an inquiry into the policies and rules pertaining to the performance of AM directional antenna systems.

According to the commission, it will review the pertinence of the present regulations concerning AM directional antenna performance verifications because of significant environmental, technological and economic

changes in recent years. Also, a determination will be made whether the present regulations effectively control interstation interference, especially at night.

Within the inquiry, the FCC plans "consider adoption" of alternative regulatory means made possible by the advances in antenna analysis methods and instrumentation.

"The commission's goal is to formulate a set of proposed rules which will ensure that array evaluations are done thor-

oughly and accurately, and to the degree necessary to meet the interference criteria put in place as a result of Docket 87-267," the FCC said.

Enco System DAD 486X Added to Harris Line

RICHMOND, Ind. Harris Allied has added the Enco Systems' DAD 486X work station/audio distribution system to its radio studio product line.

Based on a 486 PC computer platform, the DAD 486X can be configured to match precise budget and operating requirements. It features an intuitive touch screen control that emulates the familiar format of standard audio cartridges, as well as standard visual graphics waveform editing to simplify production and editing.

For more information, contact the Harris Allied Broadcast Division at 800-622-0022.

AP Goes SEDAT

ATLANTA Scientific Atlanta will equip the Associated Press

(AP) radio news service with a new satellite digital audio distribution system (SEDAT), allowing the news service to distribute audio and high speed data to stations in the U.S., Canada and Mexico.

Scientific Atlanta will provide more than 400 of its Symphony DSR-5000 Series digital satellite receivers, and other uplink equipment including the AD3318 SEDAT Studio Server. Equipment will begin shipping in late 1993 with deployment completed in mid-1994, according to Scientific Atlanta.

The new digital service for AP will be transmitted on Satcom C-5, a move that will increase the number of stations that can receive the service. About 6,000 stations are equipped to receive transmissions on Satcom C-5.

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Performance Royalty Legislation Introduced

by Randy Sukow

WASHINGTON House Copyright Subcommittee Chairman William Hughes (D-N.J.), introduced legislation early this month that would require future digital audio radio (DAR) stations to pay a performance royalty fee after airing of prerecorded programming.

The bill had been expected since the conclusion of spring hearings on performance royalties in the Hughes subcommittee (RW, April 28). Companion legislation from Senate Copyright Subcommittee Chairman Dennis DeConcini (D-Ariz.) also is widely

expected, although at press time DeConcini's staff could not confirm that a bill was pending.

Broadcasters already pay composer royalties through music licensing organizations such as ASCAP and BMI. But record companies claim to lose millions of dollars in royalties, especially in overseas payments, because there is no royalty fund for U.S. performers.

(Most European nations currently impose performance royalty payments, but reciprocity clauses often block performance royalty payments to U.S. companies.)

The Hughes bill, the Digital Performance

Right in Sound Recordings Act (H.R. 2576), cosponsored by fellow subcommittee member Howard Berman (D-Calif.), amends the current copyright law to give performers exclusive rights to their performances when aired by digital means.

DAR service, which could potentially be recorded in perfect, studio quality with digital audio home recording devices, could result in substantial losses for the recording industry, the bill's supporters say.

"In this era of advancing digital technology, it is vital that performers and record companies be protected from unlicensed exploitation," said Jay Berman, president of the Recording Industries Association of America (RIAA).

"While the advent of digital audio services may well be upon us, this bill penalizes the very industry—local, free, over-the-air radio—that has been the single largest reason for the popularity of the domestic music industry," National Association of Broadcasters (NAB) President Eddie Fritts countered in a let-

ter to Hughes following the introduction of H.R. 2576.

Performance royalty fees would serve to cripple an already economically depressed radio industry, Fritts said. At the same time, radio stations airing prerecorded programming is the recording industry's most valuable promotion tool, he said.

Record companies and broadcasters have clashed over performance roy-

alties for several years, with the most heated fighting in the mid-1970s when the Congress ultimately decided to omit such fees in the 1976 Copyright Act.

Congress has so far turned back all other attempts to pass a performance royalty since 1976. But some believe international pressure may prod current members to take the issue more seriously. There is a movement to amend the Berne Copyright Convention, a treaty governing international royalty payments, to include an international performance agreement. The U.S. is a signatory to the Berne Convention.

The Hughes Bill would require fees for digital radio transmissions.

FCC Chair Nominated

► continued from page 1

James Quello has been acting FCC Chairman since January.

The National Association of Broadcasters said it welcomed Hundt's nomination. "Reed Hundt is an attorney with outstanding credentials who will provide solid grounding for the many complex issues facing the FCC," NAB CEO Edward Fritts said. "We look forward to working with him as he begins to set the Commission's agenda and deals with decisions that will have a far-reaching impact on the broadcasters as well as the shape of the overall telecommunications marketplace."

Hundt will inherit a number of major issues and pending policies that the FCC has before it, including station migration to the expanded AM band, mandating an AM stereo standard, implementation of a new Emergency Broadcasting System and eventual adoption of a digital radio transmission system. Video issues will include the new cable regulation and completing the high definition Television (HDTV) standard.

In recent years, presidents have placed



Reed Hundt, FCC chairman nominee

significance on their FCC nominations as new communications technologies have pushed the agency into active policy making.

At press time, the nomination hearings had not been scheduled in the Senate.

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U.S. Vendors Eye Overseas Markets

When I think of the Caribbean, I think of sundrenched beaches and crystalline blue water, tall fruity drinks and fun in the sun. But for Consulting Engineer Mort Bardfield, and client station PJD-2 on 1300 kHz, St. Maarten (Netherlands Antilles), radio is radio is radio.



Apparently the island has many hillsides, one of which serves as the backdrop for the station's transmitter site on "The Hope Estate" (see photo). If you look at the object positioned a few feet away from the building, you might not notice at first glance that it is a boulder.

The boulder, roughly the size of the transmitter building, rolled down the hillside (you can see its path in the photo) and stopped within a few feet of demolishing the building. It came from the rock ledge formation visible at the



top of the hill.

The ten-foot dirt wall visible behind the boulder and the building was built to ward off the next boulder. Ah, the island life.

★ ★ ★

In the past I've mentioned to you some overseas companies that are targeting the

U.S. market. This time out I'd like to tell you about some of your colleagues who are pounding the pavement around the globe.

In early June, I went to Buenos Aires to cover a broadcasting convention for **RW's** sister publications, **Radio World International** and **TV Technology International**. Why me? As some of you may have deduced from my name, I'm of Spanish origin. In fact, Spanish is my native language. So I was fortunate enough to travel to Argentina, in the early days of their winter (that is how far south they are) to see what is happening in broadcasting in South America.

The continent is an interesting marketplace for U.S. companies willing to wade through the red tape and bureaucratic shuffle involved. It is a totally different order of the universe down there—you have to reprogram your brain completely to function effectively.

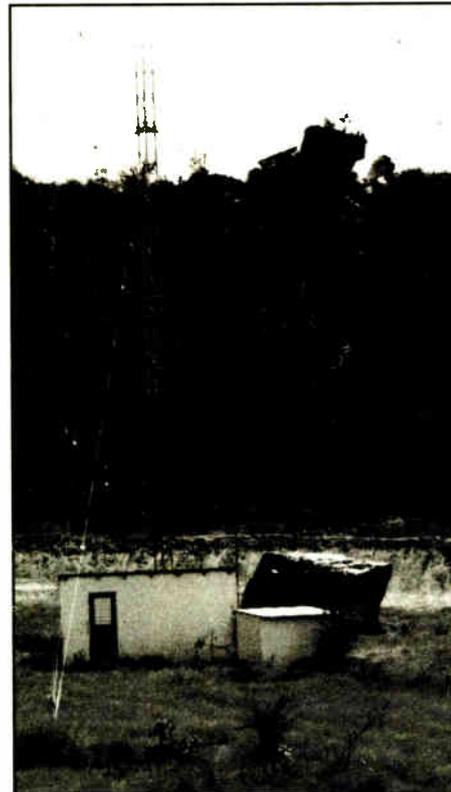
For instance, the government has been struggling for years to come up with a "Communications Act" with which to allocate radio stations. None has been written as of this writing, but stations are granted temporary permission to build. And if you don't want to secure temporary permission, you can (as many do) go on the air as a pirate radio station. The legal stations will simply kick up their power to try and obliterate your signal.

The situation will eventually be resolved, and there are many legal stations that function effectively and have money to spend on radio gear. Oh, and one more thing. The thirst for imported gear is unquenchable. One manufacturer was even asked to exhibit his gear on the shipping crates—thus making it more attractive.

I don't envy manufacturers that are trying to export their products to South America. In spite of the political progress that has been made in many of the coun-

tries, working your way through the labyrinth of rules and regulations governing importation is a feat. CRL's Ron Jones (pictured right with new International Sales Regional Manager, Lincon Arteaga) put it best: "Customs has been very much of an adventure. I'm sure we will understand it (the process) better in the future."

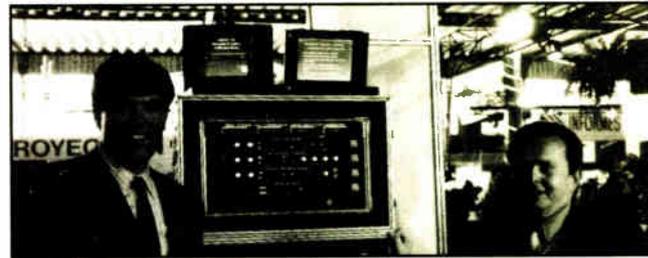
In spite of the trials and travails, open-



ing day of the convention was jam packed, and U.S. companies had a presence. Some, like Computer Concepts' Steve Sampson, had to wait a day or two longer before gear was released from customs, but the quantity and quality of the traffic on the exhibit floor more than made up for this slight delay.

As a rule, local manufacture was mostly of antennas and towers or trans-

mitters. Some companies are trying their hand at studio gear and software design, but the design is very basic. The real impetus for the local guys was finding a foreign company they could



rep in Argentina.

Among the other satisfied company reps down south were (pictured bottom left, l to r): Mario Alessi, Magneto Sonora (Argentine distributor); Jesse Maxenchs, International Sales Manager, Western Hemisphere, AKG Acoustics; Federico Pansios, Director Latin American Sales, Jampro Antennas; Lawrence Behr, President, LBA Group; Javier Castillo, VP International, LBA Group, and John Macdonald, Sales Manager, Latin America, Broadcast Electronics.



Jim Higgins was named senior vice president/sales for Unistar Radio Networks. Higgins will oversee all sales activity in the New York, Los Angeles, Chicago, Detroit and Dallas offices from Unistar headquarters in New York. Higgins was previously senior vice president/national sales.

Sina DeVito was named manager of communications for the CBS Radio Division. DeVito joined CBS in 1990 from All American Television, and has been assistant manager for the past year.

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Looking for DOS 6 fix

Dear RW,

I enjoyed Barry Mishkind's article "MS-DOS 6 Doubles Disk Space at Low Cost" (RW, April 28). There are some problems that readers should be aware of before they rush off to their favorite retailers to purchase the latest MS-DOS upgrade.

If you are using an 80286 processor with Phoenix BIOS 3.10 dated 1989 or sooner, you should be very careful to have a good backup and system disk for your previous version of MS-DOS before running the "DBLSPACE" program.

At KARV, we are using early versions of Victor's V286 machines with Seagate ST 225 20 megabyte hard drives. On my first attempt, I installed the upgrade after running the "DBLSPACE" command. The program created a 37 megabyte hard drive and, after rebooting, showed 0 bytes free on the drive. The drive originally had only about 11 megabytes of files, but apparently after compressing the files for the "dummy" drive created when "DBLSPACE" runs, the 11 megabytes filled the entire disk.

After calling the folks at Microsoft (three phone calls and 35 minutes of waiting), one of their technicians said that the upgrade has problems with versions of the Phoenix BIOS dated 1989 and earlier. In creating the "dummy" (H:) drive, the "DBLSPACE" program plays with addresses in the BIOS, and apparently the version named doesn't handle it too well.

The other programs should work well, and if you try "DBLSPACE" and have a good set of backups, no harm is done if it crashes. I reformatted the hard drive on the machine, installed the original operating system (3.3), then installed the backups, and had no problems.

After my episode with the 80286 machine, I tried the operating system on an old 8088-based machine in the newsroom with no problems. The "DBL-

SPACE" created a 34 megabyte drive on my old 30 megabyte, and the other utilities worked well.

Other than the problems mentioned, I agree with Barry that this is the first upgrade of the MS-DOS operating system that is worth its salt (and price).

Ed Caldwell
KARV(AM) Russellville, Ark.

Dear RW,

We read Barry Mishkind's article on MS-DOS 6 with interest, and while we agree that it is an interesting tool, we suggest your readers embrace it with caution.

Microsoft has acknowledged problems exist with Acer America Corp.'s BIOS versions prior to 1.2 Revision 4, Sharp's 6781 and when using ASP14DOS.SYS to support a second device such as a CD-ROM drive.

To help avoid disaster or a long and involved recovery process, we strongly suggest that your readers back up everything in their systems before loading DOS 6.0. Ask yourself, do I really need DOS 6.0? How much memory do I need to be freed up?

Alex Dunn
President, Omni Communications
Proctor, Vt.

Editor's note: Barry Mishkind has more to say about DOS 6.0 problems and solutions in this month's "Keyboard Connection," page 30.

The case for manipulation

Dear RW,

Bruce and Jenny Barlett, the authors of "Spectral Manipulation: Do we Need It?" (RW, Feb. 24), claim experience in radio engineering. After reading the article, I wondered if either of them had ever really worked in a commercial radio station.

Their most telling remark was: "The job of a radio station, I think, is to be a simple messenger of the music." This is a long hop from the philosophy of most of the radio stations I serve as an engineering consultant.

The radio station is a broker, bringing together buyers and sellers. Many use music to attract the buyers, but news, sports and talk all have their place. Certain types of programming or mixes of programming are used to lure specific groups of buyers that the broker believes are marketable.

Radio consulting is big business, with specialists helping stations to package bait. One area where the laws of physics (and the FCC) have limited the packaging options available to the broker has to do with the signal itself.

The occupied-spectrum mask imposed by the FCC tends to level the playing field on the radio dial. With restrictions on bandwidth and amplitude, broadcasters have been forced to become more creative within the domain of that limited chunk of electromagnetic spectrum.

With so many options available to the audio consumer, we sometimes wonder why they listen to the radio at all. The answer is found in a combination of fac-

Radio's FCC Wish List

The FCC chairmanship over the next four years will be a tough job. The commission will take on a steady stream of new complex legal and technical issues, and the availability of adequate funding and staffing will never be certain.

Everyone in the industry wishes nothing but success for Reed Hundt, President Clinton's choice to head the commission, and hopes that in the struggles to come he will give the radio industry the consideration it merits as he writes his priority list.

Hundt is a successful Washington anti-trust attorney and a long-time friend and former Senate aide to Vice President Albert Gore (one of the principle drafters of the 1992 Cable Act). These facts seem to suggest that Hundt was picked for one primary purpose: enforcement of the Cable Act.

This page recently applauded interim Chairman James Quello for refusing to allow Cable Act matters to distract the FCC from other, equally important tasks. During Mr. Hundt's term (assuming he wins Senate confirmation), the FCC will deal with similar dilemmas.

Here is a short checklist of items the radio industry wants the new chairman to hold on the front burner:

✓ The FCC should approve a digital audio radio standard within the next two years following the completion of EIA/NRSC transmission systems tests in mid-1994. To keep radio an active part of the future digital media universe, the FCC must focus on choosing one, technically sound system to avoid the same kind of the industry confusion that followed the commission's handling of AM stereo.

✓ Meanwhile, a proposed AM stereo standard is back on the docket. In its on-going effort to revive AM, the commission should rapidly finish what it couldn't finish before and at the same time keep the applications process flowing for reassignments into the expanded band.

✓ The FCC must also not let processing of duopoly, LMA and other station-transfer applications stall. The new radio ownership rules adopted last year have allowed many stations to remain in service that otherwise might not have, especially in smaller communities.

These and many other issues are just as significant as whether the monthly charge for basic service in some town should be \$18 or \$17.50, or whether subscribers in New York City are paying too much for HBO. Let's hope that Mr. Hundt keeps a balanced perspective.

—RW

tors that continues to make radio appealing. Portability, the low cost of receivers and the lack of distracting visuals are inherent in the medium. To those strengths, good operators have added variety, unique products, personal appeal, entertainment and non-stop, no-disc-change music.

Faced with a diverse audience with myriad types of radios ranging from the one-speaker telephone/clock radio to the multi-kilo-buck home music center, radio broadcasters (and equipment manufacturers) have responded with some of the most sophisticated audio processing ever devised by humans.

Programming considerations aside, by controlling the dynamics and spectrum, I can make you keep your inexpensive desk radio tuned to my station. That is the reason for spectral manipulation.

Do you need it? That depends on your competitive situation. If you are a music station and recognize that your competition includes MTV, storecasting, cable radio, video soundtracks, as well as other broadcasters, you do.

James A. Bender
President, Montanavision Inc.
Bozeman, Mont.

Wrong brochure

Dear RW,

The National Association of Broadcasters has developed a free brochure entitled, "Radio Station Ownership: Four Steps to Making a Station Yours" (RW, June 9). I placed a call to NAB to see if anyone had requested a copy. Much to my surprise, I was told that hundreds of individuals had requested the publication.

As a present owner not seeking to acquire a station, I requested of the NAB a companion publication, "How to Sell a Radio Station in a Small-to-Medium-Sized Market." Sadly, but not surprisingly, I was told that no such publication had been printed.

In as much as I have a station for sale, I asked permission to send an insert with each brochure instructing those that called to phone me as the first of the four steps to "making a station yours." Not being brokers, they declined.

Dennis L. Widmer
KTEL-AM-FM Ore.

Bigger discs, why not?

Dear RW,

We are a couple of DJ/management people. We were sitting around today trying to determine what internal programming format to use on our new FM hitting the airwaves soon, WBNF(FM) Marianna, Fla.

We have been considering satellite feeds (too bland), live DJs (too costly) and CD automation (best probable solution, but so many machines).

The question we raise: Why hasn't someone put music on video-sized discs?

Wouldn't the physical size allow for maybe more than 100 tunes per side or per disc? Wouldn't this allow a large base library in three to four machines, constantly available with added standard stack disc players as current material, thus reducing the number of machines necessary and lowering the cost?

It seems too easy, but why not?

Bill Dunkle
and Tom O'Brien
WTYS(AM) Marianna, Fla.

RadioWorld
Vol. 17, No. 14 July 28, 1993

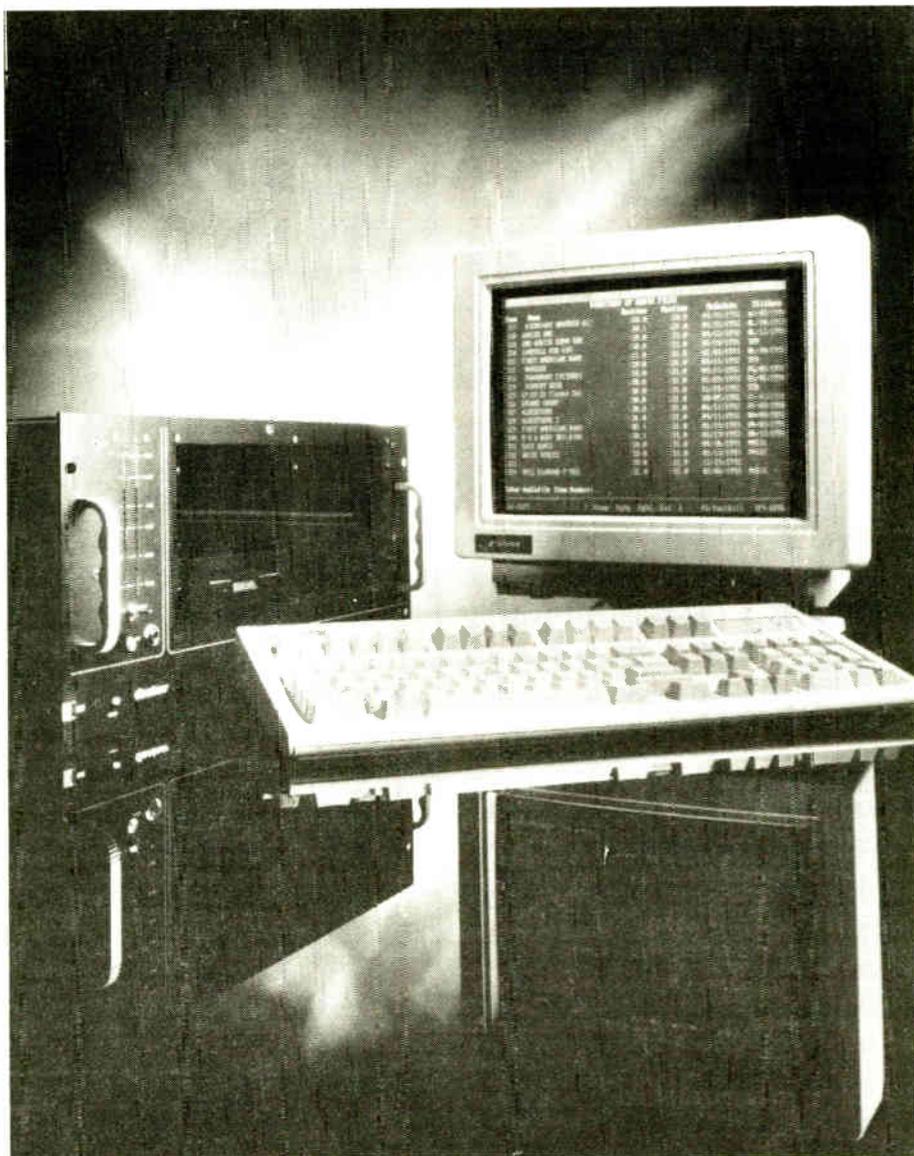
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August 11, 1993**



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World Radio History

EBS Systems Undergo Initial Tests

► continued from page 1

say that we have a systems approach, not a black-box solution," Sage President Gerald LeBow said in a veiled reference to the third major manufacturer.

♦ **TFT Inc.**, Santa Clara, Calif., developer of the EIS 911 Emergency Information System. EIS is an in-band system with many of the applications of the other systems—silent testing, automated control and optional RDS delivery—but at a lower cost. EIS allows broadcasters to keep current EBS receivers and other related equipment and install the system with the purchase of one black box.

"We anticipate that the units that would be located in the average television, cable or radio facility will only be \$750 to \$1,500," said Darryl Parker, TFT director of marketing.

EIS also is comparatively user-friendly, with only two buttons for sending and interrupting messages on the front panel at the receiving end, and similarly simple control at the origin.

About a half dozen subsystems were also tested, including a method for using pocket pagers to sound emergency alerts, developed by CUE Network Corp., Irvine, Calif., FM-subcarrier paging service.

The cable products division of the DYNATECH Video Group tested a software package designed to automate EBS reporting at TV stations and cable head-ends. The HollyAnne Corp., Greeley, Neb., tested its SAM (Safety Alert Monitor) System monitors for cable subscribers.

In spite of the wide range of technologies tested, Mitchell said there will be no losers at the end of the FCC process. The commission expects to write basic guidelines for emergency alerting equipment and allow all manufacturers to market their products within those guidelines.

What is still unclear is the extent that manufacturers will have to alter their products to meet the commission's guidelines and whether the guidelines

will in any way favor one of the manufacturers' approaches.

"It looks like the emphasis ought to be on some kind of (standard communications) protocol associated with EBS," said ISL Senior Scientist Barry Shay. It must be a non-proprietary protocol, most likely written by the FCC itself, TFT's Parker said.

Procedures

The four-day test program included three days of field and laboratory tests and a live cable TV demonstration on the fourth day. Sixteen tests (shortened from the originally planned 19 due to time constraints) were conducted to analyze the various systems' reliability, addressability, propagation and



TFT's Terry Peterson sets up EIS for a remote-transmission trial in heavy multipath conditions. The Sage and ISL systems were earlier put through the same test.

several other characteristics under various conditions.

Most of the test signals originated from either the Colorado State Emergency Operational Center (EOC), Golden, Colo., or the National Weather Service station near Denver's Stapleton Airport. Seven operational sites were set up as receive points: two AM stations, two FM stations, two TV stations and TeleCommunications

Inc.'s Denver cable system.

Volunteer engineers from around the country served as observers at each operational site to confirm that the test hurricane alerts were received. (Hurricane warnings, unheard of in Colorado, were sent so that any signals intercepted by the general public would not be presumed authentic.) The observers also took notes on the quality and characteristics of each in-coming signal.

Prior to each test manufacturers gave a brief overview to the observers of what to expect.

After the overview, however, observers were discouraged from making further contact with the manufacturers and their representatives during the test process in order to maintain the integrity of the results.

Next step

Many of the same engineers, manufacturers and government officials will soon reassemble in Baltimore for the second round of tests, expected to follow roughly the same procedures as the first with some refinements, based on information learned in Colorado.

The dates for the Baltimore round were not set at press time. The resumption of tests was originally planned for the second or third week of August, but after discussion among the manufacturers and test organizers on the last day of the Denver tests, a delay of a month or more appeared likely.

Once the testing is completed, the FCC's EBS office hopes the commission can take action on the new EBS rules before the end of the year, although Mitchell could not say whether action would take the form of

a report and order or a further notice of rulemaking.

Mitchell was confident that the current funding shortage at the FCC would not delay progress on the EBS project. In recent months, money shortages have forced the transfer of several FCC staffers from their regular duties to drafting and enforcement of the 1992 Cable Act. The commission also may be forced to furlough some employees for several weeks this fall if it does not receive a proposed \$11.5 million 1993 supplemental appropriation.

□ □ □

Editor's note: In the Aug. 11 RW, look for a special in-depth report on EBS, with a history of the current system, details of Denver trials and complete descriptions of the proposed new emergency systems.



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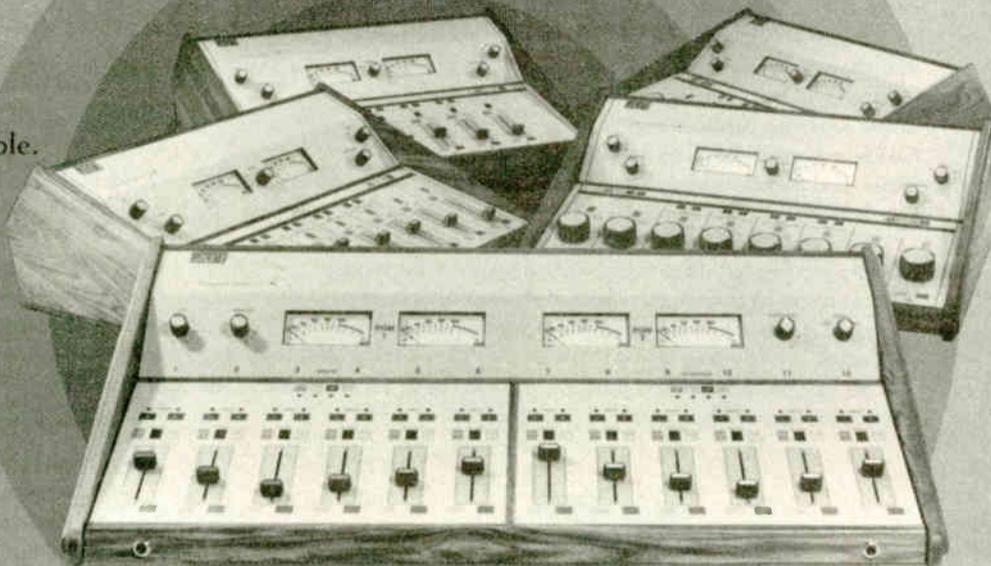
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MIT Develops Personalized Radio News

by Frank Beacham

CAMBRIDGE, Mass. Targeting radio news as one of its first research projects, the recently organized News of the Future consortium at the MIT Media Lab has developed "NewsTime," an interactive audio news and text system that could create significant new opportunities for radio broadcasters.

NewsTime gathers audio news reports, categorizes them into segments and then presents a menu of interactive choices to listeners through a "windows"-type user interface on a computer. A listener can search through a list of topics and choose

to hear only stories of personal interest. As the audio plays, a text transcript follows in sync on the screen.

What we are trying to do is come up with some prototypes that will cause the audio news providers to think.

personal interest may be flagged in advance, and stories keyed to those subjects can be played automatically.

— Chris Schmandt
Principal Research Scientist, MIT

Listeners can speed up the sound, skip to another segment or save a story or group of stories for later playback. Earlier newscasts can be accessed from an archive. Topics of

Since NewsTime audio is delivered in digitized form, radio stations can use the RDS system or other means to transmit the data to listeners. NewsTime program-

ming can be received on any personal computer.

A new generation of computers, expected to begin appearing on the market this summer, are especially suited to such a service. These highly portable, interactive, wireless personal information managers, such as Apple's Newton, weigh about a pound and could be used as portable interactive radios.

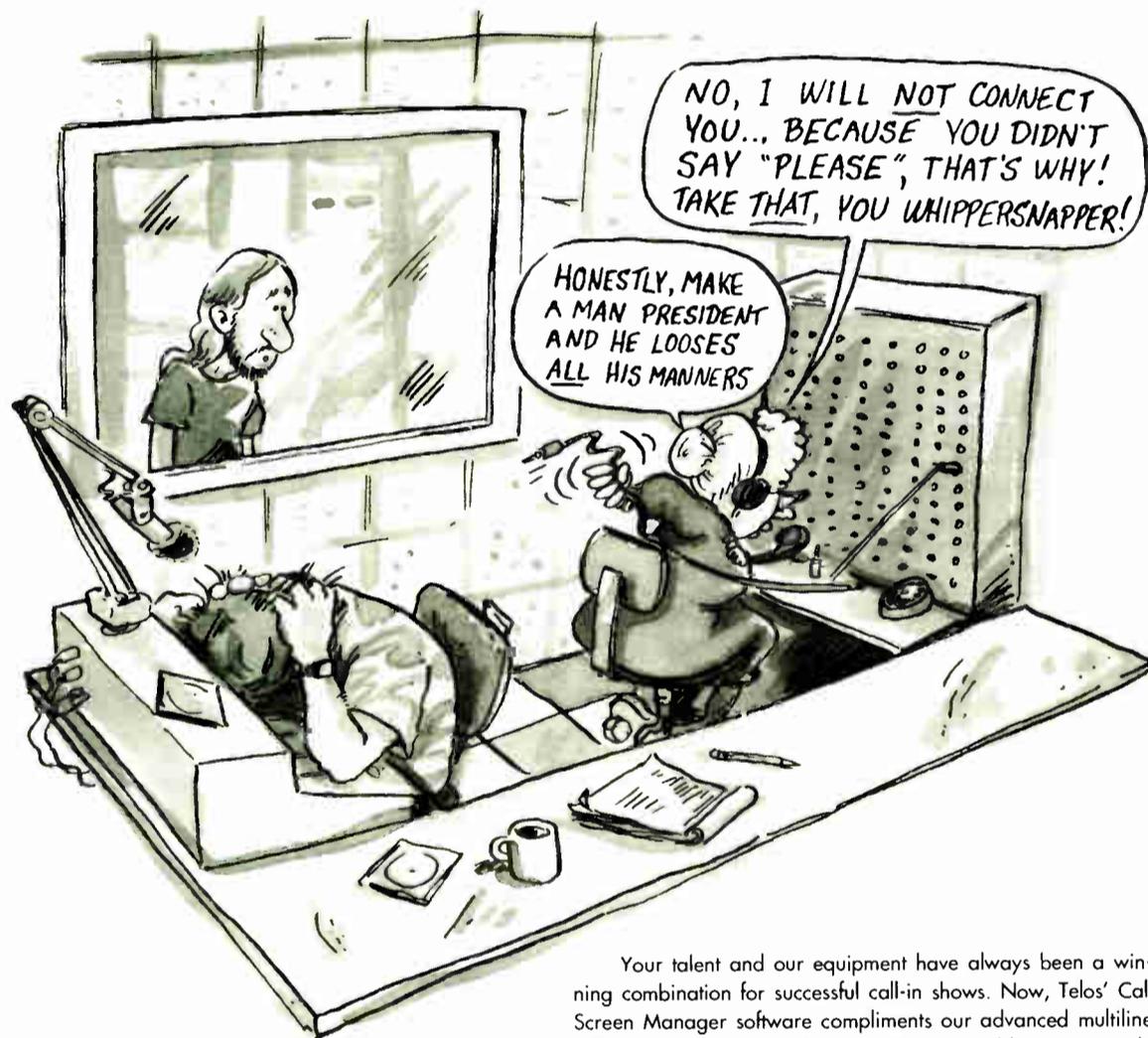
NewsTime was the masters degree thesis of Chris Homer, a recent graduate of the Massachusetts Institute of Technology (MIT). He conducted his research under the direction of Principal Research Scientist Chris Schmandt, who specializes in audio information and delivery systems at the Media Lab.

The five-year News in the Future program is backed by a consortium of some of the nation's largest media companies in an effort to explore new ways to deliver news. However, Schmandt said, it is "not really our focus" to develop fully implemented systems that companies can purchase and use off the shelf.

"This is a research project. We are wondering where radio will be in the 21st century," he said. "What we are trying to do is come up with some prototypes that hopefully will cause the audio news providers to think."

Media Lab researchers are now working with radio newscasts from NPR and the BCC and some close-captioned television news programming. "We are currently capturing existing broadcast sources and trying to analyze the audio to figure out how to build personal news distribution around it," Schmandt said.

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A prototype user interface for NewsTime on a Unix computer at the Media Lab at MIT.

like NewsTime currently exists, he said, adding that existing news programming could be modified easily and inexpensively for digital delivery. "There are only six to ten stories in a five minute newscast on the hour," Schmandt noted. "It wouldn't take very much to broadcast about 12 key words, a start time and a few time offsets in the newscast to support a service."

One of the technologies being developed at the Media Lab for news presentation is the ability to play back speech faster than it was recorded. "I routinely listen to my audio at about one and a half times the rate it was recorded," he said. "In this way 10 minutes of sound only takes seven minutes to play back. One can become very good at understanding it."

Downloads of digital news material could be made to listeners even when their computer/receiver is unattended. As

continued on page 33 ►

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Studio Sessions

What's new in
Studio Gear?
See **Product Guide**
pp. 18 & 21

Equipment and Applications for Radio Production and Recording

Stalking the Perfect Mix with the Dolby 740

by Ty Ford

BALTIMORE Nothing whets the appetite more than learning about a new audio processing circuit. I believe the efforts of the quest have several benefits. First, learning about new ways to tickle the ear adds to my baseline knowledge of audio. Second, working with new circuits keeps the edge on my production work.

As such, I was interested to learn that Dolby Labs had developed the Model 740

bel of gain reduction needed by the limiter. If you need more control for the peaks, you can use a limiter downstream."

After its trip through the processing side-chain, the audio is combined with the unprocessed audio. Each channel also has its own adjustable single-ended noise reduction circuit after the processing and before the outputs. This lets you pull down noise that the processor may have brought up.

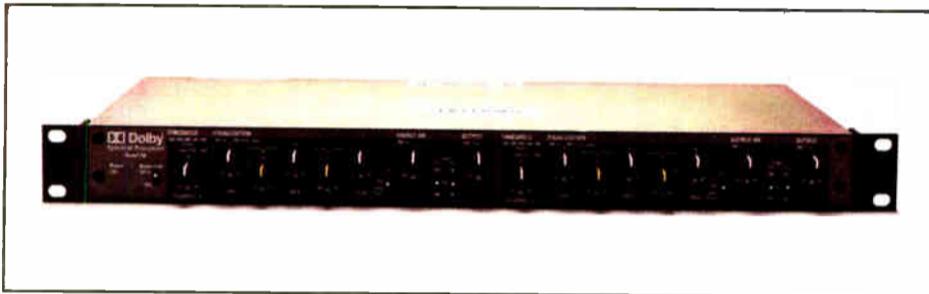
You must be in the process mode to acti-

With the Dolby 740 I was able to bring up the guitar track substantially, but along with it came the "click" on the kick drum. Figuring that the "click" was probably a bit hotter in the mix and higher in frequency, I adjusted the threshold controls counterclockwise to try and get the threshold

between the guitar and the "click" of the kick.

Then I started to work on the crossovers. With a bit of fine tuning in the side chain mode, I found that the guitar started to pop out when the crossover between the mids and highs was at about the 2 kHz mark. By the time I hit 4 kHz, the guitar was way out in front, but so was the click

continued on page 13 ►



The Dolby Spectral Processor can add "space and sparkle" to your audio mix.

Spectral Processor (\$1760 list price), a one rack space, single-ended, two-channel (or stereo) processor that uses a unique approach to increasing the density of the audio that passes through it.

How it works

Unlike most processors, the 740 allows the user to manipulate the audio *below* a user-adjustable threshold. This below-threshold processed audio is then divided into low, mid and high bands, each with its own boosting capabilities. The two crossovers, between the low/mid and mid/high bands, are overlapping and continuously variable.

Each channel of the 740 also has a pair of switchable 12 db/octave low frequency and high frequency filters that only affect audio in the side-chain. The low frequency filters roll off at 100 or 200 Hz. The high frequency filters are fixed at 4 or 8 kHz.

According to Dolby's Stan Cassette, the group delay effect or phase shift caused by the filter switches is minimal and changes with corner frequency. Low-order filters allow only a 90 degree phase shift. When the phase shift does reach 180 degrees the sidechain signal is only a very small part of the main path.

Cassette explained: "Typical compressors are set to limit the increase in levels over a threshold. The 740 makes soft signals louder without limiting or compressing the louder parts of the audio. Because it's also a three-band device, you get to define the transfer function or curve (the curve that you get when you plot output level versus input level).

"You can make different transfer curves for each of the three bands. For radio, it's a way of taking music signals with widely varying dynamic ranges and increasing their density to achieve consistent loudness, without reducing the transients. For every decibel of processing you apply with the 740 to raise the level of audio below the threshold, there's one less deci-

vate the noise reduction feature, but with the process controls set to minimum, you can also use the 740 as a single-ended noise reduction circuit, and do a nice job of reducing tape, circuit hiss and MIDI noise without taking off too much of the edge.

The unit is switchable between -6 dBu and +4 dBu operating levels that provide a +20 to a +26 dBu output respectively. The continuously variable output controls work over a 20 dB range. The unit has both input and output clip lights. You can also use the 740 in-line or as an outboard device, returning only its effected signal to your console. There is no On/Off switch and no relay bypass control so if the unit loses power, it will not pass audio. The power cord is IEC standard and detachable. The knobs have a nice touch and the pots are smooth.

What it does

The real power of the box lies in learning to adjust the threshold, cross-over frequencies and gain of each band. The secret is knowing what frequencies you want to cut before you start. At that point, switch to the "side chain" mode, which allows you to hear only the audio that will be added back in. Getting what you want requires a bit of practice. First choose how high or low to set the threshold. Set it too high and you get the whole waveform, which defeats the purpose of bringing up low level parts of the audio. Set it too low and you can't get enough to add back in. Then use the crossovers to isolate just the sounds you want to increase. Once you've got your sound, switch back to the "In" mode and dial in the amount of gain (up to 20 db per band) in the appropriate bands.

I began my practical tests by processing an instrumental spot bed from DAT. All of the tracks originated from my Roland U-20 multi-tumbrel synch except for the electric guitar lead. I had mixed the guitar a bit low to allow room for a voice track.

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Korg Soundlink Key to Byrd Studios

by Dee McVicker

ATLANTA Audio production for Tom Kihntopf, audio engineer at Audio/Video Byrd Productions of Atlanta, Georgia, is part science and part skill.

There's an enormous amount of skill that goes into the audio recordings and productions at the studio, which has built a name for itself by producing radio spots and audio for video. But there is just as much science involved when Kihntopf sits down to an editing session on the studio's KORG SoundLink digital workstation.

Currently, Kihntopf does audio work from two audio studios, one is a four-track

and the other is a digital eight-track with the SoundLink workstation. "There is nothing in that studio (that is) analog except master tapes. Everything is done directly on the SoundLink. All editing, recording, saving of the material, it all stays in the digital realm until we send it to a master tape," Kihntopf said.

An example of Kihntopf's technique is the production of the new "Jazzin' Up" radio program, which is currently being re-broadcast by radio stations in 55 markets. Everything is done on the computer hard drive. "I do all the work inside the KORG, inside the digital realm, and refine everything I need to refine until I'm ready

to send it to master tape," he said.

Music for the show is supplied locally on compact disc, which Kihntopf offloads to the SoundLink hard drive and edits and choreographs along with voice tracks recorded in the Byrd studios. With raw material on hard drive, he inserts cross fades, puts music in order and cleans up voice tracks. "That's mastered down (to tape) and sent to Los Angeles, where they actually press it to vinyl."

Digital time savings

Kihntopf has found the editing workstation to be a major time saver—light-years ahead of analog audio production. KORG

is simply a lot faster, he said. "It has the non-destructive editing feature, so if I have to do specific edit points, if I'm shortening music up or editing a sound track or sound effects voice track, things like that, it's a lot easier and a lot faster for me to get back and forth through the program to do the edits rather than the old analog tape method."

Working with three or four analog reels was always a problem when it came time to remember where information was stored, reflected Kihntopf. "With the KORG, since I don't have to touch any particular tape and everything's listed for me on the hard drive, I usually end up doing a session 20 percent faster than in analog," he said.

Of all the digital workstations he's worked with, Kihntopf said the KORG is the easiest to transition from board to workstation. Said Kihntopf: "The SoundLink has, of course, a number of faders—there are eight faders along with the MIDI and master fader—so understanding the transition between the board and the SoundLink is extremely easy."

Unheard of production

Getting in and out of editing functions in the KORG is also relatively easy and allows tasks unheard-of in the analog world, Kihntopf said.

He cited reviewing the waveform while scrubbing a channel as one feature not easily done while editing in analog. Another is changing audio channels without destroying information. Said Kihntopf, "If you laid something down (in eight-track



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The Korg Soundlink is an integral part of Audio/Video Byrd Productions.

analog), the only way to change it was to either erase that channel and relay that information again. With SoundLink, I can tell it to move it offset two to four seconds either direction and it will do that without destroying the rest of the material."

Kihntopf plans to continue adding capabilities to the system as technology permits. Currently, the main audio studio at Audio/Video Byrd Productions has a number of effects boxes, including a Lexicon PCM70 and a Urei LA-4, as well as new CD and RDAT source gear.

In the near future, Kihntopf wants to add an Tascam DA-88 eight track-track RDAT (8mm videotape format) to the studio. "We'll be able to actually do programming along with the KORG onto the 8-track digital. That will give us a lot of versatility and allow us to keep a lot of things in the digital realm, he said.

For more information on the KORG SoundLink, contact KORG at 800-645-3188, or circle Reader Service 102.

□ □ □

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

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FEATURES:	BENEFITS:
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Pop-up pan pots	Avoid accidental movement.
Link switch	Couples inputs 2 & 3 into a stereo pair.
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FEATURES:	BENEFITS:
Meter lamp	Illumination in low-light situations.
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Monitor In switch	Switches headphones between mixer output and Monitor In feed.
Tape out 3.5mm jack	Provides stereo, unbalanced, aux level signal.
Flashing red/green power LED	Green for power on; red for low battery.
Non-polarized power jack	Use external 12 to 30 VDC instead of batteries.
Internal DIP switches and trim pots	Customized FP32A operation.
Soft touch knobs with raised indicators	Tactile feedback for no-look mixing.
Black chrome finish	Extreme durability.

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20 to 20 kHz, ±2dB

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6dB down at 150Hz; 6dB/octave slope

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Threshold: 0dBm to +15dBm
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Dimensions and Weight

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(2 1/4" x 6 3/8" x 7 1/4")
without batteries: 1.6 kg; (3.5 lbs)

SHURE

Tackle Hum with Telescoping Cable Shields

Part III of IV

by Bruce Bartlett
with Jenny Bartlett

ELKHART, Ind. Here are more tips on preventing hum in your audio production system.

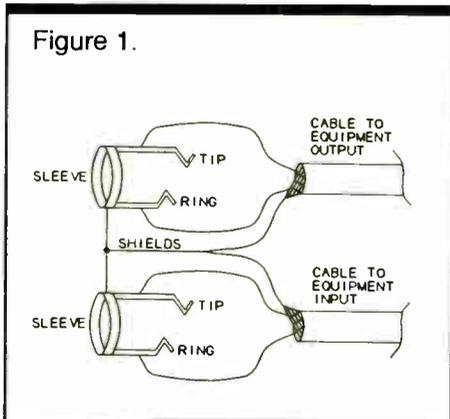
Suppose you connect two pieces of balanced equipment, and you hear hum. Maybe it's caused by a ground loop. Disconnect the cable shield at one end, so that no hum current flows between equipment.

Wire the cable shields like this: In each line-level balanced cable, connect the shield at *one end only* (in the female XLR connector). That is, solder the cable shield to pin 1 in the female XLR going to the equipment output. Leave the shield unsoldered (and cut short and shrink-tubed) in the male XLR going to the equipment input.

This arrangement is called a telescoping shield because the shield, being unconnected at one end, could be squeezed together or collapsed like a telescope. The two conductors from pins 2 and 3 carry the audio signal. The shield still drains hum interfer-

ence to ground through its single ground connection. If the shield were connected at both ends, hum currents might flow between the two components.

That is, a ground loop might be set up between the shield and the safety-ground wires, causing hum. Note: A microphone cable is an exception to this rule. A mic-cable shield should be tied (connected) to pin 1 on both ends, otherwise the mic



housing won't be grounded. Be sure to label your cables accordingly. In the cables that connect unbalanced equipment, the shield normally must be

connected to ground at both ends because the shield carries the signal along with the center conductor. Usually this doesn't create a serious ground loop unless the components have 3-wire power cords.

Suppose you have two pieces of unbalanced equipment that must be plugged into AC outlets on different breakers. If you hear hum after connecting them, use two cables in series instead, and wire a 1:1 isolation transformer between them. This disconnects the shield and breaks the ground loop.

Another way to float the shield is by using a direct box. If you get hum when you plug a synth into your mixer with a guitar cord, use a direct box instead. On the direct box, flip the ground-lift switch to the lowest hum position. If you pick up radio-frequency interference (AM or FM radio, CB, etc.) with a telescoping shield, connect the unconnected end of each shield to pin 1 through a 0.01 uF capacitor. If you locally ground a mic-connector box that is installed in a wall, this will create a ground loop. Don't ground the connector box except through its cable shield.

Try to put all unbalanced equipment in a single rack to shorten the interconnecting cables. A ground loop can occur when two chassis of unbalanced equipment contact each other through a rack. To prevent this, put unbalanced equipment in a wooden rack with wooden rack channels, and keep the chassis separated (insulated) from each other with electrical tape.

If you must use a rack with metal rails, isolate all the unbalanced rack equipment from the rack (and each other) by using electrical tape, nylon mounting bolts and nylon washers. Ground loops can occur when you use a patch panel to connect one piece of equipment to another. The telescoping shield connections prevent such ground loops, provided that you wire the patch panel in one of two ways. Either:
1. Don't ground the jack sleeves at the patch bay. Connect jack sleeves together (Fig. 1); or,
2. Don't connect anything to sleeves of jacks wired to equipment inputs. Connect cable shields to the rack ground bus (Fig. 2). Connect all leads of patch cords at both ends.

Each audio cable should have an insulating rubber or plastic jacket to prevent ground loops. If the shield is exposed, it can contact grounded metallic surfaces at more than one point, creating a ground

loop. Inside an XLR-type cable connector is a ground lug that contacts the metallic connector shell. If the ground lug is soldered to pin 1 (the shield's pin), the shell is connected to the shield through the ground lug and pin 1. Ground loops may occur if the shell touch-

□ □ □

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.

Stalking the Perfect Mix with Dolby 740 Spectral Processor

► continued from page 11

on the kick drum. I backed off to 2 kHz and boosted the mid control to the two o'clock position. With these settings the guitar was definitely up in the mix, but the kick had just barely begun to be affected.

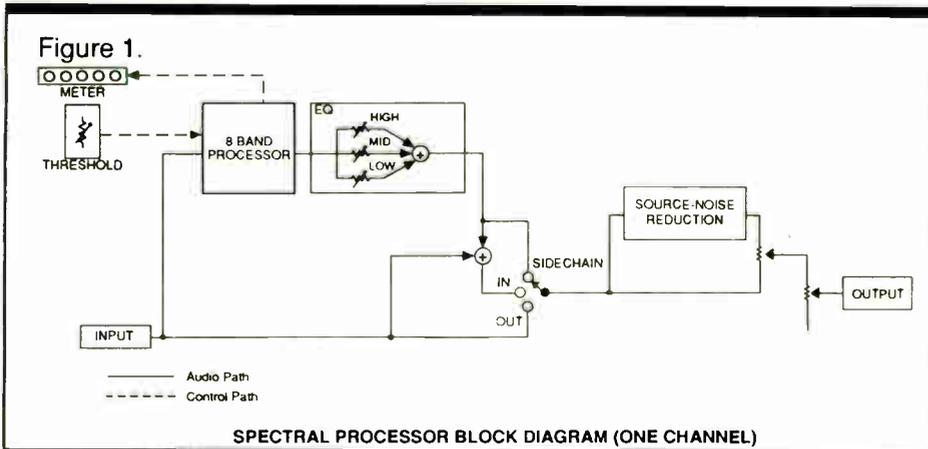
Adding sparkle

After experimenting a bit, I found that adjusting the lower crossover to 300 Hz and turning the low frequency knob com-

pletely off kept the bottom in place. When I was done, the guitar was up while the rest of the mix stayed pretty much the same. The overall level of the mix had been increased by one or two decibels as measured on my very fast peak meters. No change at all on my slower meters.

markets asking what amazing stuff I used, but I did get the satisfaction of knowing that I was able to make those spots sound just a little bit better before they left here. You also can use the 740 on solo tracks. While it doesn't offer the pinpoint accuracy of a well-designed parametric equalizer, expending the energy to track one down for a test drive is worth the effort.

In conclusion, I found that results, while predictable, vary widely depending on the

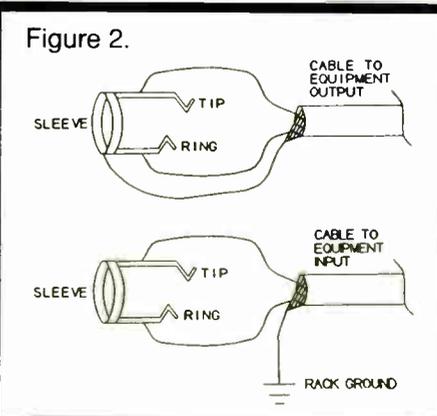


dynamic range, instrument selection, arrangement and use of reverbs and delays. In addition, I found the low frequency controls added more warmth than punch, the mid and high bands brought out vocals, solos, reverbs, "space" and "sparkle."

For more information on the Dolby Spectral Processor, call Nancy Byers at Dolby Labs at 415-558-0200, or circle Reader Service 112.

□ □ □

Note: Ty Ford's first text book, "Advanced Audio Production Techniques," will soon be available from Focal Press. Miraculously, even if you read it in a very quiet room, you will not be able to hear the agonizing screams that writing it caused him to make.

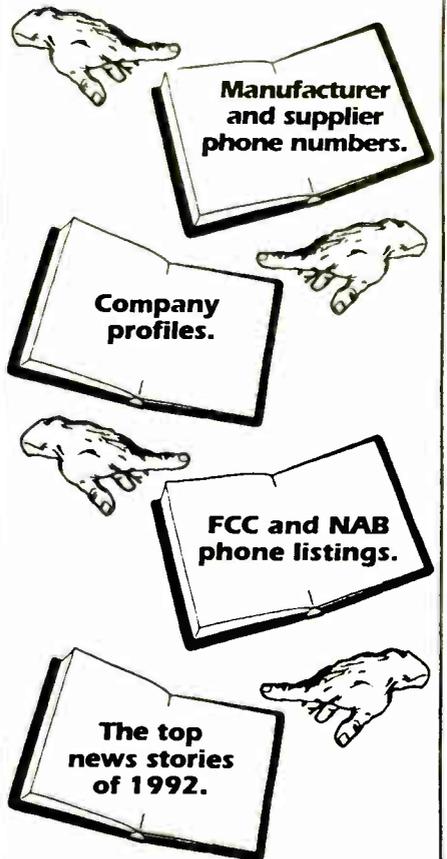


loop. Inside an XLR-type cable connector is a ground lug that contacts the metallic connector shell.

If the ground lug is soldered to pin 1 (the shield's pin), the shell is connected to the shield through the ground lug and pin 1. Ground loops may occur if the shell touch-

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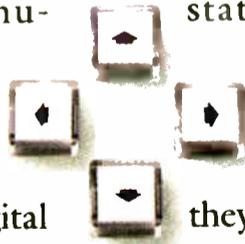
DSE 7000. In order to increase profits in the competitive

radio environment of the '90s, general managers have been asking more from their production directors, who in turn have had to do things faster and cheaper. Clearly, the trusty 8-track recorder wasn't going to lead radio stations through this new era.

Since it was impossible to become more efficient at tape splicing, astute production types contemplated digital technology. They found out



about a company with over 40 years experience manufacturing professional audio products, who was already shipping a digital sound editor for radio production. Not coincidentally, this system had many of the same controls and functions they were used to.



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World Radio History

Smoothing Out Digital's Rough Edges

by Frank Beacham

NEW YORK Although digital recording technology was introduced by the giant electronics conglomerates, it's being perfected by small companies who aggressively tackle flaws in the system.

Good examples are the new Apogee DAT tape from Apogee Electronics and the Colossus multichannel digital processor from By the Numbers. Both companies have introduced breakthrough new products that substantially advance the digital recording arts.

The Apogee DAT addresses the problems of drop out, errors, heat and archival shelf life that have plagued DAT recordists from day one. "I've got DAT tapes from 1988 that have drop out so bad they won't play back on certain machines," said Greg Laney of Apogee Electronics, a Santa Monica, Calif., company best known for its digital filters and converters.

With the goal of creating a better DAT tape, Apogee teamed with the KAO Corp. of Japan, a company that makes magnetic media for the likes of Apple, Microsoft and IBM. Eighteen months and 14 new patents later, the venture has produced the Apogee DAT.

The claims made by Apogee for this new tape are stunning. In fact, if this tape performs as the company says it will, the Apogee DAT may set a new industry standard for longevity and error rates unmatched by any other magnetic recording media.

Error free DAT

Apogee says the tape is 100 percent error free, has a 30-year archival shelf life and will withstand temperatures over 200 degrees without shell damage. "You can use these in the Sahara desert to record sound effects," Laney said. And, because of its improved binder system, tape guides and shell, Laney said, the tape offers improved performance for radio stations who push DATs to the limit through repeated use.

I won't go into all the technical info here, but, in a nutshell, KAO starts out with a very high grade of composite metal magnetic particle tape that is certified 100 percent error free. Improvements in magnetic layer thickness and the tape binder system yield, Apogee says, the lowest error rates obtainable in any magnetic media.

The magnetic particles are treated in such a way that oxidation is retarded over time. "The biggest problem with DAT tape is that after time its metal alloy will oxidize," Laney said. "It's like car paint will oxidize if you don't put clear coat on it. In a way, this tape has a clear coat on it that keeps it from being exposed to air and will keep it from oxidizing."

The Apogee DAT is available in 15- to 120-minute lengths with a price range of \$8.25 to \$14.99. It's being sold through major pro audio outlets.

Curing "digititus"

Colossus goes after the problem its creators call "digititus," that grainy, brittle sound associated with many digital recordings. The fix comes not with increased sampling frequency or longer bit words, but with highly advanced analog to digital conversion at the front end of the recording process.

Put simply, Colossus is said to have no sound of its own and therefore does not color or alter the incoming program in any way regardless of source, live or pre-recorded, even from another format.

Colossus is a 16-bit PCM digital audio system that allows the recording of four discrete audio channels on a professional NTSC video recorder. The device uses advanced bit rate converters to assure full 16 bit I/O linearity and employs no error concealment or data compression of any kind.

Invented by Lou Dorren, father of the four channel FM radio broadcast standard, Colossus has already been used to make over 100 compact discs ranging from live music and sound effects to archival A-D conversions and multi-track mix downs.

The news is the system, coupled with a new phase coherent soundfield microphone, is now being manufactured for sale to professional recordists.

Startling quality

The Colossus system has quite a history. It was commissioned in 1984 by Brad S. Miller, executive producer of Mobile Fidelity Productions of Incline Village, Nev. Miller has taken the equipment around the globe to record an eclectic array of sounds that are so startling and realistic that they transcend their subject matter and become a unique form of sonic storytelling in themselves.

The sound of trains, storms, gunfire, car chases and gentle surf with gulls are Miller's domain. Then there was the launch of the Space Shuttle carrying the Hubble Space Telescope.

There's much more to the recording philosophy that led to developing and using Colossus, and we'll explore those issues in an upcoming column. In the meantime, price for the Colossus system is \$22,500, and the MS-4 Soundfield Microphone is \$8,500. Systems are available for sale or rent from the manufacturer, By the Numbers, Incline Village, Nev., phone: 702-831-4459.

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

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The high-performance CD-401 (\$849*) incorporates TASCAM's award-winning ZD circuit to eliminate low level distortion and ensure sound quality that meets the most demanding standards.

The CD-401's fader-start feature allows play to start automatically on fade-in and stop at the completion of a fade-out. The CD-401 is available with optional hardwired or wireless remote.

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



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The How and Why of Sampling Rates

by Mel Lambert

STUDIO CITY, Calif. It is perhaps inevitable that in a world currently dominated by ones and zeros that number should play such a prominent role in all of our lives.

From zip codes and social security numbers to Ohms law and propagation patterns, few of us can escape from the dominance of digits. And in the wild and wacky world of professional audio, there is the inevitable lexicon of bit lengths and sample rates. But just how did we come to use so many different

sampling rates, and why these particular ones?

As the early digital recording systems began to emerge almost two decades ago from the R&D Laboratories of leading hardware manufacturers, sample rates were selected more for convenience than rationality. We soon came to the conclusion that 16-bit linear quantization provided a reasonable compromise between system costs and complexity on the one hand, and sonic performance on the other.

Fueled with a desire to push ahead with consumer compact disc and other

mass-market formats, 16-bit became the accepted norm. Of course, advanced recorders, editors and workstations still need to offer 20- or even 24-bit resolution to handle various DSP functions, including level adjustment, EQ and mixing, but the majority of mastering is still to 16-bit resolution.

How'd we get here?

But what of our 32, 44.1, 44.056 and 48 kHz sampling rates? Why these and not, for example, higher or lower numbers? Aside from a need to provide adequate frequency range (recall that the Nyquist Theorem states that we cannot digitize frequencies whose value is more than half that of the sample rate), several of these well-known numbers were selected for more bizarre reasons.

As many **RW** readers may already be aware, early PCM recorders were based on processors that recorded their output in quasi-video format to conventional VHS/Beta or U-Matic VCRs. Their dependency on video lead to the eventual selection of a 44.1 kHz referenced to 30 Hz in NTSC-video systems (and 25 Hz for European PAL units), and 44.056 kHz for color-time/29.97 Hz configurations. (The well-known 1/1.001 ratio between monochrome/30 and color/29.97, of the "point one percent pull up/down," turns up all the time when considering digital audio locked to video sync and timecode references.)

A sampling frequency of 44.1 kHz provides a frequency range in excess of 20 kHz, more than acceptable for the majority of professional and consumer playback applications, and has now passed into history as the CD and DAT sample rate. At the same time as CD was becoming standardized during the early 1980s, there was a move to define a "professional" sample rate that would provide extended frequency range beyond that of the CD release format. The reasoning being that mastering systems needed to provide additional frequency "headroom."

Initially, 50.4 kHz was promoted for professional applications and related to the CD rate by the simple factor of 8/7. (As in everything digital, systems designers were looking for simple mathematical techniques for converting from one sample rate to the other.) Meanwhile, in Europe the majority of broadcasters had opted for a 32 kHz sampling rate, primarily because they

felt unnecessary to provide frequency response much beyond around 15-16 kHz. Especially if standard stereo FM transmission systems would be rolling off everything above this frequency to provide space for the 19 kHz pilot tone.

Also, the majority of common-carrier digital transmission rates are in multiples of 8 kbps, a serial rate that falls quite nicely into line with a 32 kHz sampling rate.

In the end, 48 kHz became a more practical choice for professional recorders, primarily because of the simple relationship to the 32 kHz EBU standard, and also because it provides adequate bandwidth for mastering applications. Today, 48 kHz is the standard sample rate for D1, D2 and D3 digital VTRs, as well as being available on most DAT recorders, and as a system option for most workstations and editors that are configured for video applications.

The downside

The only downside to using 48 kHz comes when we need to lock systems to video-based timecode or sync signal. At the CD sampling rate of 44.1 kHz, referenced to 30 fps video, there are 1,470 digital samples per NTSC video frame; 44.056 kHz digital audio referenced to 29.97 fps color time also produces 1,470 samples/frame.

For 48 kHz digital audio referenced to 29.97 fps NTSC video, however, we end up with 1,601.6 samples/frame. So called "leap-frame" schemes with varying periodicity allow integer numbers of samples per video frame (including 1602, 1601, 1602, 1601 and 1602 samples/frame in strict sequence), but require additional DSP to keep track of the offsets and frame counts. On the plus side, all other video formats used around the world can operate with integer samples/frame at 48 kHz sample rates.

And, as I pointed out in last month's column, several firms are now producing low cost sample-rate converters (SFCs). SFCs allow mixed-rate projects to be handled in radio production studios, including direct digital transfers from, for example, portable DAT recorders operating at 48 kHz.

□□□

Mel Lambert has been intimately involved with the production and broadcast industries on both sides of the Atlantic for more than 15 years. Now a principal of Media & Marketing, a Los Angeles-based consulting service for the professional audio industry, he can be reached at 818-753-9510.



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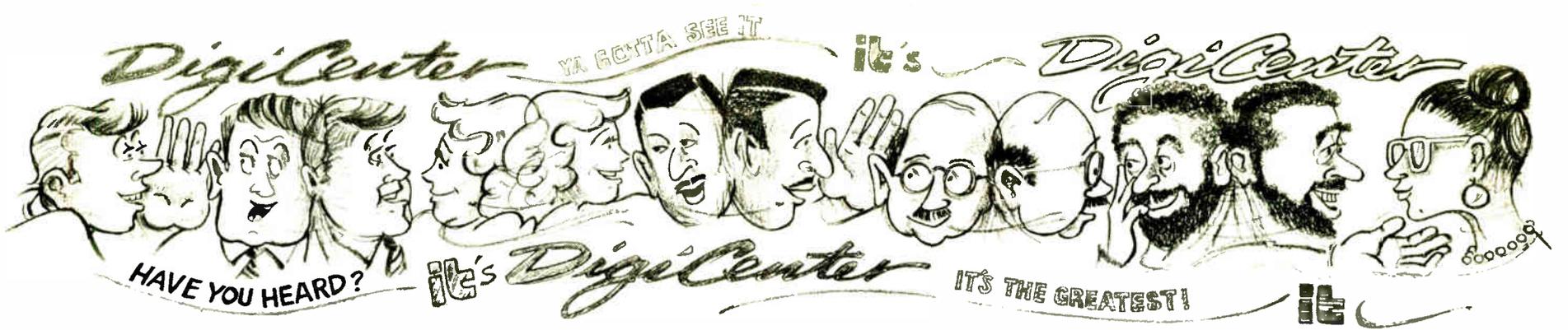
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PRODUCT GUIDE

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For more information, contact BGW at 213-973-8090, or circle **Reader Service 73**.

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The Audio Factor MX-Series Reference Monitors are a new line of nearfield monitors that include the MX-860, MX-1080 and MX-460.

The MX-860 has an 6.5-inch woofer with soft dome tweeter. The MX-1080 has an 8-inch woofer, soft dome tweeter and is built in mirror image pairs. The MX-460 has the same components as the MX-



860, but in a smaller cabinet. All models are available in a variety of finishes.

For more information, contact Mike Khosrovi at Audio Factor, 817-656-0730, or circle **Reader Service 89**.

Rane MS1 Microphone Preamp

The Rane MS1 microphone preamplifier is well suited for on-air and production console, DAT recorder and DAW applications, according to the company. The MS1 features 102 dB signal-to-noise ratio, switchable 48-volt phantom power, XLR I/Os and phase reverse.

For more information, contact Ellen Allhands at Rane, 206-355-6000, or circle **Reader Service 158**.



Yamaha DEQ5 Digital Equalizer

Building on its new DSP technology, Yamaha has developed a digital equalizer for production and live sound applications.

The LCD-display DEQ5 can be used as a dual channel, one-third octave graphic equalizer or a six-band parametric equalizer. The balanced XLR inputs connectors are capable of handling up to 24 dBm peaks. The outputs are also balanced XLRs with additional AES/EBU I/Os. Wide dynamic range (110 dB+) is provided by the 19-bit delta-sigma A/D converters. The unit also has an automatic hum canceler.

For more information, contact Yamaha of America at 714-522-9011, or circle **Reader Service 44**.



Marantz CDR610 CD Recorder

A new low-price Marantz CD recorder, the CDR610, with remote controller, has a list price of \$4,000.

The unit is based on the existing CDR-600 (now \$3,500), but has additional features including the remote controller, which controls the unit and other devices such as a CD player or DAT recorder. The CDR610 also features true AES/EBU digital I/O cascade connections for parallel operations of

other CD-Rs, balanced -10 and +4 operations, and calibration pots for digital meter matching for another reference.

Marantz is making the CDR610 upgrade available for the CDR600 for \$400, and is making recordable CDs available to registered owners of both for \$15 per disc.

For more information, contact Dave Schwartz at Marantz, 708-820-4800, ext. 220, or circle **Reader Service 120**.

continued on page 21 ▶



PUT PRODUCTION WHERE IT BELONGS—IN THE PRODUCTION ROOM

Using PC's for digital storage and random retrieval of audio has revolutionized the radio business, much like the cart machine did in the early 60's. But with the new technology came new problems. One digital audio unit in the control room could do the job of every cart machine—but how do you record? Simultaneous record playback made it possible to record into the same machine, but logistically it was still a problem—recording needed to be done in the production room, not the control room.

Now SMARTS Broadcast Systems has added a new product—The Digital Production Module. The DPM is really a computer controlling part of another unit. With the DPM, the record functions of the simultaneous record playback SMARTCASTER appear on the screen of a PC in the production room, while the control room unit playback section remains on the air. The DPM allows data entry and recording directly on the control room unit, while the control SMARTCASTER is playing spots, controlling automation, or performing other critical functions.

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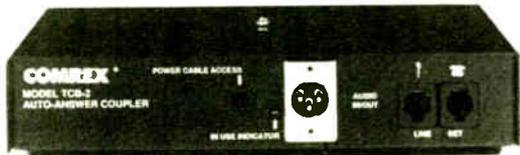
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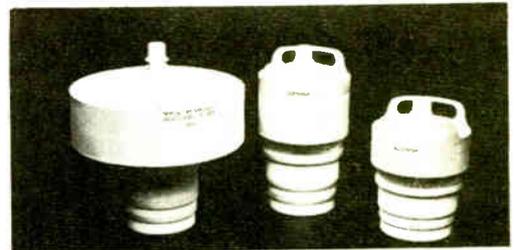
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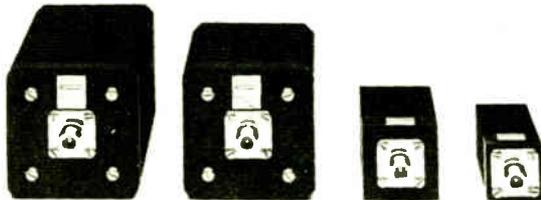
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MIDI Package Makes Quality Spots

Part IV of IV

by Al Peterson

HARRISBURG, Pa. Let's put together a MIDI production room! Time to equip a budget room for simple work, and for your lucky people with a bottomless bankroll, a higher-end facility. Both handle serious projects, crazy morning show song parodies and in-house jingle creation.

Please bear in mind, no gear alone on earth will make you a jingle production genius if you know nothing about music. True, there are "intelligent" keyboards available that bang out rhythm and backup, but they are not the answer. MIDI production, like any audio production, must be inspired. Otherwise, it's back to late '80s technopop.

That being said, let's part with your next five remote fees and go after building up a budget MIDI rig first. A department store keyboard with a MIDI OUT jack can function as a controller. It will lack features such as velocity (how loud a sound will be depending on how hard a key was struck), but should send Program Change, Pitch Bend and other commands. Perhaps a Kawai Spectra or low-end Roland or Yamaha pro keyboard will do.

The equipment

To round it out the equipment:

- A Yamaha TG100 or Roland SC-33 multi-timbral sound module for

instrument voices.

- An Alesis QuadraVerb or ART Alpha 2 processor for reverb and flanging.

• A used Alesis HR16 drum machine. Since the SR16 was released, HRs have shown up cheap in shoppers' guides.

- A MusicQuest "PC MIDI card" interface kit and Twelve Tone's "Cakewalk" sequencing software for the computer you rescued from the closet (see sidebar to part III). No computer? Then buy the Alesis MMT-8 sequencer from the guy selling the drum machine.

- The Anatek "Pocket Thru" self-powered MIDI splitter box to distribute MIDI data to all components in the rig. All things considered, a very formidable starter setup.

The drawback is in the limitations of the MIDI modules; you cannot add new sounds to update your production without buying all new gear. The answer is modules that accommodate ROM cards, such as Korg's Wavestation SR or Roland's U-220, among others. But that adds more expense.

Dedicated or not

Since most DSPs have some sampling capability (and we are trying to bring this in cheap) a dedicated sampler isn't necessary. But you may luck into an old Ensoniq Mirage or Roland S-10 on the used market. Plan to put aside at least four console inputs (keys, DSP, drum machine and module) to achieve a mix.

At the other end of MIDI land, you can assemble a stately "pleasuredome" with some very powerful and costly goods:

- E-Mu's EIII sampler. It's a steal at four grand. If too high, consider the Akai SO1 Rackmount sampler or Ensoniq's ASR-10, combining keyboard, sampler and built-in sequencer/disc drive.

- Kurzweil's K200R keyboard with the SCSI option—the Schwarzenegger of synths/controllers.

- E-mu's Proteus/2 Orchestra MIDI module. Reviewed in the February 6, 1991 **RW**, still one of my favorite devices. An entire symphony in a single rackspace.

- Ensoniq's DP/4 Processor. Four DSPs in one box. Rack this next to the biggest Eventide you can find.

- Passport's "Master Tracks Pro" and "Encore for Windows" sequencing software running on a 486.

- The baby Mackie mixer or Soundcraft/JBL's "Spirit Folio" to submix and assign everything before it hits the console. Power, speed, open-endedness, with new sounds only a floppy or ROM card away. Editing capability like waveform redraw, and clean sounds with lots of punch.

These components all lend themselves to creative radio production without frills you may not need (when's the last time you had to sync-to-SMPTE for that pet store spot?).

Whether used for automated mix, ripping through DSP programs, or creating music beds, lasers, or jingles, it's here; it's inex-

pensive; it's upgradable; and the sound you create is yours. Having MIDI production could bring additional agency income, with your station's "studio of choice" for the big jobs.

Al's setup

I'll complete this series by examining a typical MIDI setup. Specifically, mine. The master keyboard is a Roland D50, directed into a MIDI Patch Bay, where info is routed to the rest of the rig.

Data is directed to Yamaha TG33 and Roland SC55 multi-timbral sound modules. Both contain a multitude of sounds and drum "kits." A Roland TR505 drum machine provides more traditional percussion sounds and helps to arrange rhythm tracks before dumping into memory. Very low-tech, but very essential is my ten-year old non-MIDI Moog analog synth.

An early Alesis MidiVerb and Yamaha SPX-90 (doubling as a two-second monophonic sampler) handle my processing needs, all included in the MIDI chain.

Sequencing and storage is done with an Alesis MMT-8, a budget Brother MDI-30 floppy recorder and an Acer XT clone running CakeWalk 4.0. Audio mixes through an overworked nine-year old Teac 2A 6x4 mixer into Tascam multitrack and two-track reel recorders for stereo mastering.

Good luck with your studio. In the right hands, MIDI is a very potent tool opening new dimensions to creative radio production directors.

□ □ □

Al Peterson is production director for WINK(FM) in Harrisburg, Pa. He can be reached in care of RW.

PRODUCT GUIDE

► continued from page 18



Aphex Aural Exciter Type III Model 250

Professional processing without noise and distortion are features of Aphex's Aural Exciter III Model 250.

The Model 250 uses the SPR (spectral phrase refractor), which corrects the bass delay anomaly inherent in recording, according to the company. The process is said to restore clarity and openness, and increase the bass energy level. Other features include Adjustable Harmonics

Enco DAD486X Production System

The Enco 486X is a highly capable digital audio production, recording and playback system. Designed for use on a 486-based PC, Enco can configure a total hardware/software package, or the user can supply the hardware.

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For more information, contact Brad Young at Enco Systems, 314-453-0060, or circle Reader Service 130.

Mixing and Null/Fill, and XLR connectors.

For more information, contact Aphex at 818-767-2929, or circle Reader Service 9.

BBE Pro Sonic Maximizers

BBE recently introduced the Model 862 and Model 462 Sonic Maximizers with the BBE II process.

The new BBE II process is said to reduce noise down to -95 dBu for the Model 862 (-92 dBu for the Model 462). Both are being used in on-air and radio production suites, according to the company. The Model 862 also includes XLR and quarter-inch I/Os with levels to +4 dB. Model 462 is similar to the 862, but has unbalanced quarter-inch and RCA jacks with levels to -10 dB.

For more information, contact Rob Rizzuto at BBE, 714-897-6766, or circle Reader Service 163.

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TECH TALK

A 'Production Rat' Makes Audio Easier

by Judith Gross

NEW YORK Anyone who has ever had to sit down in front of a studio mic and mixer and come up with a dazzling bit of production to make clients dance with delight, knows what a daunting task that can be.

In today's world of digital audio, the job can be even more formidable, especially for talent, sales and managerial staffs who view themselves as "non-techies."

Many of those non-technical production people turn to what we fondly refer to as an expert "production rat" to provide just the

right blend of equipment savvy, artistic sense and golden ears to turn radio audio into revenues. One such "rat" (forgive me, Ty) is RW's own Ty Ford who not only writes about equipment and production techniques, but produces out of his own studio in Baltimore.

Ty has blended the basics of his own knowledge into a book for Focal Press. Managers, novice producers and engineers can all learn from "Advanced Audio Production Techniques," which might also make a good textbook to go along with an audio production course. Here's a book that you don't have to be a microprocessor design wizard to comprehend.

Role of equipment

What's particularly effective about the material covered is that it takes an equipment-oriented approach to the idea of production. Ty has an engineering background and thus understands all facets of production.

I was pleasantly surprised by the level of complexity the book manages to convey. The information starts out simple, with how to listen, and extends to include the newest digital and MIDI techniques. Experienced production personnel can either skip over the more elementary information, on monitor placement, for example, or use it as a refresher course to be filed under "Things You Know But Don't Always Apply."

Station engineers, especially if they've had to concentrate a little too much on RF, can use the information to get more in touch with the nuances of audio gear which should prove invaluable the next time they have to advise on new processing.

And managers, who are staying in closer touch with their station's equipment these days, will increase their education and at the same time be able to speak knowledgeably about what their own studios are producing.

Listening is key

The first part of the book is devoted to listening, starting with how to visualize and how to compare finished audio products to your own audio references. I'd always wondered how a "golden ear" just seems to know when a sound is right. While I'm sure "gut feeling" plays a major role, Ty explains how getting enough practice comparing recordings to what you are intimately familiar with can go a long way toward improving your own work.

The "Advanced Listening" chapter talks about studio set-ups and asks producers to consider the actual use of the finished product when setting up the sound. Ty explains polarity and phase cancellation

and then gives a thorough discussion of audio's worst enemy: noise.

His engineer's training shows in a section on impedance, and he goes on to cover the meaning behind terms such as "headroom," "dynamic range" and exactly what is meant by "balanced and unbalanced" audio.

some experienced production rats? This is the chapter that tells all.

From that jumping off point, Ty goes on to cover new, specifically digital, technology, which is what makes the book a good read for even old audio pros. There is a good discussion of sample rate, bit rate and

quantization and the advantages of digital audio. Ty cautions (and rightly so) that just because a piece of audio is digital doesn't always mean that it's better.

He also covers MIDI, digital editing and talks about digital audio workstations, which have gained such prominence in audio production.

It's probably due to space limitations, but I would have loved to hear more from Ty on specific digital formats. The book might have benefited from more discussion of DAT, DCC and MD, in addition to the coverage of digital cart machines.

I was glad to see some information on audio data compression in the section on digital cart machines. In a longer book, or a second volume from Ty, the debate on this technology, which looks to play a major role in audio of the future,

could be expanded as well. But these are minor criticisms of a book which covers a lot of ground.

From the source

Another interesting part of the book is an interview with production gurus Nelson Funk of Washington's Rodel Audio and Louis Mills of Baltimore's Flite Three. These two guys can boast 60 years of combined production experience and their answers to Ty's questions nicely illustrate many of the points made in the earlier sections.

In fact, readers might like to start with this last chapter first, since a lot of the basics which come before may be even more relevant once you understand the way art and craft combine in the work of actual successful producers. Particularly interesting is how both producers take special care to consider the environment of the finished product, mixing and recording differently for TV, radio and industrial radio.

And, in case you're wondering, both Funk and Mills say they produce audio to be louder in volume and stand out on the dial (or on the tube) as much as possible.

In the end, it's clear their experiences help to shape "a production greater than the sum of its parts," which Ty believes is such a critical part of any audio production.

Ty Ford's book, "Advanced Audio Production Techniques" can be ordered from Focal Press by calling 1-800-544-1013.

□ □ □

Judith Gross is vice president and head copywriter for Media/Scan, a marketing/advertising agency for broadcast and pro audio companies. She can be reached at 212-929-6108.

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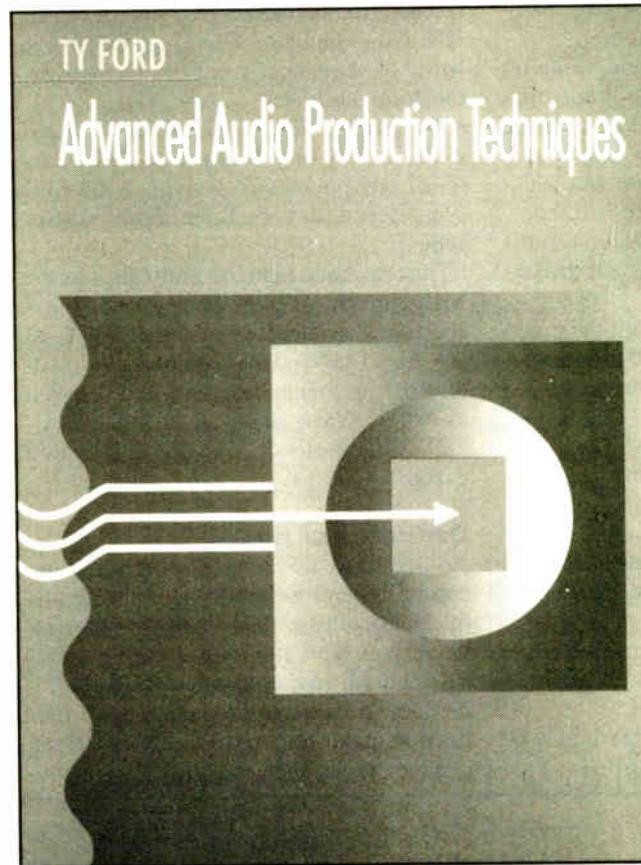
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Ty Ford's recently published book can serve both audio pros and novices.

The book's chapter on signal flow is where the connection between audio gear and the sound of a finished production really comes to the forefront. If you've ever stood confused in front of a stubborn patch by trying to envision how "the music goes round and round" through DAs, switchers and consoles before "it ends up here," this section should remove the mystery.

Limiting and beyond

The real meat of the book, however, is contained in Ty's lengthy chapter on "Shaping Audio." This is where a producer can learn or re-learn the fundamentals and how-tos of equalization, gain control, reverb, stereo spatial effects and special effects. Have you been trying to get a handle on attack and release times? Wondered about compression versus limiting? Would you like to understand why the Aphex Aural Exciter or Bedini Audio Spatial Environment is the first love of



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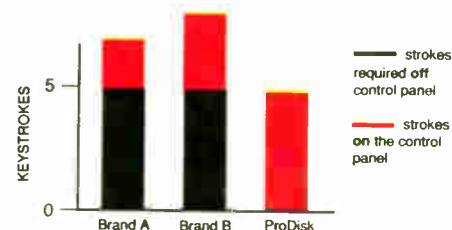
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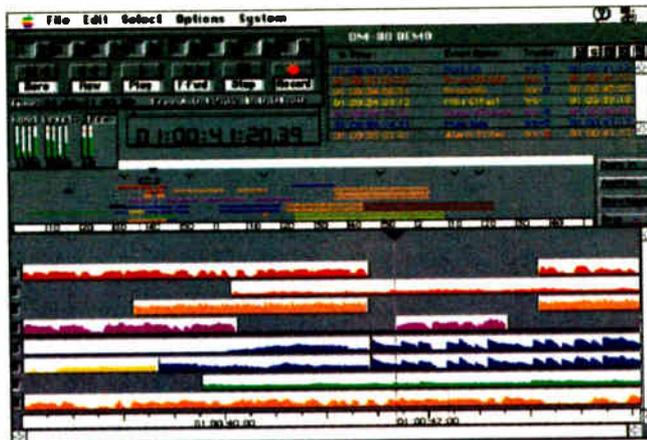
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Problem: Many DAWs just can't give you all of these things.

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The Answer: A workstation that separates the hardware "engine" from the user interface computer. This way, audio information processing is not slowed down by the user interface, and the interface computer operates without the load of additional tasks. And you save time and money.

Problem: A system crash in the middle of a complicated project could cost you as much in time lost as some of the less professional DAWs are worth. You should expect reliability you can count on from your DAW, and get it.

The Answer: First, call around. Check the reputation of DAWs. We have DM-80s working every day all over the world in high volume production environments. Our customers will tell you they're reliable.

Problem: Some systems don't give you a user interface that's familiar and easy-to-use.

The Answer: Buy a DAW that lets you choose either a dedicated hardware remote that gives you familiar tape recorder controls, or computer software control that is simple to understand and easy to operate.

Problem: Some DAWs are the weakest link in the audio chain. The DAW you buy should deliver sonics as good or better than any piece of audio equipment you own.

The Answer: Choose a DAW from a company that knows professional audio, not just a company that knows computers. But most of all, ask audio professionals who own one.



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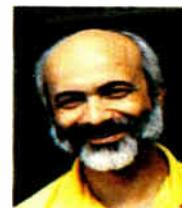


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COLE'S LAW

Don't Gamble with FCC Lottery Regs

by Harry Cole

WASHINGTON Let's take a page from the Johnny Mathis songbook—"Chances Are." That's right, I'm talking about lotteries.

Life was simple once upon a time. It was pretty easy to determine what "lotteries" were and what activities could not be promoted on the air. It was a lottery if it had the three fatal elements—prize, consideration and chance. You couldn't say diddly-squat about it.

Then the states, facing declining tax revenues, realized what organized crime, the stock market and the insurance industry had known for years: the great unwashed like to gamble and are willing to fork over big bucks to do so.

Suddenly state lotteries were the ticket (so to speak) back to financial well-being. But what good is a state lottery if the state can't publicize it?

Changing the rules

After some prodding, Congress accommodated the states by amending the Communications Act to allow broadcasters limited authority to broadcast state (but not private) lottery information. The gist of the law is that a broadcaster could promote a state lottery (regardless of which state) as long as the broadcaster's state has a lottery of its own.

(You should note that some aspects of this law have been challenged successfully in a lower-court ruling. As of this writing we are awaiting a Supreme Court decision. Exactly what might happen if the ruling is upheld is not at all clear.)

By the end of the 1980s, the universe of permissible lotteries had expanded still further with two more amendments to the Communications Act. Now you can broadcast advertising for private lotteries as well, if:

- The lottery is conducted by a non-profit organization or governmental organization, as long as the lottery in question is not otherwise prohibited by the state where it is being conducted; or

- The lottery is conducted as a promotion by a commercial entity and (1) the lottery is not otherwise prohibited in the state where it is being conducted, and (2) the lottery is only conducted occasionally and is ancillary to the entity's primary business.

Then some Native Americans convinced Congress that broadcasters should be allowed to advertise gambling (or "gaming," as it is sometimes more delicately referred to in this context) conducted pursuant to the Indian Gaming Regulatory Act. That law permits Native American tribes to run gambling establishments on their reservations, subject to certain regulatory restrictions.

If things weren't murky before, they got murky here. The Indian Gaming Regulatory Act is a complex piece of legislation drawing various lines between, say, "Class II gaming" and "Class III gaming," with each class being subject to significantly different regulations, restrictions and governmental authorizations.

Fortunately, there is a thing called the National Indian Gaming Commission that can provide information concerning tribal gambling activities—especially reassurances that a particular tribe is actually authorized to conduct games.

As of right now, then, the old-fashioned "prize-consideration-chance" mantra is a quaint reminder of what the law of broadcast lotteries once was. It remains useful

because an activity that does not include all three elements cannot be a lottery at all.

Chancy questions

But even if all three elements are present, it may still be possible to promote a lottery on the air. Once the prize-consideration-chance trinity has been applied to a particular activity, you should run down the following questions:

- Is the activity a state lottery and, if so, does your state have its own lottery?
- Is the activity being conducted by a non-profit or governmental organization?
- If the activity is being conducted by a

private commercial organization and is not prohibited by local law from doing so, is the activity clearly just occasional and ancillary to the organization's primary business?

- Is the activity being properly conducted pursuant to the Indian Gaming Regulatory Act?

If the answer to any of these questions is yes, you are likely to be in good shape. However, as you might gather, except for the state lottery situation, these are all judgment calls. There are some gray areas.

When that is the case, be careful. The commission has been in a fining mood lately,

and fines in the low five figures for lottery-related miscues are not been uncommon.

As tempting as it may be to take a gamble and pocket the advertising revenue from a lottery promotion, if you guess wrong any profit you make could be chewed up in legal fees and fines.

All of this leads ineluctably to the standard closing suggestion, which is that you should not be shy about consulting with your communications counsel. In this day of increasing fines and forfeitures, and particularly in view of the relatively complex manner the law has evolved, a consultation will almost certainly improve your odds.

□□□

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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T M C I 9:52 AM ULTIMATE DIGITAL STUDIO Wednesday 07/28/93

ON THE AIR 0:05			System AUTO-SEGUE LOADING:3 LOGGING:ON TIME UPDATE
PEG			
STEELY DAN			
Time: 3:28	Intro:15	End:F	
> NEXT TO AIR			
ONE MOMENT IN TIME			CD JUKEBOX #3 Slot:36 Cut:14 CD ID:160 Sked at:09:55A Sked on:07/28
HOUSTON WHITNEY			
Time: 4:41	Intro:14	End:C	
NEXT TO FOLLOW			
LEGAL ID			DIGITAL AUDIO
DIGITAL AUDIO			Spot:5013 Sked at:10:00A Sked on:07/28
Time: 5:10	Intro:00	End:C	

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- F3 View Events
- F4 Edit Events

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The screenshot displays the Ultimate Digital Studio interface with the following elements:

- Header:** T M C I 9:22 AM ULTIMATE DIGITAL STUDIO Wednesday 07/28/93
- ON THE AIR 1:59:**
 - SURFER GIRL** (CD JUKEBOX #3, Slot:28 Cut:01)
 - BEACH BOYS** (CD ID:307, Sked at:09:21A, Sked on:07/28)
 - Time: 0:22 Intro:14 End:F
- READY TO AIR:**
 - HORMEL_3** (DIGITAL AUDIO, Mode:STEREO)
 - COMMERCIAL_1** (HDSK, Spot:7012, Sked at:09:23A)
 - Time: 0:30
- System AUTO/SEGUE LOGGING:ON TIME UPDATE** (Blue box)
- F1 Help** (Button)
- VIEW EVENTS ESC to Exit:**

9:14 AM	3	YOUR WILDEST DREAMS	MOODY BLUES
9:18 AM	3	JUST A SONG BEFORE I GO	CROSBY, STILLS & NASH
ON AIR		SURFER GIRL	BEACH BOYS
09:23 AM	:30	HORMEL_3	COMMERCIAL_1
09:24 AM	:30	KXAS_TV5_2	COMMERCIAL_1
09:24 AM	:10	MIX_105_12	JINGLES
- NEXT T:**
 - KXAS_TV5_2**
 - COMMERCIAL_1**
 - Time: 0:30
- Footer:** Copyright 1990 - 1993 TM Century, Inc. Dallas, Texas

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KEYBOARD CONNECTION

Important Information About MS-DOS 6

by Barry Mishkind

TUCSON, Ariz. Back in April, Microsoft introduced MS-DOS 6. Since then, nearly 4,000,000 copies have been installed. While most users have been extremely pleased with the enhancements and utilities in DOS 6, some have reported problems, usually data corruption after using DoubleSpace.

Until now, solutions have been somewhat elusive. But your friendly fellow keyboardist set out to speak with three of the largest and best respected diagnostic

software manufacturers in an attempt to find accurate answers. Here is some information that can help put your mind and computer systems at ease.

The problems

Many users who were doing just fine, thank you, seemed to begin having problems after loading DOS 6 and DoubleSpace (a utility program designed to enhance the capacity of hard drives). Some had programs crash, others lost data, some lost everything.

After speaking with Symantec, PC Kwik,

and TouchStone, I can tell you it isn't mainly a DoubleSpace problem, but rather a combination of factors working in tandem. Two are software problems, but the two most critical are essentially hardware problems.

The first relates to caching programs. A cache program speeds up a computer by intercepting data your computer tries to save, delaying the writes to time slices when you aren't using the CPU for something else. One simile would be the "catch up" feature on digital delay boxes which waits for periods of silence to gradually increase the effective delay, rather than making you stop and wait for seven seconds.

Data loss can occur when a user finishes a project, and immediately flips the off switch. Any data in the cache will be lost. If it's critical data, such as system information, you might have a complete "crash." (Any disk compression system, has more critical areas than straight DOS.) Usually the cache will "flush" after a few seconds waiting and all is OK. Not understanding this delay causes over half of all reported problems.

Symantec's Norton Cache™ uses a command similar to SmartDrive to flush all data out immediately. PC Kwik's Super PC Kwik™ has gone further, doing two interesting things. First, its default is "no delayed writes." And, even with the delayed write turned on, the cache can be set so the DOS prompt is not returned until it's empty. This helps prevent problems.

A second area of concern is media defects, or bad sectors on a hard drive. In my case, in over eight months of heavy usage, I've not had a single problem, even with DoubleSpace. But in an interview with Shannon Jenkins, President of TouchStone Software, makers of CheckIt Pro™, a key reason was made clear.

The latest hard drives prevent you from seeing or using bad sectors. However, IDE drives make up less than 20 percent of the

installed base. If you have an MFM, RLL, SCSI or ESDI hard drive, you have to do some preventive maintenance.

PM on computers

Ms. Jenkins explained media defects are the biggest non-user caused problem source. Like any other piece of equipment, hard drives develop weak areas after use, and these can glitch under stress. She compared running a hard drive with DoubleSpace to "driving down the freeway at 100 mph." If your car had bad tires, you'd think twice before stressing them that way.

Jenkins commented that before DoubleSpace "many drives previously hadn't remotely had any operation as stressful as disk compression."

Clearly those most eager to benefit from disk compression have those older 20 and 40MB hard drives. These usually are MFM or RLL types with some bad spots. In order to help users stress-test their hard drives and identify potential problem areas TouchStone has released CKMEDIA. Available as DOS6PREP.ZIP from many retailers, CompuServe, and the TouchStone BBS at 714-969-0688, CKMEDIA checks hard drives and marks bad sectors off, preventing their use.

To be sure, there are two problems identified in DOS 6. However, they're not a problem for most users. The DOS FORMAT command will reset all the pointers to the bad sectors, and certain illegal characters in filenames will cause DoubleSpace to choke. Few people repeatedly format their hard drives (again, IDE drives are not affected). But if they do, CKMEDIA will restore the markers. It'll also report on potential problem filenames.

Additional references

Further information on how to get the most out of DOS 6 is available in many after market books, on a variety of levels. Here's a sampling of books you might find useful:

"Running MS-DOS" by Van Wolverton (Microsoft Press) is a well written, easy to understand guide to all aspects of DOS. Using real examples, Wolverton helps you to understand the whys and hows of DOS operations. Another Microsoft author, Dan Gookin tackles the area of "Managing Memory with MS-DOS 6." If you want to know where and how to pack programs in memory, try this book.

For the more experienced power user that wants to explore the power of DOS, Jeff Prosize's "DOS 6 Techniques & Utilities" (Ziff-Davis Press) is the perfect manual. Complete with a diskette containing 48 utilities, Prosize will help you tweak your system for optimal operation.

And with so many users feeling like they'll never understand DOS, a whole group of basic books has appeared, leading the user to understanding, step by step. "PC Learning Labs Teaches DOS 6" (Ziff-Davis) will take a novice and move him/her up to speed quickly.

And for those that just want to understand how to get things running in plain language, "PCs for Non-Nerds" and "DOS for Non-Nerds" (New Riders Publishing), or "The Complete Idiot's Guide to DOS" (Alpha Books) are just the ticket for the secretaries, salesmen, and other technophobes around the station.

□ □ □

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

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NAB CD-II Builds on Past Success

Editor's note: In this article, Workbench Editor John Bissett, who helped design NAB Test CD-II, explains the useful measurements and adjustments engineers can make using the disc.

by John Bissett

WASHINGTON In 1988, the NAB embarked on a project to provide useful test tones on compact disk. The NAB Test CD-I, mastered by Denon, quickly became an industry standard, being adopted by several manufacturers for the alignment and maintenance of their equipment.

In addition to basic CD performance test signals, this first CD also included a number of specialty tones for Bessel Null Measurement, determining phase shift, plotting pre-emphasis and de-emphasis, and calibrating peak flashers, PPM/VU meters, as well as THD analyzers.

In late 1991, work began on a complement to Test CD-I, based on input from broadcasters and manufacturers alike. As tracks for the second disk were reviewed, one of the first suggestions implemented was to lower the level at which the tones were recorded.

In Test CD-I, most tracks were recorded at the maximum CD output level of FFFF or zero dB. In a workbench setting, this level posed no problem; however, many engineers were running their CD player through a console for testing purposes. This elevated level meant that nominal fader settings could not be maintained.

The average level of music is usually 15 dB below the clipping point of the CD player. Since there is no such thing as +1 output on a CD player, that is, the maximum output is 0 dB, the tones on Test CD-II were recorded at -15 dB.

Fader compatible

This corresponds to a console set up for zero VU = +4 dB. The result of this change is that the tracks can be played with the console faders set for normal operation.

Test CD-I provided calibration tones for Total Harmonic Distortion Analyzers. In Volume 2, flutter meter calibration tones were added. Short term variations in a tape transport define the term "flutter."

Both DIN and NAB flutter standards are provided, but with precise amounts of flutter added to the standard test signal. Flutter is typically measured using a stable reference frequency. 3.0 kHz is used for DIN and 3.150 kHz is the NAB standard. When a stable reference frequency is played back, any variation of frequency will be directly proportional to the transport speed errors.

It is important to remember not to use these tones for actual flutter measurement. Instead, the flutter meter is connected to the Test CD output; and the meter is observed as a standard reference tone with a frequency modulated error signal corresponding to 0.1, 0.3 and then 1.0 percent flutter is played.

A number of reverse polarity test tracks are provided on Test CD-II that permit evaluation of crosstalk, dynamic stereo separation, input level matching and interchannel delay matching in digital audio equipment.

There is a unique reverse polarity sweep tone that was engineered to make response measurement on an oscilloscope

easy to read. This sweep track is also repeated in the L+R mode elsewhere in the CD.

The rapid sweep from 20 Hz to 20 kHz occurs in 0.25 seconds. What distinguishes the NAB Test CD Sweep track from other sweeps is that the beginning cycle of the sweep is 2 dB higher than the rest of the sweep. This allows the scope to trigger easily on the frequency burst and puts an end to a "wandering" or unstable CRT display.

Logarithmic time

In addition, the frequency is a function of logarithmic time. By doing this, the high end is not squeezed into the right end of the scope CRT. When you view the display of this track on a scope, 20 Hz will appear on the left edge of the screen, and 20 kHz will appear on the right of the screen. This makes frequency response evaluation quick and simple to interpret, using a standard oscilloscope.

To further ease response interpretation, a scope graticule identifier is provided in the accompanying CD booklet. This identifier



NAB Test CD-II

permits the user to define the specific location of a particular frequency or frequencies, without the need for a costly spectrum analyzer.

A couple of years ago, Chuck Kelly, a former chief engineer and now director of international sales at Broadcast

Electronics, presented a paper on tuning an FM transmitter for best stereo to SCA crosstalk. Chuck's paper discussed the impact that transmitter tuning had on minimizing main to SCA crosstalk. Five minutes of a 4.5 kHz tone in the left channel is provided on the Test CD-II for tuning a transmitter using Chuck's technique.

In this track, along with most others, another "customer suggestion" was implemented. The length of these tracks was increased. Rather than provide 30 seconds or one minute of a transmitter tuning tone, only to be very close to your final adjustment and have the tone drop out, a full five minutes is provided.

If you own a spectrum analyzer, the noise performance or slot noise test tracks will be of interest. On these tracks, band limited white noise is recorded. The noise has a usable bandwidth of 20 Hz to 20 kHz. A very steep notch or slot exists at an Fo of 3.25 kHz. The 3 dB points are at 3.0 and 3.5 kHz.

A broadband noise signal will excite any system non-linearities. In an STL, for example, non-linearities that could not be discovered using the more traditional two-tone intermod test can be seen.

Examining non-linearities

If the system under test is purely linear, the shape of the noise, or its amplitude, may vary, due to frequency response changes, but the hole or slot will still be there. As intermod products are created, the slot fills up quickly. Two different tracks are provided. One track has a slot at 10.5 kHz, providing sensitivity for higher frequency intermod products. The second track has an Fo of 3.25 kHz and is useful in identifying lower frequency THD.

An instrument that seemed to arrive before its time is the QA-100 Quant-Aural® Audio Program Analyzer, manufactured by Potomac Instruments. The primary function of the QA-100 is to "take

continued on page 35 ▶

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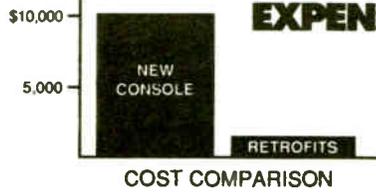
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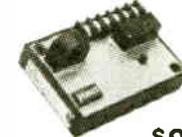
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The Pen is Mightier Than the Source

by Mark Strausberg

AUSTIN, Texas Engineers have a new, easy-to-carry tool that can help diagnose potentially lethal electrical problems at transmitter sites.

The device, called the Safety Pen, measures voltages at transmitter sites. The hand-held device was developed by the Texas Association of Broadcasters (TAB), Clear Channel Communications and the Society of Broadcast Engineers (SBE).

The Safety Pen emits a bright red light when it detects electromagnetic fields with 90 volts or higher. The unit also can be inserted into a wall socket or be run along the wires of a transmitter.

"Where you would put your hand, you put the pen first," said Karen Monsen, communications director of the TAB.

According to Gil Garcia, chief engineer at Clear Channel's KPEZ-FM in Austin, Texas, who was instrumental in launching the unit, the pen can detect RF fields 200 feet away.

Originally developed for electronics engineers by a company called

Centronics, the pen has only recently been introduced to the communications industry, mainly through the efforts of Garcia and the TAB, which has

Texas, who was electrocuted working on the station's transmitter in July 1992.

Since the TAB has been distributing the pen, along with a video tape on

Dick Pickens, a consultant engineer, claimed that the pen saved his life by alerting him to a previously unknown power source.

launched an effort aimed at heightening transmitter safety awareness.

The effort was spurred by the death of Ivan Fajkus, engineer and general manager of KVLG/KBUK in LaGrange,

transmitter safety, it already has saved lives.

Dick Pickens, a consultant engineer in Gonzales, Texas, claimed that the pen saved his life by alerting him to a

previously unknown power source leading to the transmitter. After turning off the breakers at the transmitter site, rather than opening the transmitter door, he checked the site with the pen and found another line that led to another breaker.

"I keep one (Safety Pen) or two in the truck, one in the tool box and always one in my pocket," Pickens said.

The Safety Pen carries a lifetime warranty and sells for \$15.

The TAB already has received more than 1,500 orders for the pen, including 150 for CBS. The group will be working with other state associations to make the safety package available in other states at a low price.

For more information, contact the TAB at 512-322-9944.

MIT Develops Personal News

► continued from page 8

an example, Schmandt noted that with RDS and some digital storage memory, a car radio could make the latest traffic reports instantly available to drivers upon leaving home.

"A station sends the traffic report to my car tuner and the audio is stored in memory," Schmandt said. "When I turn on my ignition I immediately hear the latest traffic information."

One of the most appealing uses of the new personalized news technology is the possibility of acquiring a wide diversity of viewpoints and opinions on a news event at the same time on a single device. No longer would listeners be limited to the viewpoints or prejudices of a single news organization. Different international perspectives on an event could be heard at the touch of a finger.

Schmandt is already using the technology to do just that. Rather than tune in to a local all-news station, he listens instead to a favorite BCC newscast retrieved for him by his office computer and downloaded to his home answering machine. "I happen to like the BCC perspective on world news," he said.

Do news junkies really want such new interactive technology? Schmandt thinks yes. "I love news but I'm saturated with print media," he said. "The number of seconds that I have available today to read more text is zero. Yet I commute 25 minutes each day to work. That's wonderful time for me.

"In fact I'm doing it right now while I'm talking to you on this cellular phone from my car," he told the RW reporter writing this story. "I was so busy today, I couldn't have possibly made this call otherwise."



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STATION SKETCHES

Taking Steps to Save Aged Audio Gear

by Tom Vernon

HARRISBURG, Pa. Many small-market stations still have audio equipment in service from the 70s or earlier.

Properly maintained, it can be very reliable, but problems occasionally arise involving loss of low-frequency response or motorboating (low-frequency oscillation). These problems most often reside in coupling and bypass capacitors that are well past their prime.

A number of steps can be taken to troubleshoot electrolytic capacitors in venerable audio equipment.

Coupling capacitors isolate DC between transistors or stages, while allowing audio to pass freely. Their value is chosen by a formula to set the -3 dB point for low frequency response.

Coupling failure

These coupling capacitors are usually aluminum electrolytics. They typically deteriorate gradually with changing capacity, degrading LF response and leakage upsetting the bias level of the following stage.

Decoupling capacitors isolate the power supply from the rest of the circuit.

Motorboating or distortion are usually the result of their failure—the volume may be cranked all the way, but gradually worsens until the effects are noticeable at normal operating levels.

Fortunately, troubleshooting these circuits is relatively easy.

Feed a low frequency signal of about 75 Hz into the amp. Use a scope or VTVM to measure the response on each side of the capacitor. Any degradation means the cap is suspect. To confirm this, lift one end and substitute a new one in the circuit. If the response improves, you've found the problem.

Some people take the easy route and parallel a new cap across the one that is suspect—not a good idea. This may remedy capacity-related problems, but if the capacitor in the circuit is both leaky and out of tolerance, there will still be a leakage path to upset bias, even after the new one is paralleled.

Money matters

Economic issues must be considered together with the theory of coupling and bypass capacitors.

Aluminum electrolytics can be purchased for well under a dollar each from mail order houses such as Digi-Key. If the electrolytics in your equipment are more than seven years old, it may be worth it to replace all of them at once. It

will save you in terms of equipment downtime and labor later.

Rebuilding one or two circuit cards during each overnight maintenance session may also save you emergency calls over the coming year. You can demonstrate your proactive maintenance skills and efficient use of time by explaining this procedure to management.

Check the date code stamped on each component to determine the age of the capacitors. A four-digit number shows the year and week it was manufactured. A part marked 7414, for example, was made in the 14th week of 1974.

Be sure you have a diagram of each cap's polarity before replacing of all the electrolytics on a circuit board. If you get distracted in mid-project, a chart can be a lifesaver.

Old caps can be quickly removed from circuit boards with a low-wattage soldering iron and desoldering braid. Be sure to place new parts face up to make future component identification and circuit tracing easier. Finish your work by removing solder flux with an aerosol flux remover for a professional look.

It's a good idea to keep a few electrolytics on hand for emergency repairs, but don't keep more than you can expect to use in about a year. Components deteriorate quickly on the shelf and you'll end up either discarding them or replacing bad old components with bad new components.

□ □ □

Tom Vernon divides his time between consulting and completion of a Ph.D. He can be reached at 717-367-5595.

NAB Test CD-II Ready; Builds on Past Success

► continued from page 31

apart" the technical characteristics of a station's sound, so it can be analyzed for competitive and quality control purposes.

The QA-100 has a mysterious front panel switch labeled "DIST." This switch, when used in conjunction with several tracks on the Test CD II, permit real time evaluation of the processor level, AGC level, as well as audio processor distortion.

Several of these tracks are ramped on and off in a controlled manner. This narrows the frequency spectrum of the burst, since the switching sidebands are contained near the fundamental frequency. The result is a controlled envelope of tone, from which the second and third harmonics can be read on the QA-100, down to 0.1 percent. The advent of these tracks permits the measurement of all sorts of processing artifacts, like clipper distortion, which is otherwise impossible to quantify.

By combining these tracks with the different detection time constants of the QA-100, distortion that occurs for only a few milliseconds can still be measured.

Precise alignment

The Test CD II is rounded out with a series of tones for cartridge and recorder alignment. Chris Downing, formerly a senior design engineer at ITC and now chief engineer at KMPC in Los Angeles, spent many hours with me in developing a series of tracks that are unique to the industry.

For example, aligning the "bumpy" low end response has always been difficult due to phantom gaps or the physical construction of the head itself. To overcome this problem, two low frequency adjustment points, 30 and 50 Hz, permit optimization of recorder low frequency response. To compensate for head wear, 12 and 15 kHz tones are provided.

By insuring that the response is flat between these two frequencies, a flat high end response is more easily predicted. Furthermore, by setting low and high frequency EQ before the spot frequency run, the machine can be tested in one pass.

The spot frequency tracks are indexed and have the voice announcement identifying the frequency recorded simultane-

ously with the tone. By recording the voice announcement 10 dB below the tone level, however, the meter you are using to measure response will respond minimally to the announcement.

Reducing meter bounce, or having the meter drop to zero as one tone ended and another began, was the reason we butted the tones up against each other. This technique makes for a much more efficient response measurement.

Similar adjustment tracks are provided for cartridge machines, with the addition of cue tone reference signals. Recorder alignment wouldn't be complete without an azimuth adjustment signal, and the Test CD II contains a unique track that, in my opinion, is worth the price of the CD all by itself.

When Chris and I first discussed azimuth alignment, we discounted using just a 15 kHz tone. To the untrained technician, it's possible to get a single tone to collapse to a diagonal line, but still have the head misaligned to the wrong amplitude peak. Pink noise was considered as a substitute, but also discounted, since exact adjustment of the fine high frequency azimuth is difficult.

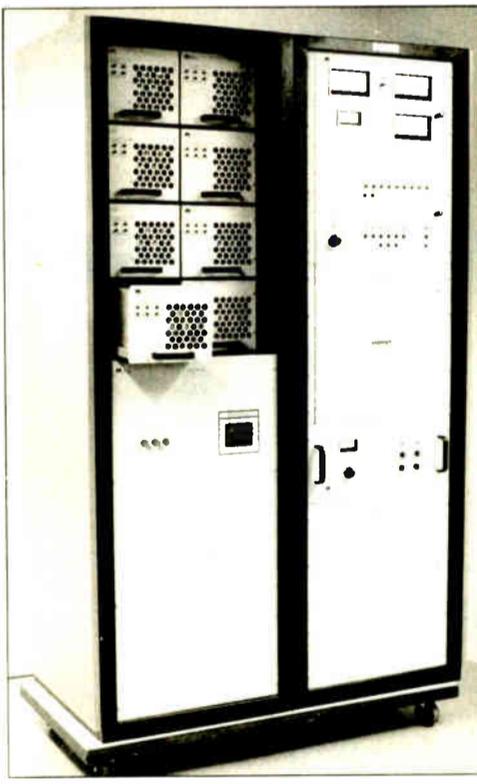
What we ended up with was what we called the "DB" (for "Downing/Bisset") Alignment Signal. This signal "time multiplexes" white noise and a high frequency sinusoid of either 15 or 16 kHz. When viewed on an X-Y scope display, the two signals visually overlap.

The white noise provides a wide-bandwidth representation of time differences between the two recorded tracks, and the high frequency sinusoid provides an exact high frequency reference point. You won't believe how quickly and precisely you can align a head using this new tone.

The advantage of the "DB" signal over pink noise alone is that the high frequency sinusoid permits exact adjustment of fine azimuth, in spite of mid-range phase differences caused by equalizer adjustments, which would obscure the white noise display.

The NAB Test CD-II is offered individually, or as part of a two-CD set with Test CD-I. For NAB members, the individual discs are \$40 each, or you can buy both discs for \$60. For non-members, the individual discs are \$80 each, or \$120 for

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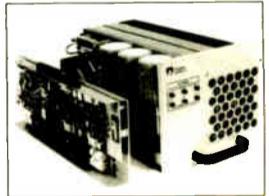
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USER REPORT

Vega Off to a Good Start at Daytona 500

James Stoffo
Wireless Specialist
GIENT Communications

ORLANDO, Fla. Ever associated wireless systems with radio broadcasting? Most of us generally don't think of using wireless microphones or monitors when dealing with radio. But I have found they are good for use in a number of applications.

And each application can make your job easier while saving time in overall production. Wireless systems not only free users from being tied down by cables, but enable some applications otherwise impossible.

For example, field announcers must be completely mobile when using wireless microphones, all while receiving cues remotely on wireless monitors. Read on about a worst-case scenario—because the equipment and techniques apply to virtually any application.

Off to a quick start

A Vega "600 Series" wireless system was recently installed at the Daytona International Speedway in Florida for the annual running of the Daytona 500. The system supplies program audio to MRN Radio, which then distributes programming to hundreds of radio stations across the country.

Interviews with winning drivers, crash survivors, etc., account for some of the activity and general race announcing. Naturally, RF drop-outs and lost audio or missed cues on the monitor won't be tolerated. The RF link between the wireless



The Vega "600 Series" wireless system covered a distance of over one mile during the Daytona 500.

handheld microphone and the control room, and the control room transmitter to the wireless monitor, must all be extremely reliable.

This particular installation was challenging because the wireless microphones and monitors were tested beyond their normal limits. A normal wireless system range is about 800 feet. Covering the speedway entailed a distance of over

one mile from the east pit and garage area to the west pit and "Victory Lane."

There was also the issue of frequency coordination. On any given race day, there are literally hundreds of licensed and unlicensed radio emissions in and around the Speedway. Reporters, news crews and communication systems between drivers and pit crews account for many of the possible interfering sig-

nals, covering a frequency band from 150 MHz to over 950 MHz.

Overcoming the engine noise of all the cars is also a demand placed on any wireless monitor. This was a real challenge, as race car ignitions are extremely noisy at all radio frequencies.

The wireless mic receiver and monitor transmitter were racked in the P.A. room in the press box. This gave us a significant height advantage.

Unfortunately, it also increased the chances of interference. The area coverage pattern from east pit to west pit was an angle of about 180 degrees (refer to sketch), so conventional directional antenna techniques would not suffice.

Long-term quality

GIENT Communications chose the Vega "600 Series" UHF wireless microphone and VHF wireless monitor systems for several reasons. The equipment

continued on page 39 ▶

USER REPORT

KIOI Hits Target Audience With AKG C5600 Microphone

by **Kevin Douglas**
Engineering Director
KIOI(FM)

SAN FRANCISCO KIOI(FM) is a highly rated Hot AC station located in the nation's fourth largest radio market. We

target women aged 25 to 54, so we're concerned that our announcers come across as very warm and friendly on the air.

After recently hiring a new midday personality, it was instantly apparent that his voice and its resonance didn't work with our existing mic and mic processing. However, we didn't want to radically change the way everyone else sounded for the sake of one person.

It seemed to me the best solution was also the simplest: change the mic. One month before this, David Angress of AKG

offered a demo of the new C5600 condenser mic.

Externally, the C5600 is one of the strangest microphones you've ever seen. Internally, it uses the same diaphragm as AKG's top-of-the-line C414 studio condenser.

The main difference between the mics, aside from the shape, is that the C5600 is strictly a cardioid microphone while the C414's pattern is adjustable. And the C5600 doesn't have some of the C414's expensive circuitry. The elimination of these two features allows the C5600 to be

competitively priced with high-end dynamic microphones.

Its cardioid pattern is directional enough to avoid extraneous studio noise, but not so tight that you lose the talent if they turn their head.

Like all condensers I've worked with, the C5600 is breath and pop sensitive. AKG is working on a suitable windscreen, I'm told.

Announcer acceptance of the C5600 is excellent. Most feel they sound even better than with the old mic.

Do we like the C5600? We bought the first two off the plane from Vienna, with more to follow.

□ □ □

For information on the C5600, contact **Joey Wolpert** in California at 510-351-3500; fax: 510-351-0500; or circle Reader Service 76.

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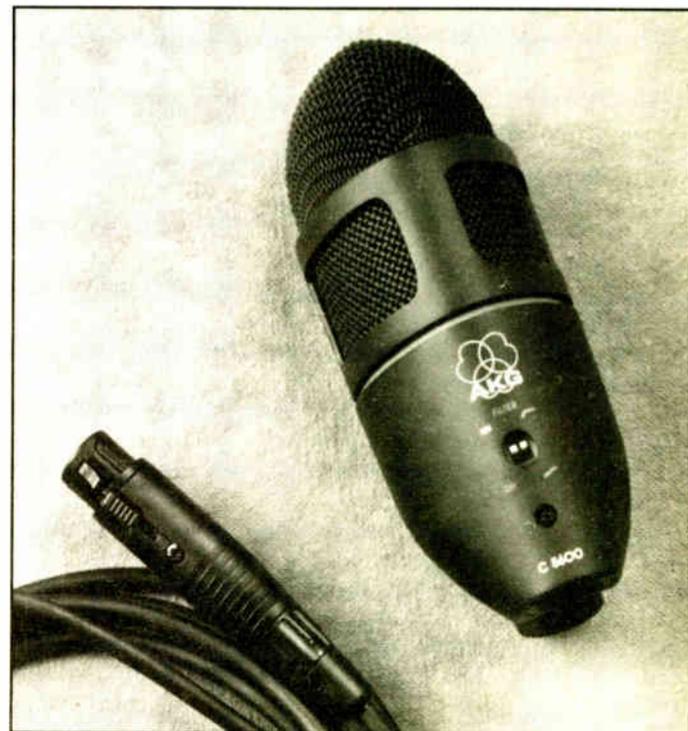
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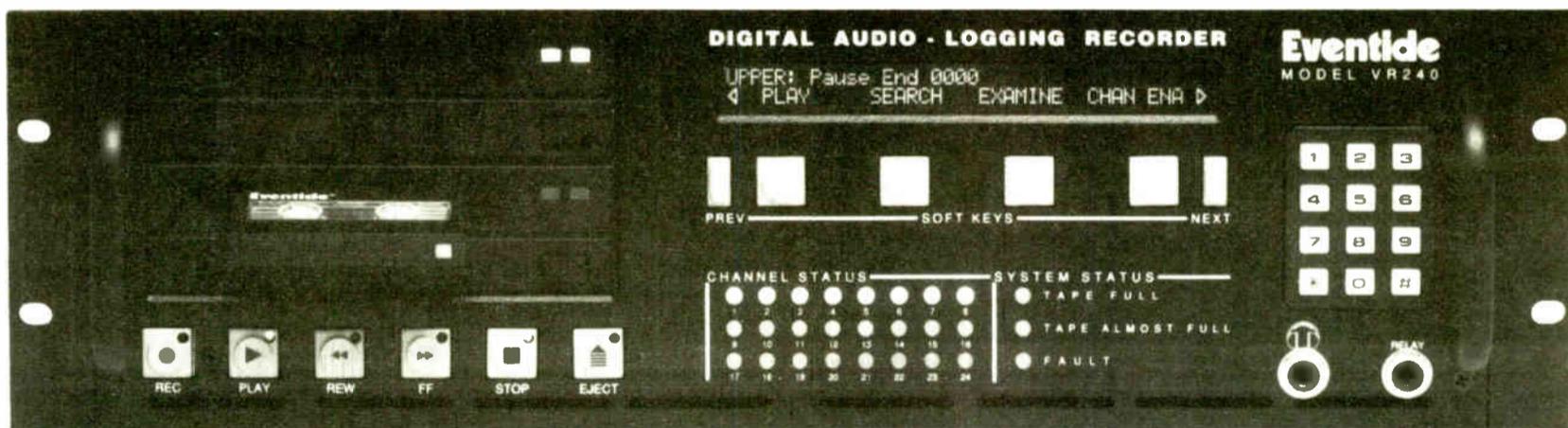
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AKG's C5600 condenser microphone was an instant hit at KIOI (FM).

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dispatchers said. The VR240 even records modem, fax, and transmitter remote control telemetry transmissions. The advantages of logging have always been clear. Now the Eventide Digital Broadcast Logger gets rid of the disadvantages.

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USER REPORT

KUSC and Neumann Form On-Air Link

by Pablo Garcia
Assistant Chief Engineer
USC Radio (KUSC-FM)

LOS ANGELES Recorded music is the heart of programming at USC Radio (KUSC-FM). But the all-important link between music and audience is the presentation by USC Radio's announcing staff. This presentation is effectively enhanced by the use of high-quality microphones.

The Neumann U-87 FET condenser microphone is a high-grade studio microphone characterized by first-class transmission qualities. And it's equally well suited for a large number of applications in live recording and radio broadcasting.

Heat and age resistant

The capsule is fitted with a diaphragm of polyester foil, particularly resistant to heat and aging. Below the capsule are three switches enabling directional pattern, bass roll-off and a 10 db pad.

In the cardioid and figure eight positions, the frequency response of the transmission factor is practically linear for perpendicular sound incidence, even in the upper audio frequency range. This makes the microphone particularly suitable for use at close ranges without unnatural sharpness.

A frequency dependent feedback attenuates components below 30 Hz at the FET's gate, while components above 40 Hz are transmitted untouched; low frequency interfering noise is then minimized at the input of the microphone amplifier.

A pre-attenuation of about 10 db also can be inserted in the circuit, enabling the microphone to transmit sound pressure levels up to 130 db without distortion.

The U-87 has an internal resistance of 200 ohms, which can be reduced to 50 ohms by changing the soldered connec-

tions of the output transformer.

The U-87 is a great voice microphone with superb intelligibility. Its has a slight bump in its response in the upper-mid-range, and it emphasizes the lower sibilance without overly pushing or stressing the high sibilance.

The bass response is very smooth without being boomy, enabling the talent to work at close range without engaging the roll off circuit.

Condenser microphones

Among the family of Neumann mics we use are the KMS 140 and 150 mics, designed for vocal and instrumental work. They are both part of the Neumann FET 100 series condenser microphones featuring transformerless electronics. These are advantages in the broadcast environment with RF and other electrical fields. The microphones have exceptional utility, possessing impeccable clarity and naturalness and are free of any coloration.

USER REPORT

Crown Covers Great Distances For the Indy 500 Radio Network

By John Royer
Chief Engineer
Indianapolis Motor Speedway & Radio Network

INDIANAPOLIS For several years, Tom Allebrandi and I served as chief audio engineers for both the Indianapolis Motor Speedway and its radio network.

Over this period of time, we constantly sought better ways to bring sound to the hundreds of thousands of people attending the "greatest spectacle in motor racing" and the millions listening to the 1,200-station worldwide radio network.

The KMS 150 is a hypercardioid condenser microphone that's essentially identical to the KMS 140, with a cardioid capsule. The capsules are field interchangeable by simply unscrewing them from the microphone, which is completely isolated from its housing. This way, there are no extraneous noise transmits to the capsule, eliminating the need for elastic suspension.

The uniform polar response of the KMS 100 series microphones assures consistent harmonic content of the voice, even at an off-axis position.

To reduce the high sound energy of explosive consonants, the KMS 140 and 150 are acoustically filtered with three different wire gauzes consisting of the outside of the grille, a middle gauze between the grille and the capsule, and the third at the capsule itself. This effectively suppresses explosive sound interference without jeopardizing the distinctive directional characteristic of the capsules, all the way down to the lower register.

These three gauzes are optimized with regard to their spacing and mesh size, providing 10 to 12 db better pop suppression than comparable conventional microphones with protective grilles.

A sensitivity reduction of 10 db and a high-pass filter are easily switched with a dual set of recessed switches on the microphone's housing. In addition, an acoustic attachment that slips over the capsule is provided to add additional boost for extra brilliance of program material in the upper frequency range.

To quote Gene Parrish, producer/host at USC Radio: "As an announcer, I have worked with Neumann microphones for nearly 20 years at radio stations in San Francisco and Los Angeles. To my ears, they are the best microphones I have ever used because of their quiet sensitivity, comfortable dynamic range and great level of clarity. Frankly, I think they probably make me sound better than I really am."

□ □ □

For information, contact Jürgen Wahl in California at 818-845-8815; fax: 818-845-7140, or Jeff Alexander at 203-434-5220; fax: 203-434-3148; or circle Reader Service 62.

the intercom belt packs with custom switches allowing signals to be sent only through the intercom.

The CM-311 is the latest Crown microphone product we've used to enhance sound quality at this highly specialized event. The track PA announcer uses a CM-310 Differoid that features the same rejection and sound quality characteristics of the CM-311.

Another Crown microphone, the CM-230, is used for the traditional announcement of "ladies and gentlemen, start your engines!" The CM-230, with a tridundant design, includes three miniature capsules in one grille.

Each of these capsules feeds a separate electronics interface, which has isolated

This year, a primary goal was to improve the sound quality of the four network announcers delivering the latest action as race cars rush by at speeds often exceeding 220 mph. The announcers are positioned high in the grandstand at the four turns of the speedway.

Vocal presence

The main problem with microphones used for this application in the past was an overall "thin" sound: they lacked vocal presence. A microphone providing added vocal presence while still discriminating against the numerous ambient noise sources was desired.

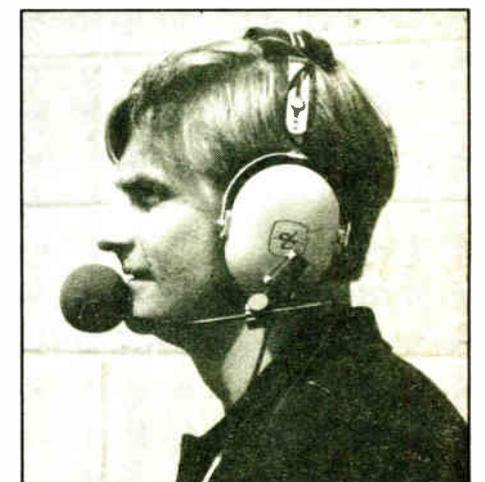
Our ideal microphones also need to resist the considerable wind noise occurring due to the location of the announcers high atop the grandstand. And the mics need to be head-worn to provide hands-free operation.

In the weeks leading to the race, we evaluated the new Crown CM-311 head-worn mic, which features Differoid capsule technology providing very high gain before feedback. The electret condenser capsule, with a cardioid polar pattern, also rejects unwanted background noise and leakage, discriminating against distant sound sources.

With the CM-311, overall sound quality and vocal presence at each announcing position was much improved, as was noise rejection. Our wind noise problem diminished when Crown supplied specially modified windscreens. Crown's Bruce Bartlett also helped design a special adapter that attached the CM-311 boom to the David Clark headsets each announcer used.

Moving fast

The microphones are connected to ClearCom intercom belt packs, which allow the mic signal to pass through at line level to the main network console, where the producer selects the appropriate announcer feed. We also equipped



The CM-311 mic is a winner with the Indianapolis Motor Speedway Radio Network.

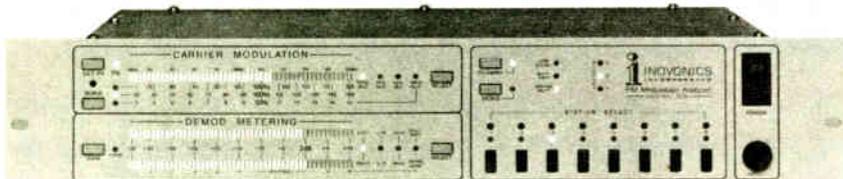
outputs preventing ground loops between the three feeds. One feed goes to ABC Sports for its live television broadcast, another feed goes to a trackside "pool" feed, while the third goes to the track PA system/radio network.

The bottom line is that we like the Crown approach to microphone design. The company has a number of products that fit the bill for typical uses, while also meeting special needs and applications.

□ □ □

For information, contact Bob Herrold in Indiana at 219-294-8000; fax: 219-294-8329; or circle Reader Service 144.

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USER REPORT

Vega Moves At Daytona

► continued from page 36

is the most rugged and reliable in our experience, and the audio quality is better than any other wireless systems we evaluated. The UHF receivers utilize a combination of helical resonators and GaAsFETs, making it extremely selective yet sensitive.

To avoid the multitude of other frequencies, we implemented the Vega system in the 600 MHz band. This seemed to be a safe distance from the communication systems. The FCC only recently opened up the band for commercial use, so the probability of another independent wireless on that frequency was small. We needed a way to cover the 180 degree reception pattern required by the speedway.

We used two log periodic antennas pointed in opposite directions and designed a small RF control unit enabling the operator to select the desired antenna. These high-gain, fairly directional antennas covered up to 3,500 feet each.

They have a beamwidth of approximately 70 degrees, so care was used in both angling and positioning. We supplied various low loss RF cable for the longer runs and were able to maintain an entirely "passive" receive antenna system.

The Vega wireless monitors supplied "talk-back" from the P.A. control room to the announcer using the wireless handheld transmitter. We again chose the Vega for its superior signal-to-noise ratio and RF selectivity.

The receivers are crystal controlled, and the dual frequency makes future expansion cost effective to the user. A dipole transmit antenna was used with a vertical orientation to maximize effectiveness to the miniature monitor receiver.

I can't stress enough the importance of a proper site survey by a qualified wireless engineering organization. With the capability of anticipating potential problems, understanding wireless system design characteristics and limitations, a well thought-out and engineered wireless system can be designed to fit any application.

The installation far exceeded all of our expectations. Isaac Addison, the audio operator charged with supplying program audio to MRN radio's link, will never again need to follow the announcer with a portable receiver, plugging into audio jacks around the speedway to get great audio.

□ □ □

For information, contact Robert Bell in California at 818-442-0782; fax: 818-444-1342; FAXBACK: 818-444-2017; or circle Reader Service 61.

USER REPORT

beyerdynamic Remains a WNCN Classic

by Vito Colonna
Production Director
WNCN(FM)/GAF Broadcasting

NEW YORK WNCN(FM) is one of the city's two successful commercial classical stations (in addition to a number of noncommercial competitors). To stand out from the pack, WNCN uses beyerdynamic microphones to serve three basic production needs: live music recording, studio work and news gathering/interviews.

For live music recording, I use a M-S setup with a beyer M 160 and M 130. I use M 69s and M 88s in the production studios, which I freely interchange with each other, and for interviews and press conferences, I use M 58s.

When I first came to WNCN(FM) 10 years ago, the station was using one mic for everything.

Once I convinced management to try something new, I contacted the local beyerdynamic supplier, who loaned me the M 130 and M 160. We bought them after a short trial period.

I chose those mics because I wanted to record with a M-S setup using the 160 cardioid as the middle and the 130 figure-eight for the sides. At the time, beyer didn't have a stereo mic in a single housing. The company has since developed a five-pattern stereo condenser mic.

They're both ribbon mics, so the sensitivity is a little low, but the smooth frequency response and very warm sound more than make up for it.

The M-S setup delivers fully controllable stereo effect without the problems inherent in summing up other stereo mic configurations to mono. The engineer has the added advantage of making a stereo blend and adjusting for soloists on site, while recording directly to two-track.

This came in very handy on one remote recording. After a day's worth of hanging cables and sound checks, Murphy's Law took over 15 minutes before performance

time, shorting out one of my two mic cables and enabling me to pick up every AM station in midtown Manhattan—simultaneously. I was able to use the 160 cardioid to record the performance in mono and stereo—synthesize it later in the studio.

With the quick turnover required at WNCN(FM), this flexibility is invaluable. Some weeks, I must turn over five remote concert tapings within three days for broadcast.

Many of the concerts I record are outdoor summer festivals. I have used the 130 and 160 in every extreme of weather, from hot steamy tents in the rain to

air-conditioned concert halls.

Our success with these mics led to the purchase of additional beyers. The M 58 is a great omnidirectional interview mic. Taped interviews often require no processing other than editing.

In the production studios, all of our voiceovers are done with M 69 hypercardioids. Their high output levels allows me to work with many different announcers and mic positions.

□ □ □

For information, contact Mike Solomon in New York at 516-293-3200; fax: 516-293-3288; or circle Reader Service 104.

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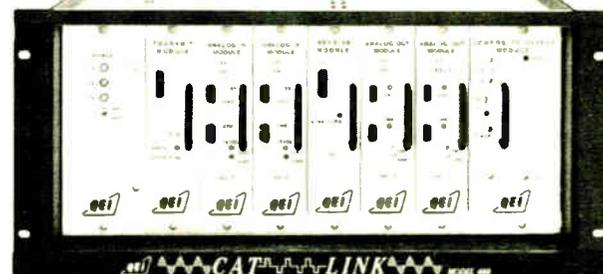
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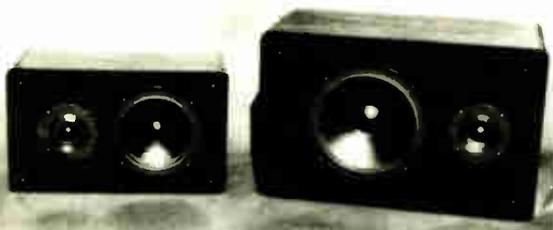
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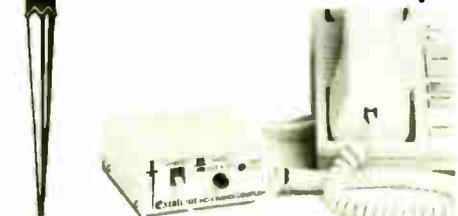
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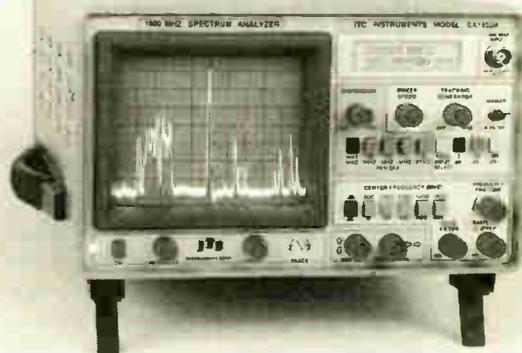
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USER REPORT

AT4033 Makes the Difference for WKSU

by **Don Danko**
Chief Engineer
WKSU-FM

KENT, Ohio For the technical staff at WKSU-FM, a NPR and classical music format station, staying on the forefront of technology is important. Broadcasting since 1950, the 50,000 W station recently went on the air this past December from its new state-of-the-art, 15,000 square-foot facility on the campus of Kent State University.

additional repeater stations in the near future. Although most decisions regarding cutting-edge technology in the new facility are arduous, deciding on an "on-air" microphone was an easy task.

Outfitting plans

I was visiting **Audio-Technica** about a year ago with Harold Chambers, WKSU-FM recording engineer, and we met with Ken Reichel, A-T vice president of professional products.

We explained our plans for outfitting

microphone. It's also amazingly quiet and clear for a large-diaphragm mic.

The mic has a fantastic, full sound—very rich in content. I can even hear the difference on my car stereo. It's more realistic; more like you're standing right next to the announcer.

Ron Bartlebaugh, director of engineering for WKSU-FM and the Kent State University Radio Network, says the A-T microphone solved the multiple problems often experienced with previous mics.

At one time, we actually had two different microphones in our on-air studio. Depending on the type of each announcer's voice, we'd recommend use of one of the two mics. Microphone processing was out of the question because of the distortion it produces, so we were stuck with the two-mic dilemma. The AT4033 microphone is the first reasonably priced, large-diaphragm microphone we've seen work this well.

Good as gold

The Audio Technica AT4033 is a transformerless studio microphone featuring a gold-plated, "aged diaphragm" condenser element with an internal baffle plate to increase the signal-to-noise ratio. Constructed with low-noise, transformerless electronics, the cardioid capacitor microphone provides exceptional transient response and clean output signals, even under high-output conditions.

The AT4033 has a dynamic range of 123 dB and accepts up to 140 dB SPL without capsule or electronic-system distortion above 1 percent THD.

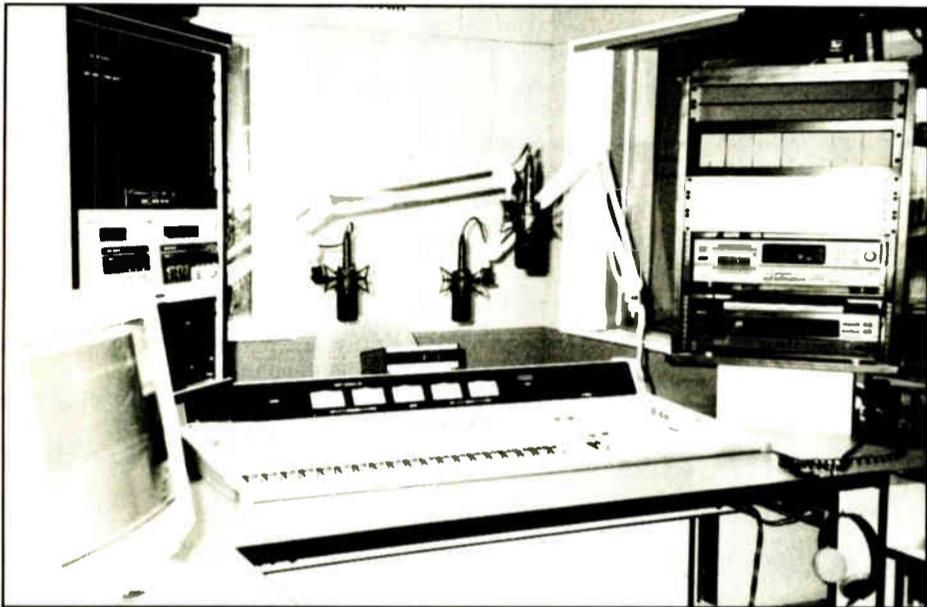
After a year of using the mic, we returned it to Audio-Technica to have some rubber bands on the shock mount replaced. Although the microphone was only out for about four hours, we received all kinds of complaints from the announcers.

We have a great relationship with Audio-Technica. We've borrowed some of the company's other mics, and we frequently use a pair of AT4051s as flanking microphones.

We've also used the AT871Rs as foot mics at the Cleveland Opera, and they've done a fantastic job. Audio-Technica has been very good to us here at WKSU-FM.

□ □ □

For information, contact Buzz Goodwin in Ohio at 216-686-2600; fax: 216-688-3752; or circle Reader Service 138.



WKSU-FM announcers rave about the AT4033 microphone.

Due to the stringent requirements of broadcasting classical music, the station must consistently maintain the highest quality audio specifications. The station currently takes advantage of the latest technology, including the use of a fiber-optic STL.

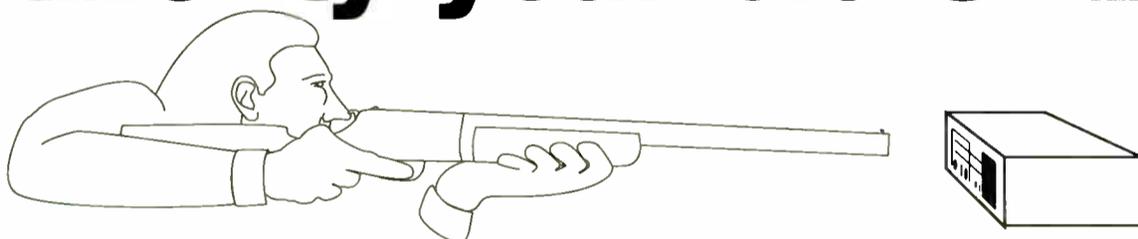
In addition to WKSU-FM, the University also operates WKRW(FM), a 2.1 kW repeater station in Wooster, Ohio, and has plans for at least three

the new facility and mentioned our interest in hearing A-T's new AT4033 microphone. Ken immediately gave us one to take back to the station for testing.

Once we returned and listened to the AT4033 in our studio, we put it on the air after about five minutes.

It has a nice, crisp high-end without being harsh, and its resonator cuts down on the proximity effect so our announcers don't sound like they're eating the

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competitors, and have become exceedingly popular with stations large and small. Both the high value LC Series and the high performance SD Series offer front-panel frequency programmability, which makes delivery immediate in most cases.

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TECHNOLOGY UPDATES

SENNHEISER

MKH80-P48: Designed to Meet the Changing Needs Of Digital Recording

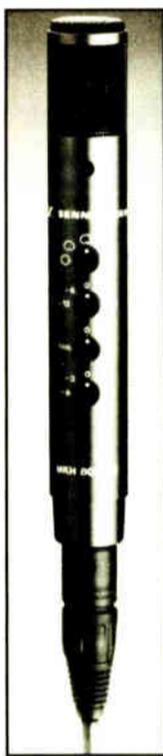
OLD LYME, Conn. Sennheiser's MKH80-P48 is the newest member of the transformerless MKH family of microphones designed to meet the demands of digital recording. Suited for a number of applications, it combines the features of the MKH20, 30, 40 and 50 microphones.

The capsule is part of a tuned circuit in a radio frequency system. This makes the MKH80 highly immune to humidity and provides for its low inherent noise.

A symmetrical push-pull capsule design allows for resistive loading, virtually eliminating intermodulation distortion. The low noise floor provides for a large dynamic range.

Features include five switchable polar patterns (omnidirectional, wide cardioid, cardioid, supercardioid and figure-of-eight), attenuation and treble boost.

For information on the MKH80-P48, contact Joe Ciaudelli in Connecticut at 203-434-9190; fax: 203-434-1759; or circle Reader Service 39.



AURATONE

5PSC Primo-Sound-Cube Works As Console Mixdown, Monitor and Extension Speaker

CORONADO, Calif. Auratone's 5PSC Primo-Sound-Cube™ is a single driver system designed for use as a point source console mixdown, comparative reference monitor and full-range extension speaker.

The system replaces the 5C Super-Sound-Cube™, while remaining a narrow-band monitor operating as a mixdown reference for small speaker comparisons (such as radio mixes).

A new rubber surround and coated cone contribute to the damping of internal break-up,

which lends to a clean and more accurate sound. The wide half-roll rubber suspension also allows extended cone excursions for minimum distortion bass response.

Other features include 8 ohms of nominal impedance; power handling of 35 watts nominal and 70 watts music power; 88 dB 1W/1M sensitivity; and an audible frequency response of 50 to 17,000 Hz.

For information, contact Jack Wilson in California at 619-297-2820; fax: 619-296-8734; or circle Reader Service 71.

YAMAHA

NS10M Studio Professional Speaker Offers 60 Hz to 20 kHz Frequency Range and Woofer/Tweeter Matching

BUENA PARK, Calif. The Yamaha NS10M Studio Professional near-field studio monitor features full response 60 Hz to 20 kHz and a two-way configuration.

A sheet-formed, white-cone 18 cm woofer and newly designed 3.5 cm soft-dome tweeter help achieve the high-end response required in professional near-field monitor applications.

The woofer/tweeter matching and crossover design help ensure a smooth transition between frequency ranges with minimum phase variation.

The monitor's power capacity is 60 W (Program) and 120 W (Max), and it comes in a wood, black finish cabinet. The construction is designed to withstand non-stop professional use.

For information, contact Yamaha International Corp. in California at 714-522-9011; fax: 714-739-2680; or circle Reader Service 125.

INDUSTRY ROUNDUP

Versatile Mics Make the Right Moves For Radio Broadcasters

by Mary Ann Dorsie

WASHINGTON Modern day technology is aimed at increasing efficiencies on any scale, with just about any product. Microphone technology is no exception.

Microphones, which have been a necessary fixture at radio stations and recording studios since their inception, are changing on the manufacturing side rather than on the research and development side, according to some micro-

phone manufacturers.

"There will be better material to make the mics more rugged, more efficient and smaller," said Joe Ciaudelli, applications engineer with Sennheiser Electronic Corp.

He said these modifications can be seen in microphones today: The housing is made with a fiberglass type of material rather than metal; a stronger magnetic material makes the microphones stronger and more efficient—and the membranes and coils are lighter and thinner.

Natural sounds

"With a stronger magnetic mass ... there's a more natural sound, a more transparent sound," Ciaudelli said.

In addition, a higher output level helps microphones retain a higher signal to noise ratio, he said.

Mike Solomon, market development manager for beyerdynamic, said the developing trend is to lower noise, lower distortion microphones.

"Almost recording studio-type products are sought out by broadcasters," Solomon said.

David Angress, vice president of sales and marketing for AKG Acoustics, said

condenser microphones are now in a more-affordable price range, similar to that of dynamic microphones.

"Our new condensers with built-in shock mounts give the sound of high end condensers at the same price as dynamic mics," Angress said.

Easier moves

Solomon said radio, in essence, is a "fixed" installation. But he predicts that more DJs will start wearing microphones for greater mobility.

beyerdynamic's DT 190 on-the-air sportscaster headset, introduced at this year's NAB, is a 30 dB noise isolation microphone, which can be wired for dual mono and stereo. He said more and more broadcasters are looking to this microphone as an option for DJs.

Vega President Gary Stanfill said his company, which specializes in the wireless lavalier mics, is aiming for convenient-sized mics.

"In the last five years, I've seen massive amounts of work to make very, very small, high quality mics suitable for all applications," Stanfill said.

And echoing Solomon, Stanfill said these microphones are also important for radio announcers.

"A lot of people, like the announcers, don't just sit and talk," he said. "They get into things and go hopping around the studio."

In addition, these mics allow DJs to make commercials or promotions outside the studio. This is especially important for smaller studios wishing to remain close to the community, he said.

But Howard Zimmerman, national sales manager for Nady Systems, said even though broadcasters are looking to move away from a base mic and are more cost conscious than ever before, wireless mics won't displace tradition.

"People want to get away without using a cord ... but [they] will never replace wire," Zimmerman said.

Solomon added that the bottom line with any microphone is "value: good quality at a reasonable price."

And as Ciaudelli said, anything that can make DJs on the radio sound better is the name of the business.

"That's extremely important because that's the only way the audience is judging you," he said.



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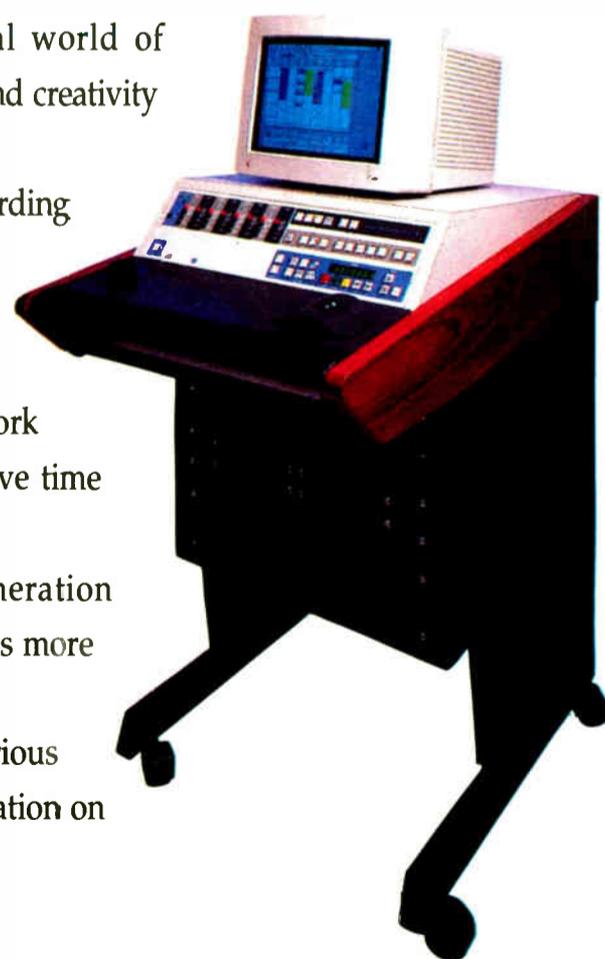
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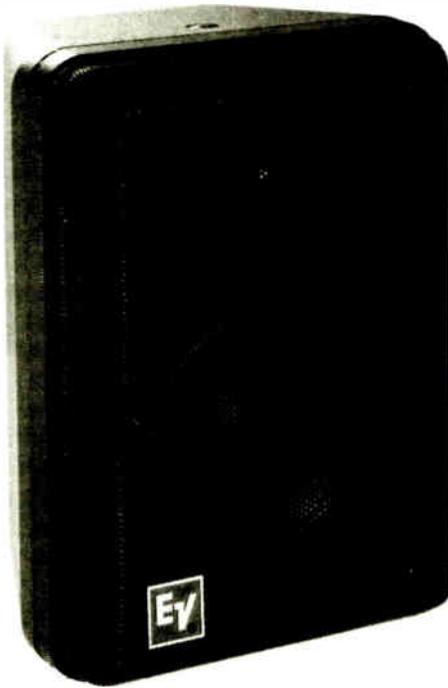
S-40 Monitor Handles the Tight Spots While Providing 160 W Output

BUCHANAN, Mich. The new Electro-Voice S-40 compact near-field monitors are designed to fit into tight work spaces in the studio, post-production facility and production truck.

A 5 1/4-inch direct-radiating woofer with a polypropylene cone provides low frequency. The woofer, combined with an optimally-vented polystyrene enclosure, supplies extended bass response down to 85 Hz. The plastic materials in the enclosure and woofer cone offer strong resistance to high-humidity environments.

The high frequency section is a one-inch direct radiating soft dome tweeter, ferro-fluid cooled, and includes flexible tinsel lead wires that combine to prevent thermal or mechanical failure. The monitor's crossover point is 3,500 Hz, with high-frequency response ranging to 20,000 Hz.

S-40s offer a high output, handling 160 W of power. The woofer and tweeter also have independent power protection circuits (EV's proprietary PRO-design) that automatically reduce power delivered to the drivers if their threshold is exceeded.



Both woofer and tweeter are protected by a rugged steel grille and include low-flux-leakage designs enabling the monitor to be used in close proximity to video monitors without interference problems.

For information, contact Rick Sanchez in Michigan at 616-695-6831; fax: 616-695-1304; or circle Reader Service 119.



TELEX

FMR-100 Wireless Mic and HT-100 Mic Transmitter Make Live Remotes Easier

MINNEAPOLIS The Telex FMR-100 true diversity wireless microphone receiver and HT-100 handheld microphone transmitter are designed for radio station live remotes.

The FMR-100's IF strip features linear phase filters that are computer matched before assembly to minimize distortion-causing group delay.

The filters discriminate against unwanted RF energy while allowing the signal to get through without distortion. A GaAsFET transistor increases usable

range without overload, while an improved Pos-i-Squelch II™ system uses a noiseless relay to help eliminate pops and static.

Pairing the FMR-100 with an HT-100 series handheld microphone provides increased RF field strength and an antenna to the unit. This design prevents hand interference, or signal attenuation.

The series, which is available with a variety of condenser and dynamic head options, includes a power on/off switch at the base and a recessed standby on/off switch and screwdriver adjustable mic gain control at the side.

For information, contact Jeff Peters at Telex Communications Inc., at 612-884-4051; fax: 612-884-0043; or circle Reader Service 157.

SHURE

VP64 Omnidirectional Mic Offers Field Flexibility

EVANSTON, Ill. Shure's VP64 Omnidirectional Handheld Microphone provides all the traditional benefits of an omnidirectional microphone, including pickup of sound from every direction and an absence of proximity effect (low frequency boost) when used close up.

But the VP64 doesn't suffer from coloration—shifts in frequency response—if the sound source is off-axis.

In addition, the VP64 cartridge utilizes a neodymium magnet to produce a higher output than previous Shure omnidirectional models. The microphone features internal shock mounting for reduced handling noise, a critical characteristic for audio feeds in handheld reporting or interviewing. The VP64 is priced at \$135.

For information, contact Chris Potter at 708-866-2586; fax: 708-866-2279; or circle Reader Service 105.



NADY SYSTEMS

950GS UHF Wireless System Offers 40 Channels and Nady's UHF RF Link

EMERYVILLE, Calif. The 950GS UHF wireless receiver by Nady Systems is a rack-mount, True Diversity unit with 40 frequency synthesized channels. The channels are arranged in four user selectable groups of 10 channels each.

The receiver is available with Nady's all-metal Surface Mount Technology (SMT) handheld, lavalier or instrument transmitters.

With instant access to UHF channels, the Nady 950GS allows users to find an operating channel free of interference virtually anywhere in the world.

The 950GS utilizes Nady's proprietary UHF RF link, and Nady's patented compounding noise reduction. The dynamic range is 120 dB.

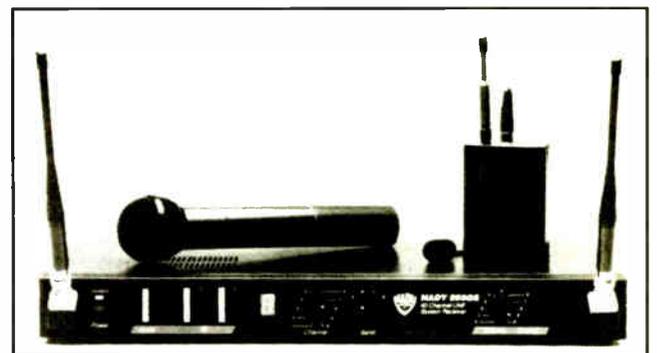
Because of the physi-

cal problems inherent in designing UHF wireless, it's not uncommon for a wireless company to offer a UHF system that is 5 to 10 dB noisier than the same company's VHF system. The Nady 950GS can be up to 20 dB quieter.

The 950GS features Nady's hiss mute circuitry, which maintains audio quality as the user moves to the outside limit of the system's operating range.

Other features include switchable balanced level out (line/mic), 115/220V AC power, and 20 to 25 V DC power option.

For information, contact Howard Zimmerman in California at 510-652-2411; fax: 510-652-5075; or circle Reader Service 46.



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ALTEC LANSING

Automatic Microphone Mixer Eliminates Gating, Adjusts Input Levels As Needed

OKLAHOMA CITY Altec Lansing's 1684A automatic microphone mixer performs the same function as a console operator. Your mic will be turned up, the others turned down. When two or more mics are used, each will share the total system gain without sending the system into feedback.

While a "gated" mixer turns off the

mic when the talker moves out of the microphone's pick-up pattern, the Altec 1684A doesn't "gate." It smoothly adjusts each input level as needed.

Altec automixers are based on a gain sharing patent. Each input is adjusted as needed. Coherent signals require more gain corrections than non-coherent signals, which results in additional attenuation.

The 1684A mixer features include four xfmr balanced inputs, expandable to eight; mic or line inputs; and selectable 200 Hz high-pass filter.

For information, contact Gary R. Jones in Oklahoma at 405-324-5311; fax: 405-324-8981; or circle Reader Service 32.

USCO AUDIO

Surround Sound Package Adds Two Loudspeakers to Reference Monitor Series

HOLLYWOOD, Calif. USCO AUDIO's surround sound monitor package is a five-speaker system incorporating two new loudspeakers in its Reference Monitor series.

The left and right channels are handled by USCO's DFW-3 reference monitors, and the center channel audio is handled by the DFW-3C. The rear/side channel audio is controlled by the SP-2, a two-way system.

The design of the DFW systems include a down-firing woofer and mirror image driver replacement. All cabinets are

made of M.D.F. to reduce panel resonances. The effects of surface diffraction and reflection are minimized by rounding cabinet edges.

The crossovers are handmade, tested and matched. All loudspeakers are aligned to reduce phase distortions at the crossover points. The internal wiring is oxygen free, and cable runs are kept to a minimum. This helps permit maximum power transfer from input to loudspeaker.

A mono summing subwoofer also is available for low frequency extension to the system.

For information on USCO Audio Reference Monitors, contact Bruce Maddocks in California at 213-465-4370; fax: 800-932-6456; or circle Reader Service 57.

JBL

Three New "A" Versions of 4400 Monitor Series Features Extended Listening Without Ear Fatigue

NORTHRIDGE, Calif. The new 4400 Series of professional studio monitors from JBL enables extended listening without experiencing the "ear fatigue" factor often associated with extended monitoring.

Each of the three models in the new "A" versions features components designed for recording/playback environments. The eight-inch 4408A two-way compact monitor is ideal for the broadcast control room or smaller recording studio.

The 10-inch 4410A is a three-way monitor loudspeaker system designed as a

vertical line array, delivering transient response characteristics and spatial detail. The 12-inch 4412A three-way system fits environments requiring maximum low frequency output from a bookshelf-sized monitor.

The low frequency transducers reflect JBL's research and design in this area. Symmetrical Field Geometry (SFG™) magnet structures help minimize harmonic distortion, resulting in maximum definition of bass and low midrange information. Large diameter edgewound ribbon voice coils provide good transient response characteristics and power handling.

A titanium dome tweeter helps minimize distortion levels. The tweeters are oriented to create "Left" and "Right" models, achieving mirror-imaged pairs for imaging.

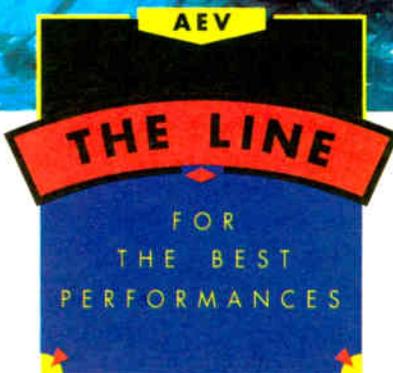
By employing conjugate circuit topologies and tight tolerance components, 4400A Series monitors can control amplitude and phase characteristics. They help deliver smooth transitions between transducers for imaging and power response.

For information, contact JBL in California at 818-893-8411; fax: 818-893-3639; or circle Reader Service 85.

THE LINE



Research For The Benefit Of Broadcasting



- Broadcast Audio Consoles
- Radio Automation
- Audio Processor
- Audio Digital Sampler
- Clock System
- Stereo Generators
- Stereo Decoders
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World Radio History



BRÜEL & KJÆR

Ambience and Clarity are Key with Series 400

ALLEROD, Denmark The Brüel & Kjær Series 4000 Professional Microphones, originally built by request for the Danish broadcast organization, are designed for any recording where ambience and clarity are important.

By adjusting the distance to the source, you can adjust the amount of reverb when recording. For example, if a concert hall or church has an undesired reverb, the Acoustic Pressure Equalizer (APE) attachments can help correct the problem by adding directionality at higher frequencies, while keeping the omnidirectionality at lower frequencies.

When using the Brüel & Kjaer type 4003 and 4006, the APEs can give you improved reach with a presence boost and clarity without proximity when working at close range.

The B&Ks are also designed for news readers and as hand-held microphones during interview situations.

A Pro Audio Forum explaining the theory behind the APE is available from Brüel & Kjær/Danish Pro Audio APS. For information, contact TGI North America at 519-745-1158; fax: 519-745-2364; or circle Reader Service 168.



STUDIO TECHNOLOGIES

**Mic-PreEminence Two-Channel Preamplifier
Designed for Broadcast, Studio or Live Work**

SKOKIE, Ill. The Mic-PreEminence from Studio Technologies Inc. is a high-performance, two channel microphone preamplifier designed to produce

a transparent, clean, smooth sound.

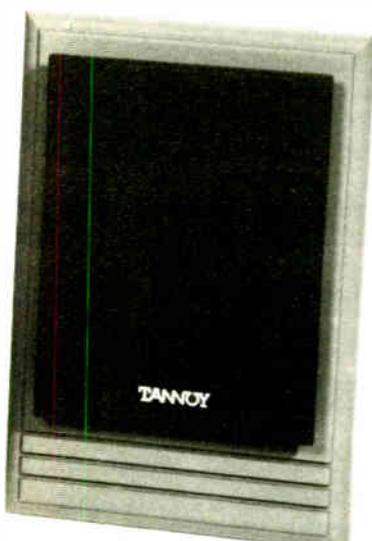
The Mic-PreEminence delivers the gain required without adding to or subtracting from the original mix. It's designed to be a dedicated microphone preamplifier for broadcast, studio or live concert work.

The preamplifier can be used for dedicated microphones in announce booths and for on-air talent. In the studio, the Mic-PreEminence helps minimize the signal flow through a console during

original recording and over-dubbing. For location recording, you can plug a stereo mic pair into the Mic-PreEminence, then connect the output directly into a two-track digital recorder.

The unit features two independent channels, each with a gain control; dual, five-segment LED level meters; output phase reverse switch; phantom power with an on/off switch; outputs selectable for balanced or unbalanced operation; and a gain range adjustable from +12 dB to +68 dB.

For information, contact Barbara Govednik in Illinois at 708-676-9177; fax: 708-982-0747; or circle Reader Service 194.



TANNOY

**DMT Monitor Series
Upgrades With System 6
NFM Loudspeaker**

ONTARIO, Canada Tannoy's new System 6 NFM studio reference loudspeaker is the newest addition to the company's Monitor Series based on Tannoy's Differential Material Technology (DMT™).

The unit is designed with a 6 1/2-inch Dual Concentric transducer, and the System 6 NFM cabinet is 15.8 inches x 8.8 inches x 9.4 inches.

The loudspeakers utilize graphite-filled, polyolefin copolymer layered cones, to ensure response and to help prevent fatiguing and breakup of the cone's apex. The cones are terminated with a nitrile rubber surround attached in a two-part molding process.

The introduction of the System 6 NFM phases out production of the System 2 NFM.

For information, contact Bill Calma in Canada at 519-745-1158; fax: 519-745-2364; or circle Reader Service 129.

SPEAKERKITS

**CD Loudspeakers and CD Studio Monitors Complete
Sound System for Radio Stations and Studio Work**

FLORAL PARK, N.Y. For over 15 years, Speakerkits has designed and built sound systems for the home, car, DJ/PA, background and studio applications.

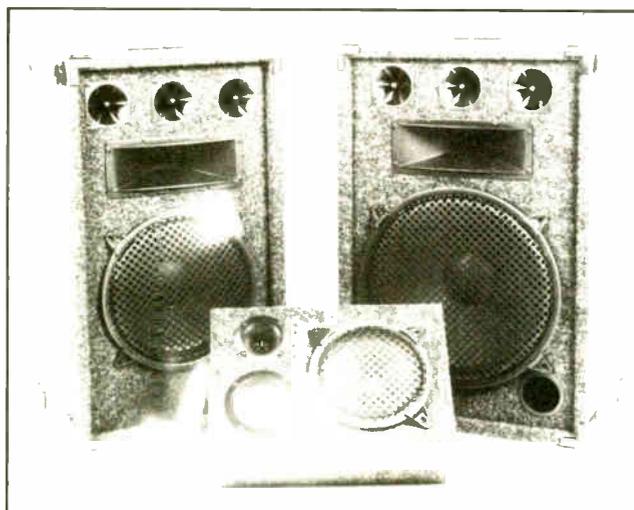
The company has a wide selection of woofers, tweeters, mid-ranges and crossover components in stock to repair, rebuild or improve any brand speaker systems.

In addition, Speakerkits designs or builds spec speaker systems for other companies and retail stores. The CD Loudspeaker series is an outgrowth of this need for sound systems.

The CD Studio Monitors are installed in radio studios around the country. The studio monitors were designed for accuracy, high power handling, compact size and durability, and they were

recently added to the company's standard line.

Speakerkits currently has 24 standard models, hundreds of replacement parts in



stock and the capability to custom design or build to specification.

For information, contact Bob Wilson in New York at 516-354-7006; fax: 516-354-7012; or circle Reader Service 27.

Who's running the ship?

Unattended operation is one way to keep your station profitable, but you still have to mind the store.

The acclaimed Burk Technology ARC-16 Remote Control System is the first step. You can control transmitter and studio from any phone.

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BURK
TECHNOLOGY

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- B. Commercial FM station
- C. Educational FM station
- E. Network/group owner
- F. Recording Studio
- G. TV station/teleprod facility
- H. Consultant/ind engineer
- I. Mfg, distributor or dealer
- J. Other

II. Job Function

- A. Ownership
- B. General management
- C. Engineering
- D. Programming/production
- G. Sales manager
- E. News operations
- F. Other (specify)

Reader Service

July 28, 1993 Issue Use Until October 28, 1993

Please first fill out contact information at left. Then check each advertisement for corresponding number and circle below.

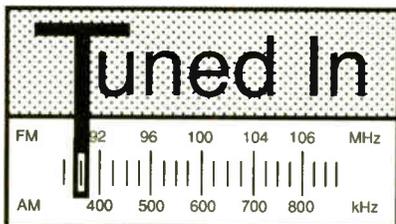
Purchasing Authority
1. Recommend 2. Specify 3. Approve

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002	024	046	068	090	112	134	156	178	200
003	025	047	069	091	113	135	157	179	201
004	026	048	070	092	114	136	158	180	202
005	027	049	071	093	115	137	159	181	203
006	028	050	072	094	116	138	160	182	204
007	029	051	073	095	117	139	161	183	205
008	030	052	074	096	118	140	162	184	206
009	031	053	075	097	119	141	163	185	207
010	032	054	076	098	120	142	164	186	208
011	033	055	077	099	121	143	165	187	209
012	034	056	078	100	122	144	166	188	210
013	035	057	079	101	123	145	167	189	211
014	036	058	080	102	124	146	168	190	212
015	037	059	081	103	125	147	169	191	213
016	038	060	082	104	126	148	170	192	214
017	039	061	083	105	127	149	171	193	215
018	040	062	084	106	128	150	172	194	216
019	041	063	085	107	129	151	173	195	217
020	042	064	086	108	130	152	174	196	218
021	043	065	087	109	131	153	175	197	219
022	044	066	088	110	132	154	176	198	220

Copy & Mail to: Radio World, PO Box 1214, Falls Church, VA 22041, or FAX to: 703-998-2966

MARKETPLACE

A compendium of new and recently introduced radio broadcast products



People, Promotions And Appointments

Sean C. Bowers was appointed DCS Sales Representative for **Computer Concepts Corp.** Bowers, previously with Broadcast Supply Worldwide, is in charge of marketing Computer Concepts products and assisting customers from the company's Denver office.

Tony Mezey joined the sales team of **Audio Broadcast Group Inc.** Mezey, previously the Western sales manager with Broadcast Services, will cover the West and Southwest areas of the United States for the company.

Telecommunications Techniques Corporation appointed Helmut Berg T-BERD Division President. He will manage the division's engineering, marketing, manufacturing and accounting functions.

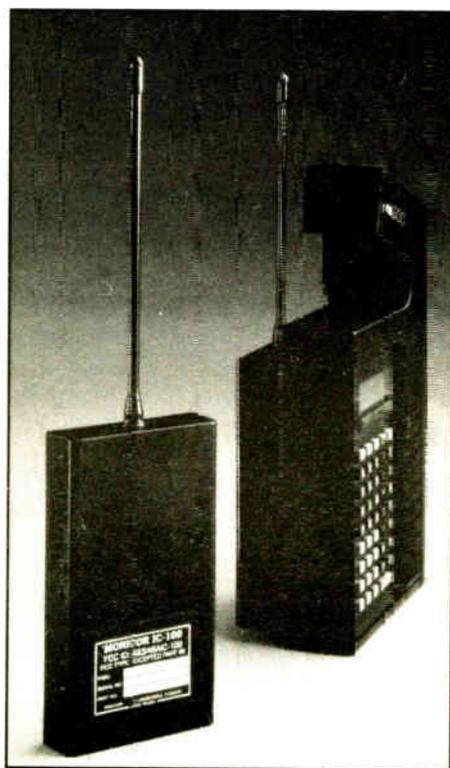
Company News

The **National Supervisory Network**, supplier of VSAT Services and Technology, formed a new division—**NSN Network Services**. The division distributes ComStream digital audio and data networks, including the ComStream ABR200 Integrated Musicam VSAT receiver.

The USA Radio Network ordered audio satellite receivers, utilizing FM² technology, from **Wegener Communications**. In addition, the network is working with Wegener on future products, such as a sub-audible tone to help stations automatically respond to network signals.

Consulting engineering firms **Frank Thatcher Associates**, **Hatfield & Dawson**, and **Suffa & Cavell Inc.**, have announced their affiliation. Each firm will retain its existing identity, local management and operations, but will share staff and equipment resources for larger projects.

Best Power Technology expanded its North American Field staffs throughout the United States and Canada, with six additional regional sales representatives working to develop BEST's field sales presence.



Two-Way Radio Modem

Model IC-100 by **Monior Electronic Corp.** introduced a two-way radio modem to enhance portable data collection in a real time warehousing applications and to replace computer cables.

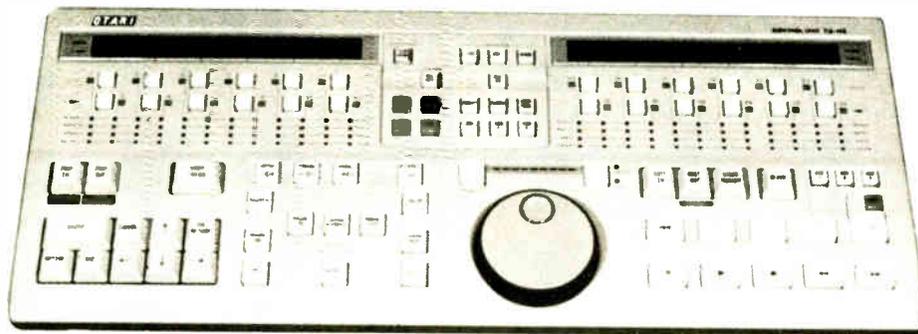
The IC-100 uses 16-bit detection-and-correction techniques to help guarantee data integrity. It also provides line-of-sight distances up to half a mile separation. IC-100 adapts to any RS-232 computer peripheral.

For more information, contact Monroe Miller in Florida at 305-979-1907; fax: 305-979-2611; or circle **Reader Service 202**.

Hardware Control Panel

The CB-158 **Hardware Control Panel (HCP)**, introduced by the Otari Corporation for the company's ProDisk line, speeds up operation and helps reduce the learning curve by placing all recording and editing functions on dedicated keys.

In addition to controlling the ProDisk, the



Fader Consoles

The new **LPB 7000 Series** offers 12- and 18-channel stereo linear fader consoles. The use of modular plug-in electronics behind a unitary front panel, gold contacts, socketed ICs and heavy duty front panel switches help ensure a long life.

Features of the 7000 Series of consoles include two inputs per channel; three stereo busses (program, audition and utility); mono mixdown plug-in for utility bus output; built-in timer and fully programmable muting for every input individually.

Additional features were designed into the new consoles based on engineer and operator feedback.

For more information, contact LPB at 215-644-1123 or FAX 215-644-8651; or circle **Reader Service 26**.



Power Amplifiers

The **RAMSA WP-1000 Series** power amplifiers are designed for use within THX® Sound System Programs.

Ramsa's WP-1000 Series uses a dual-voltage supply in a "Class H" circuit configuration. When power demands are low, the Class H circuitry switches in the amplifier's lower-level power supply voltage, assisting the amplifier in running cooler and

more efficiently.

Other features include balanced XLR and TRS phone jack inputs, "5-way" binding post (dual banana) outputs, stereo or mono-bridge operation, rear panel level controls and "peak" and "protect" LED indicators.

For more information, contact RAMSA in Los Angeles at 714-373-7277; fax: 714-373-7903; or circle **Reader Service 19**.

Digital Audio Receiver

Comstream added the ABR75 and ABR75B, a pair of new SCPC digital audio receivers, to its family of satellite digital audio transmission products. The receivers feature configurations made for two specific digital audio market segments: radio broadcasting (ABR75) and business music (ABR75B).

The ABR75 offers BPSK modulation and a single data rate, and it provides a basic feature set for cost-sensitive applications. The standard rate for the ABR75 is 128 kbps, but users can specify 64, 96, 192 or 256 kbps at the time of order.

The main difference between the ABR75 and the ABR75B is that the ABR75B includes relay contact closures providing remote control of radio broadcast networks.

For more information, contact Bruce Rowe in California at 619-458-1800; fax: 619-453-8953; or circle **Reader Service 214**.

HCP also provides machine control of up to four external video or audio decks via the ProDisk's machine control capability. The CB-158 HCP is priced at \$3,495.

For more information, contact the Otari Corporation in California at 415-341-5900; fax: 415-341-7200; or circle **Reader Service 53**.

Dual-Channel Op Amp

Analog Devices' **SSM-2135**, a dual-channel op amp, can be used in +5-volt single-supply audio applications. Features include ultralow noise and distortion, wide voltage output swing and high current output.

The SSM-2135 can drive headphone loads, approximately 24 Ω , directly with ultralow distortion and without the addition of higher voltage and/or negative supplies.

Other applications include balanced line driving and receiving, and sigma-delta ADC buffering. It can also be used as a low-pass filter and current-to-voltage converter, smoothing the oversampled audio output signal of an 18-bit DAC.

The amp is available in eight-pin plastic DIP and SOIC packaging, and is guaranteed for operation over the industrial temperature range of -40 degree Celsius to +85 degree Celsius.

For information, contact Analog Devices in Massachusetts at 617-937-1428; fax: 617-821-4273; or circle **Reader Services 81**.

Models 8722B and 8732 Shaped Probes

Narda has unveiled two new probes for non-ionizing radiation measuring, the 8722B and the 8732. The probes are shaped in accordance with the new IEEE C95.1-1991 standard for exposure to RF/microwave energy.

Model 8722B monitors the electric fields and Model 8732 monitors the magnetic fields. Both have a detection sensitivity that mirrors the new standard.

For more information, contact Loral in New York at 516-231-1700; fax: 516-231-1711; or circle **Reader Service 142**.



Broadcast Equipment Exchange

"Broadcast Equipment Exchange" accepts no responsibility for the condition of the equipment listed or for the specifics of transactions made between buyers and sellers.

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TESTS 18% BETTER THAN SONEX!
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1-800-95-WEDGE

Crown D-75 power amp, \$300. Jerry, WLTO, POB 499, Harbor Springs MI 49740. 616-526-8730.

AMPLIFIERS

Want to Sell

Marantz 8-B, excel, \$1350; pair of Marantz 9's, \$7500. D deForrest 305-866-6048.

Marantz 2130 quartz locked tuner w/scope, Marantz 3250B control preamp, Marantz 140 amp w/VU meters, rack mount, \$695; Marantz 2270 tuner, pre-amp & amp, rcvr, rack mount, \$150. J Price, Price Recdg Std, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Marantz 8-B, excel cond, \$1350; pair of Marantz 9's, \$7500. David, 305-866-5401.

Shintron 220 audio DA card (1x6) w/manual, fits mdl 213 tray or may use mating connector to break out, new in box, never used, \$15. D Bailey, Rock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Ramko DA-16BR/E dist amp, \$150. J Vavricek, KSYZ, Grand Island NE. 308-382-0108.

Micro Track distribution amp, \$100. C Arnold, KIPR, 415 N McKinley Ste 290, Little Rock AR 72205. 501-663-0092.

Rane HC-6 headphone amp, new, \$250; Radix DA 1600 dist amp, new, \$325. G Grassie, RNTC Bldg, POB 146, Dexter NM 88230. 505-734-5565 before 7AM/after 6PM.

McMartin

Closing out new product at greatly reduced prices. All McMartin audio amplifiers, 25 watt, 50 watt, several models.

Also line monitors, compressor-limiters, equalizer, line amplifiers.
Radio Engineering Industries
6534 L St., Omaha, NE 68117
402-339-2200.

New 250 W solid state amp, \$1800. Call for details. Bill Hoffman, 518-583-9490.

Want To Buy

Tube amplifiers. 612-866-6183.

ANTENNAS & TOWERS

Want to Sell

Phelps Dodge HFM-LP-12 12 bay H polarized FM on 104.1, just removed, \$1000/BO. M Bishop, KXYL, POB 100, Brownwood TX 76804. 915-646-3535.

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

CCA Coamark 3-bay tuned to 92.7, good shape, BO. D Barron, KWJM, POB 777, Farmerville LA 71241. 318-368-3094.

Rohn SSV 100' comm tower, still standing, near Pontiac MI, BO. S Dewey, TCI, 4500 Delemere, Royal Oak MI 48073. 313-549-8288.

Stainless TV tower, 199', 4' face, fortified for 10-bay antenna, w/guys, lighting, hdwe; channel 15 antenna & 6-1/8" line. P Durham, WVTF, Grand Pavilion, 4235 Electric Rd, SW, Roanoke VA 24104. 703-857-8900.

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Cablewave CP-1000-1 one bay tuned 105.5 MHz like new, \$750; ERI 31CP3 3 bay tuned to 105.5 MHz, \$1800. C Fletcher, WLJE, 2755 Sager Rd, Valparaiso IN 46383. 219-462-8125.

FM antenna, 12 bay, high power rototiller style, \$7500. EL Roskelley, KMRK, 4000 Rasco Ave, Odessa TX 79764. 915-363-9696.

1983 Utility 30" face 280' hollow rod galvanized steel tower avail for no cost, you take down & remove. R Simmons, KRGT-FM, POB 50124, Austin TX 78763.

ERI 403 isocoupler tuned & tested, gd cond, cmptly rebuilt, BO. D Barron, KWJM, POB 777, Farmerville LA 71241. 318-368-3094.

Harris FMC4-A 4 bay antenna, 2.1 gain, avail 9/1/93, has de-icers, \$2500 or trade for STL or ? T Hodgins, KLKY, 14 E Main, Walla Walla WA 99362.

Shively Labs 4 bay 6813 medlum pwr FM antenna w/radomes on 98.9, we must change freq, antennas are less than 3 yrs old, \$5500. R Ruff, WKHJ-FM, POB 2337, Min Lake Pk MD 21550. 301-334-4272.

Hilomast NK9 pneumatic telescopic antenna mast for remote bdc transmission, \$1500. D Hendricks, WBYN, POB 177, Boyertown PA 19512. 215-387-0673.

772' TV tower, 8' face, 43% guy radius, new Central w/warranty. Original price \$321,000, available for \$150,000. Scott or Ray (812) 853-0595.

Want To Buy

Tower w/guys & lights, 450-500' in gd cond. Mark, WPF, 1715 Michigan St, Sturgeon Bay WI 54235. 414-743-7443.

Foam coax cable 7/8", min 280', no splices, no kinks. J Steele, WKBX, POB 2525, Kingsland GA 31548.

Icing researcher needs info on lower collapse, if your tower has collapsed, either partially or totally, because of icing, I would like to talk to you. Nathan Mulherin, Research Physical Scientist, Cold Regions Research & Engineering Laboratory, Hanover, NH. PH 603-646-4260; FAX 603-646-4644. Internet Email: mulherin@hanover-crrrel.army.mil

Any 1-3 bays of FM antennas tuned to or near 107.9 for back up. M Shafer, KEKB/KBKL, 315 Kennedy, Grand Junction CO 81501. 303-243-3899.

AUDIO PRODUCTION

Want to Sell

Symetrix 511A one-way NR system, 2 chnl, excel cond, \$175. D Humphreys, Masterwork, 1020 N Delaware, Philadelphia PA 19125. 215-423-1022.

ADC TT144 patchbay, excel cond, 144 point TT bay wired to 50 pin telcos, \$110; Niche ACM 8 chnl audio automation unit controllable by MIDI, 1 rack space; Barcus Berry Sonic maximizer 402 2 chnl, needs some work, \$100/BO. S Wytas, SWP, 165 Linden St, New Britain CT 06051. 203-280-3913.

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CompuServe: 75366,311

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ART Multiverb, vgc, \$275. T Backer, WXHC, POB 388, Homer NY 13077. 607-753-6182.

Pultec EQH2 passive equalizers (3), very clean w/manuals, \$2000/ea or BO; ITI stereo parametric EQ rack mount, \$800/BO; Spectra Sonics 610 complimitters (2), \$400/ea or BO. C Foster, WFOV FM, 727 Hammond St, Bangor ME 04401. 207-947-4487.

MXR 129 pitch transposer & separate display unit, both rack mount units, excel cond, \$125. J Block, Prod Block, 906 E 5th St, Austin TX 78702. 512-472-8975.

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Eventide BD 955 delay unit for on-air use, \$1800. M Rollings, WZNF, 400 N Broadway, Urbana IL 61801. 314-458-5595.

ADC 48 patchbay, D Nelson, 619-758-0888.

Want To Buy

Orban 111B stereo studio reverb unit, \$400. M Rollings, WZNF, 400 N Broadway, Urbana IL 61801. 314-458-5595.

Orban 674A stereo parametric EQ. P Davis, 804-980-2940.

MERCENARY AUDIO

WANTS TO BUY YOUR:

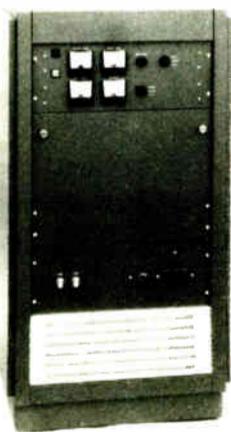
- NEVE-SSL-TRIDENT-AMEK
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Tascam MU-40 meter unit. D Green, KTCU, POB 30793, Ft Worth TX 76129. 817-921-7630.

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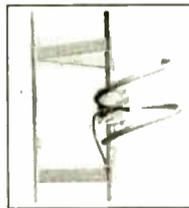
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Aviod Heavy Fines for EBS Non-Compliance
Easily handles EBS requirements for "walk away" Operations
Allows direct access to the air chain
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AUTO PRODUCTION...WTS

Fairchild 600 conac or 602 Conex high freq limiters. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

AUTOMATION EQUIP

Want to Sell

Custom cassette automation, Schafer Brain, 8 Sony TCRX390 decks, 1 yr old country cassette library, \$3995. A Tranmer, KRXR, POB 545, Goosing ID 83330. 208-934-8630.

Carousels in automation unit, \$400 each. R Coleman, WGEN, 1003 S Oakwood, Geneseo IL 61254. 309-944-4633.

TM Century Ultimate Digital Studio, complete package, \$10,995. T Hodgins, KLKY, 580 Roger Rd, Walla Walla WA 99382. 509-529-7094.

Cetec-Schafer 7000 level 1 memory w/expansion, pwr supply, CRT, keyboard, printer, works as is or gd for parts, BO. B Dieckman, KCLN, 1853 442nd Ave, Clinton IA 52732. 319-243-1390.

IGM Instacarts/Go-Carts (2), stereo 48 tray Instacarts touch pad on front panel, \$3000 ea; (2) stereo 42 tray Go-Carts, gd cond, \$1000 ea, buy 2 get rack free. D Greer, WDDZ, 1830 Genesee Trws, Flint MI 48502. 313-238-7300.

Harris 9000 w/Tec 70 CRT/keyboard, Extel AH1R printer w/10 cases of paper, \$500. D Greer, WDDZ, 1830 Genesee Trws, Flint MI 48502. 313-238-7300.

SMC 350 Carousel System, (3) Carousels, 72 spots total w/computer controller, AL-1, PDC-4A & 2 dedicated cart decks, manuals, \$3000/BO. P Dickinson, KLPZ, 816 6th St, Parker AZ 85344.

IGM Basic-A control syst w/all panels & chassis plus 41 plug-in cards & interwiring, \$600 plus packing; (4) random select Carousels in fair cond, \$100 ea plus packing. B Tilton, KELA, 1635 S Gold St, Centuria WA 98531. 206-736-3321.

Sonomag Mini Pro 1 SMC Brain, (2) Carousels, (5) Otari PB units w/automatic rewind, \$4250. R Coleman, WGEN, 1003 S Oakwood, Geneseo IL 61254. 309-944-4633.

Control Design Corp CD-256 25 Hz tone generator, excel cond w/manual, \$100. D Bailey, Rock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Systemation QuickDisc digital audio storage satellite automation, excel condition, complete w/manuals, \$6995/BO; Format Sentry FS12C automation controller, \$2500/BO; IGM Instacart SMC \$350/BO. T Troland, 505-863-9391.

Sonomag Mini Pro, (4) PR 99, (2) 350 Carousels, RSC-100 random programmer, automation head & controller w/remote, 2 racks on casters, \$3500 you pickup. S King, KGFL, Box 33, Clinton AR 72031. 501-745-4474.

SMC DP-2 77 mdl, gd cond, usable or for parts, PDC-5 clock, DS-20 switcher, Extel printer & manuals, \$500/BO. B Christie, Grande Radio Group, POB 907, LaGrande OR 97850.

Conex CG-25 25 Hz gen, BO. J Vavrick, KSYZ, Grand Island NE. 308-382-0108.

Arrakis Digilink II digital automation syst only used for 1 yr, great for live assist & satellite automation, CD quality sound, \$5500. D Murphy, WYZM-FM, 6313 Odana Rd, Madison WI 53719. 608-273-9774.

Schafer 901, complete system w/903 control unit keyboard, (5) random select Carousels, (5) R-R, (4) ITC cart players, (5) racks, cables, spares & manuals, ready for shipping, \$6000. B Crow, KINT, 2501 N Mesa #303, El Paso TX 79902. 915-534-0094.

Broadcast Products AR-1000/2000 automation system including audio control, programmer, power supply, time gate, R-R, 25 Hz detector, Carousels, encoder, decoder, logging code converter, logging decoder, triple player, single players, teleprinter, system taken off the air in gd working cond, will demo system to serious buyer, will also sell as parts. B Wolf, WFUN, 3226 Jefferson Rd, Ashtabula OH 44004. 216-993-2126.

MW Persons 3A 4 source programmer, \$180 plus shpg; MW Persons 25 Hz tone processors (2) 2-chnl 25 Hz tone decoders, \$100 ea plus shpg. J Rowland, WZIO, POB 478, Wheelersburg OH 45694. 614-574-6255.

Colorado Magnetics Satcue 400 automation switcher, \$400. B Eustis, KTMK, POB 848, McAlester OK 74502. 918-423-1400.

Qwik Disk dig audio system from Systemation, leftover from douply deal, \$5800. D Miller, WINA, Charlottesville VA. 804-977-3030.

IGM/NTI Basic A includes (2) 48 tray Insta-Carts & (4) Otari ARS reel tape decks, \$3000/neg. S Spencer, KZ106, 99 W First St, Coming NY 14830. 607-962-2424.

Cetec 7000 w/B150 Series computer terminal, (5) ITC 750 reel tape decks & (6) Audio File trays, all in operation. S Spencer, KZ106, 99 W First St, Coming NY 14830. 607-962-2424.

SMC MSP-1 2000 event programmer w/battery back up, logging printer, 4 SMC 450 Carousels, 3 mono cart PB, satellite switcher, in 2 racks, \$5995. D Kelly, KWPN, Box 84, West Point NE 68788.

Control Design Corp CD25S 25 Hz tone detector, 4 units, \$25/ea; assorted CDC manual, schematic, source cards, parts & assort 74 series chips, open. G Hoppe, WVVAL/NHMH, 1010 2nd St N, Sauk Rapids MN 56379. 612-252-6200.

Want To Buy

TM Century Auto Sequer unit w/Pioneer PM-710 or 730's in working cond or not. R Williams, KQFX, 3639 B Wolfun Ave, Amarillo TX 79102. 806-355-1044.

CART MACHINES

Want to Sell

Pacific Recorder Micro-Maxx (2), new cond w/standard heads & speeds, pwr cords, rack mount, casing & manuals, \$1900/pr. K Rosato, Snd Bdcgt, 303 Webster Ave, New Rochelle NY 10801. 914-645-1626.

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ITC Delta, several new 99B stereo repro units, \$1195; ITC 99B repro, several new stereo units, \$1195. J Addie, WLTL, 708-579-3749.

Tepecaster 700P & 700RP, \$250/both. T Hodgins, KLKY, 580 Roger Rd, Walla Walla WA 99362. 509-529-7094.

RCA RT 7A 19" mono PB (5), \$100 ea/\$375 all. P Drake, 312-392-4618.

Spotmaster 505 mono desk top rec/PB, \$250; Spotmaster 500 PB mono desk top, \$200 or \$350/both. P Drake, 312-392-4618.

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249 Kennedy Rd., Greendell, NJ 07839
(201) 579-5773 Fax (201) 579-6021

ITC triple deck, working w/automation at present, \$950. R Coleman, WGEN, 1003 S Oakwood, Geneseo IL 61254. 309-944-4633.

Spotmaster 505C (3) R/P reconditioned, work fine w/manual, \$125/ea. G Gibbs, KMNS/KXEZ, 901 Steuben St, Sioux City IA 51102. 712-239-3966 pm.

Tepecaster X700RP (2) stereo decks, R/P, all manuals, both gd cond, \$450/ea or \$900/both. J Winters, Wintersound, 45 E Washington St, Elizabethtown PA 17022. 717-367-1119.

Fidelipac Dynamax CTR12 PB (3), CTR14 R/PB, rack shelves (2), excel cond, \$4000/set. Stu, First Take Recording, 301-963-7758.

Sonomag 590 R/P, rack mount w/drawer type sliders for servicing w/record manual, \$200. J Vukelich, Am Best Svc, 4551 Flag Ave No, Minneapolis MN 55428. 612-537-1431.

Collins Twin Tape dual mono units, (3) machines, \$35/ea, \$100/all; Collins mono record amp (2), \$25/ea, \$40/both. G Hoppe, WVVAL/NHMH, 1010 2nd St N, Sauk Rapids MN 56379. 612-252-6200.

IGM cart machines, light use as automation backup, 2 PB, 1 rcd, PBs probably 20 yrs old but sound quite good & run fine, rcdr similar vintage, runs but needs some TLC, PBs \$140/ea; rcd, \$100; all 3 for \$330/+ shpg. Marc, WDFH, Dobbs Ferry NY 10522. 914-693-3963 after 6pm.

BE 5300 triple deck works w/connectors & manual, \$700. B Oostenburg, KCKY, POB C, Coolidge AZ 85228. 602-723-5448.

ITC PD2 cart machine, R/PB mono, very few hrs, like new w/manual, BO. N Alexander, Loomis Prod, 1015 N I-35E Ste 200, Carrollton TX 75006. 214-242-7774.

Audicord E-20 mono 1 slot, new, \$750. G Grassie, RNTC Bdcgt, POB 146, Dexter NM 88230. 505-734-5565 before 7AM/after 6PM.

ITC SP (2), 1 record amp, all work need minor repairs or adjustments, \$800/all. C Arnold, KIPR, 415 N McKinley Ste 290, Little Rock AR 72205. 501-663-0092.

Nortronics heads 2057, 2007, 2003, 2002, 3002, new; Gates Criterion 80 rack mount kits; Beau eraser/splice locator, rack mount kit for (3) Beau cart machines. H Kneller, WKII, 3151 Cooper St #56, Punta Gorda FL 33950. 813-639-1112.

BE 3000A mono delay rcd, rack mount, never used, \$800; Gales 3000A stereo R/PB, \$1325. D Kelly, KWPN, Box 84, West Point NE 68788.

ATC/Gates Criterion 1, can modules, program amps, power supplies, 150 cue & 1000 cur, 11 modules total, Microset head assy, \$50/lot; Beau motor, \$75; lot of misc switches (start/stop) some brand new, \$15; R/P interface cable, \$10; lot of misc parts free w/order; Japan Servo Motor for Criterion 90 machine, needs bearings, \$50. H Kneller, WKII, 3151 Cooper St #56, Punta Gorda FL 33950. 813-639-1112.

Tepecaster 700 R/P mono units (2) in gd cond, one is tape delay, \$180 ea plus shpg. J Rowland, WZIO, POB 478, Wheelersburg OH 45694. 614-574-6255.

Audicord A-50, dual R/P, mono, one cue, \$800; Audicord triple play, mono, horizontal, \$1250. B Eustis, KTMK, POB 848, McAlester OK 74502. 918-423-1400.

BE 5300C tripledeck, stereo, PB, mint less than 50 hrs, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Want To Buy

ITC single play/PB & rcd/PB machines, must be in vgc. M Shafer, KEKB/KBKL, 315 Kennedy, Grand Junction CO 81501. 303-243-3699.

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Want to Sell

Tascam 38 8 trk 1/2", extra clean, low hrs, gd heads, 13 reels, Ampex 1/2" tape, \$2000/all. J Powers, Power House Prod, 338 N University Dr, Nacogdoches TX 75961. 800-388-1077.

Ampex MM1200 8 trk remote AL 8 chnl, dbx 208 PURC cards, etc, \$4500; Otari MTR10-2C stereo, exc, \$3500; MCI Sony JH110B stereo big reels in console, \$2000; MCI Sony JH110A stereo in console, excel, \$1295; MCI JH110B mono, \$895. J Price, Price Recdg Std, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Teac X10R stereo recorder dual capstan drive bi-directional, like new, \$495. J Price, Price Recdg Std, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Scully 270 1/2 trk stereo R/P in roll around rack, \$1000 plus S&H. J Dyer, KRAP Prod, 1140 Dixieanne Ave, Sacramento CA 95815. 916-927-4201.

Otari ARS-1000 (4), PB only, 10.5" R-R's, gd cond, \$300 ea or \$1000/all. J Kimmel, WLF, 102 Swanton Rd, St Albans VT 05478. 802-524-2133.

Revox A-77, 7.5-15 ips, works great, \$395; Tascam 38 in mint condition with dbx on all 8 channels & new 1/2 gold master reel, \$1800 or trade for type accepted STL. T Hodgins, KLKY, 580 Roger Rd, Walla Walla WA 99362. 509-529-7094.

Ampex ATR 700 stereo, \$595; Scully 280B mono in console, like new, \$795; Ampex 440C stereo, new hds, mtrs, etc, \$895; Ampex 440 transports, recond, bearings, brakes, etc, \$395; Ampex, MCI, Scully, mtrs, parts, 8 & 16 trk heads avail. J Price, Price Recdg Std, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

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Nashville, TN 37203 (615) 244-6892

Otari MX 5050 MK II 1/4" R/R in gd cond, \$1500/BO. K Stevens, 14241 Ventura Blvd #204, Sherman Oaks CA 91422. 818-981-8255.

Tascam 38 1/2" 8 trk with 8-channels of dbx NR, \$1500/all, with out dbx, \$1200. P Cibley, Cibley Music, 138 E 38th St, NYNY 10016. 212-986-2219.

Tascam 32 2 trk R-R, low time on new heads, \$837. J Blodgett, WGTF, 308 Westgate Pkwy, Dothan AL 36303. 205-794-4770.

Otari MX 5050 B II, mint condition, 2 track, \$1200/BO. S Wylas, SWP, 165 Linden St, New Britain CT 06051. 203-280-3913.

Ashland/Ampex capstan motor for 350/440 series 3-3/4 & 7-1/2 ips, \$50. H Kneller, WKII, 3151 Cooper St #56, Punta Gorda FL 33950. 813-639-1112.

Tascam 80-8 8 trk w/varispeed, DX-8 dbx, Mod 1 line mixer, wooden case, spares, \$1800. W Slaten, Audio Intl, 424 Grant Ave, Scotch Plains NJ 07076. 908-322-4466.

Teac A-3300SX, 10", 3.75/7.5 ips, 1/4 track stereo, vgc, \$250; Tascam 102 cassette deck, new in 8/92, vgc, \$275. T Backer, WXHC, POB 386, Homer NY 13077. 607-753-6182.

Sony 800B prof portable with variable speed, built-in mic, switchable limiter, 5" reel capacity, never used, \$150. J Monelli, 901 Fairfax Rd, Drexel Hill PA 19026. 215-789-5672.

MCI JH 110B-1 (2) 1/4" FT, \$2500; MCI JH 110B-2 1/4" 2-track, \$3000; MCI JH 110C-1 1/4" FT & 2-track, \$3000; Otari MX5050 1/4" 2-trk, \$1000, all machines in good working condition, can negotiate individual prices or package deal. B Schwab, Audiocraft, 915 W 8th St, Cincinnati OH 45203. 513-241-4304.

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Otari auto rewind in automation at present, \$695. R Coleman, WGEN, 1003 S Oakwood, Geneseo IL 61254. 309-944-4633.

Teac 22-4 4 channel 1/4" with factory tech manual, \$500. J Hunter, KBRE, Box 858, Cedar City UT 84720. 801-590-1277.

Ampex 440 reconditioned less than 9 mths ago, \$100. B Lacy, KARX Radio, 3611 Soncy 6-A, Amarillo TX 79121. 806-359-4000.

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

Student of radio possessing leadership experience seeking position, all offers considered. Randy, 919-854-9073.

Experienced, versatile & reliable sports director looking for same stable position; PBP, sales, AT, news, willing to relocate. Robert 319-524-5831.

Board operator or DJ position, grad of Am School of Bdct, 1 yr on-air exper, nominated for MD of yr, West Coast preferred, country format. D Wilson, 509-684-4730.

Sales, management, programming, mktg and engrg, expertise to successfully achieve turnaround for any station w/good signal in decent mkt. 813-649-3477.

Looking for an experienced, affordable morning team? We're original, talented & get the listener involved. Jack, 414-242-4357.

American Indian Engineer/Manager, Sr SBE, AAS Degree, 18 yrs exper, strong analog, digital, xmir, FCC applications, consultant, design & construction. Former Owner/Operator. Write to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box # 07-14-01RW.

Seeking the unobvious? Janet Lynch, no beginner, no pricey personality, hit PT announcing, research glass ceiling, management, entrepreneurial skills, wants permanent announcing, programming gig. 502-895-5888.

Sensational sales/mktg exper for station w/decent signal & population coverage. B Elliott, 813-849-3477.

Looking for someone that eats, breathes and lives radio? Here I am, prefr midwest! Peter Miles, 7319 Cedar St, Davenport IA 52806. 319-391-0465.

On-Air/promotion/prod/PR 5 yrs exper, modern/CHR/AOR/AC/Oldies formats prefer, anywhere. Brandon, 688 Portland, Collinsville IL 62234. 618-344-1721.

Experienced engineer, directionals, RF, studios, computers, seeks maintenance pos w/board shift, SW mtn area pref but not limited. Engineer, 7894 Palm Grove, Indianapolis IN 46219.

Ham Radio operator, NABer, NARTE FCC licensed, NABET member seeks FT/PT contract work. College radio exper, NBN, Microband. M Rakoff, 114-41 Queens Blvd #148, Forest Hills NY 11375. 718-591-3859.

Ops Director, 12 yrs exper in public radio seeks FT ops or program dir position. Thomas at 904-877-8412.

1992 graduate working at IL radio station, 5 yrs of play-by-play & overall radio exper, incl news, seeks sports job, no geographic preference. Derek, 618-667-6169.

AAS grad, computer/electronic engineering, 6 mos exp announcer, FCC GRT0 license, amateur radio license holder seeks ENG pos in SE med/trg mkt, station to grow with. Fred, POB 453, Webster NC 28788.

Engineer w/ten yrs exper in all phases of AM/FM, Harris, Cont txs, satellite interfacing, automations, will relocate but prefer SE. 804-971-9973.

Engineer w/23 yrs of exper seeks a FT position, ideally within 8 hrs drive of Highland Park IL, N.E. Illinois, S.E. Wisconsin, N.W. Indiana or S.W. Michigan preferred, other areas considered. Call Jeff at 719-579-8651, leave msg.

23 years of radio production exper, let me join your production staff, any market, any format, professional job done cheap. John Peace, 803-669-1719.

If your product is not selling...I'm not on your team. Broadcast equi sales/mktg executive. Consider mgmt or staff, avail immediately, will relocate. Write to Radio World, POB 1214, Falls Church VA 22041. Attn: Box #07-28-01RW.

Unlimited potential! UNC grad, experienced, hardworking team player w/great voice seeks FT AT/production, any format, any time slot, any region. Ben, 407-351-3939.

Salesperson looking for a good list in a small town, NW, goal: management. J Wiegman, 208-753-0601.

HELP WANTED

Assistant to C.E. start October 1, 1993. A Gannett station. Must be A-1 on bench work and studio repair w/proven experience. Send resume to: Jack Rabell, Chief Engineer, KSDO-KCLX FM, Ste 200, 5050 Murphy Canyon Rd, San Diego CA 92123.

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

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3M 56 4-trk in floor cabinet, \$1800/BO. C Foster, WFV FM, 727 Hammond St, Bangor ME 04401. 207-947-4487.

Otari ARS 1000 PB stereo (2) w/25 Hz tone decoder in gd cond, \$450 ea plus shpg; Technics 4-trk 1506, needs work, \$200 plus shpg. J Rowland, WZIO, POB 478, Wheelersburg OH 45894. 614-574-6255.

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Otari hubs for 10" NAB reels, as new, \$25 ea/BO. L Snyder, Madera Bdcg Inc, Box 812, Floral Park NY 11001. 718-347-2940.

Otari R/R ARS 1000 (2) w/25 Hz tone selector & cue tone relays, \$300/ea. R Chambers, 916-257-2121.

Ampex 350 stereo R/P w/Viking electr tape hold downs, rack mount, long life heads, \$375. J Vukelich, Am Best Svc, 4551 Flag Ave No, Minneapolis MN 55428. 612-537-1431.

Scully 288B 16-trk w/auto locator, new headstack, 15 & 30 ips, 2" format, excel cond, \$5800; Scully 260B 2-trk w/locator, excel cond, \$1325; Fostex mdl 20, 2-trk, excel cond, \$325. Music Prod Co, 318-636-0545.

Technics RS-1520 2 trk stereo, 3 spd, bal & unbal in/out, rack mount adapters, remote control, extra FT plug in head assembly included, gd cond, \$700/BO plus shpg. E Helvey, Ed Helvey Prod, 461 Layside Dr #100, Winchester VA 22602. 703-877-2717.

3M 16 trk 2" recorder w/remote; 3M 2 trk 1/4" recorder, both in excel cond, has latest upgrades & mods, call for prices. S Zito, Prof Snd Shoppe, 124 Midfield Ave, Hueytown AL 35023. 205-491-3303.

Recordex 330 Series II 1x3 cassette duplicator, excel cond, \$600; Telex Copyette 2 stereo 1x1 duplicator, needs tweeking, \$200. G Grassie, RNTC Bdcg, POB 146, Dexter NM 88230. 505-734-5565 before 7 AM/after 6 PM.

Marantz PMD221 port cassette R/R, excel cond, BO. Davis, 803-276-0639.

Telex 6120XTP stereo duplicator, new, never used, master & 7 slaves, all boxes & factory hardware, \$6800. J Block, Prod Block, 906 E 5th St, Austin TX 78702. 512-472-8975.

Tascam 234 syncaset, one new, \$700, one used, \$450; Tascam 32-2B (2), excel cond, \$600 ea/\$110 both; Tascam 22-2 (2), excel cond, \$450 ea/\$300 both; Teac X-300, new, excel cond, \$375; Revox B-77, one 1/4 trk, \$450, one 1/2 trk, \$600; Sony TC230 (2), TC 630 med belts, \$100/all. G Grassie, RNTC Bdcg, POB 146, Dexter NM 88230. 505-734-5565 before 7AM/after 6PM.

Ampex AG-350 2 trk stereo, R/P, Inovonics 3 spd electr, 3 spd reversible Beau motor, all mounted in AG-440 console, gd cond, \$700/BO plus shpg. E Helvey, Ed Helvey Prod, 461 Layside Dr #100, Winchester VA 22602. 703-877-2717.

Otari MX 5050 MK-III-8 w/cables & roll-around stand, excel cond, \$2995. S St John, St John Productions, POB 641448, Kenner LA 70064.

Various R/R drive motors; 1-Scully, 1-UMC, 1-Nidex, 2-Ampex 440, 2-816 drive, \$200/ea; Revox RB 77 (2) machines complete, one may work, \$275/both; Ampex mdl 600, BO. C Arnold, KIPR, 415 N McKinley Ste 290, Little Rock AR 72205. 501-663-0092.

Technics head set for Technics RS-1500 Series, 2-trk stereo erase-record-play, plus 1/4 trk play head, in box, never used, BO. L Snyder, Madera Bdcg Inc, Box 812, Floral Park NY 11001. 718-347-2940.

Otari MX-70 16 trk 1" rcd w/remote cntrl box & auto-locator on roll about stand, mint cond, \$10000/BO. M Wein, WIOD/WFLC, 1401 N Bay Causeway, Miami FL 33141. 305-759-4311.

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Telex 235 3 to 1 cassette duplicator, mono, perfect shape, no notch in heads, \$600/you pay shpg. S Russell, 60410 Klett Dr, Decatur MI 49045. 616-782-9258.

Otari Mark II-IV 1/2" 4-trk, multi-trk, mint, less than 50 hrs, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Olympus L400 micro miniature recdr, smallest avail, auto reverse, voice activated, new in box, \$185. J Morinelli, 901 Fairfax Rd, Drexel Hill PA 19026. 215-789-7872.

Ampex 350 good condition with solid state elect, work horse, mono, \$350 + shipping. G Gibbs, KMNS/KXEZ, 901 Steuben St, Sioux City IA 51102. 712-239-3966 pm.

Revax A77 stereo 2-trk (6) units, \$95/ea; Melrotech 8-trk logger w/rec amp, \$30/both. G Hoppe, WVVA/NHMH, 1010 2nd St N, Sauk Rapids MN 56379. 612-252-6200.

Otari MX5050 BII w/15-30 ips conversion which cost \$800, mint cond, \$1400. W Gunn, 619-320-0728.

Telex Series 235 open reel tape duplication system, 7.5 & 15 ips with one master plus spare & four slaves, 2-channel electr with manual, mint condition, \$300 plus shipping. J Morinelli, 901 Fairfax Rd, Drexel Hill PA 19026. 215-789-7872.

Norton heads (3) new FT for Ampex 350, \$125/BO for all; (3) Norton 2-trk stereo tape heads for Scully 280, \$180/BO. L Snyder, Madera Bdcg Inc, Box 182, Floral Park NY 11001. 718-347-2940.

Tascam 32 mint cond, barely used, BO. D Mayer, 603-466-3453.

16 trk 2", \$3450; Otari 1" 8 track, \$2450; 5050 III-8, \$1950; Ampex ATR800 mono, \$750; Tascam 25-2, \$750; Tascam 52 mint, \$1200; MCI Locator III, \$1195; Ampex AG350 solid st electr, \$100/ch. W Gunn, 619-320-0728.

Recorder heads, used Scully mono & 2 trk, \$25-50, ATR100's, 3M M79-16 & 8's, Otari 1/2" 8 trks, \$495. W Gunn, 619-320-0728.

Scully 280 1/2" 4-trk. D Nelson, 619-758-0888.

Ampex MM1200 16 trk R-R R/P, excel cond, Mark, 619-758-0888.

Want To Buy
Pioneer CT-F950 schematic or service manual, call with cost. C Leasure, WTBO, POB 1644, Cumberland MD 21502. 301-722-6666.

Sony EM-1 hand wind recorder plus portable 770 Pro; also miniature open reel recorders, prof & consumer type. J Morinelli, 901 Fairfax Rd, Drexel Hill PA 19026. 215-789-7872.

Double-speed cassette rcds any make or mdl. J Garvey, 203-744-2476.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 4646 Houndshaven Way, San Jose CA 95111. 408-363-1646.

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

CD's/PLAYERS

Want to Sell

TM Century Gold Discs, mellow AC library w/optional vocal EZ library, 110 discs, \$2500 or trade for type accepted STL. T Hodgins, KLKY, 580 Roger Rd, Walla Walla WA 99362. 509-529-7094.

Technics SL-PG300, new in 8/92, vgc, \$170. T Backer, WXHC, POB 386, Homer NY 13077. 607-753-6182.

Denon 1200 F/C 200 disc player & cntrlr will interface any IBM w/software, new w/all paperwork etc & warranty, will ship UPS, \$2700. Keith, ALI, 9 Roxbury St, Keene NH 03431. 603-352-8460.

Russco CD-100, new, \$50. G Grassie, RNTC Bdcg, POB 146, Dexter NM 88230. 505-734-5565 before 7AM/after 6PM.

COMPUTERS

Want to Sell

MacIntosh computer, upgraded, 2.5 Meg RAM, 80 Meg hard drive, (2) 3.5 floppys, 9600 baud, S/R fax modem, all programs, imagewriter printer, \$1800/all. J Powers, Power House Prod, 338 N University Dr, Nacogdoches TX 75961. 800-388-1077.

Yamaha MDF-1 disk drive for storing MIDI system exclusive info, \$100; NEC P6 24 pin dot matrix printer, \$125; TASCAM 38 8-trk w/8 chnl or dbx type I, \$1500, w/o dbx \$1200. P Cibley, Cibley Music, 138 E 38 St, NY NY 10016. 212-986-2219.

Word Processors (2) Amstrad PCW-9512, \$150/ea. G Arroyo, 407-830-0800.

Copyrite CR1 daisy wheel, wide carriage, excel cond, \$200; SPC-700C1 four color printer, std carriage, 9 pin, new, \$100; Epson RX-80 F/T std carriage 9 pin w/tractor feed, excel cond, \$150. G Grassie, RNTC Bdcg, POB 146, Dexter NM 88230. 505-734-5565 before 7AM/after 6PM.

CONSOLES

Want to Sell

Eddor AM400 4 chnl auto mixer, 1 rack unit high, excel cond, \$95. G Wachter, KFYL, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161 MST.

Ramco DC5RA 5 inputs 2 output chnl mixer w/mon amp & spkr built in, \$150 plus S&H; Sparta Centurion II 12 chnl 56 stereo input 3 stereo, one mono out, fully remote, \$2500 plus S&H. J Dyer, KRAP Prod, 1140 Dixieanne Ave, Sacramento CA 95815. 916-927-4201.

Soundcraft Series II mixer, 12x4x2, \$650. W Slaten, Audio Intl, 424 Grant Ave, Scotch Plains NJ 07076. 908-322-4466.

Arrakis 150SCT 6 chnl, mono, rotary pots, can convert to stereo, mint cond, 4 mos old, \$1100. J Hart, Radio Genesis, 767 S Xenon Ct #117, Lakewood CO 80228. 303-987-9442.

Audio Technica ATC 820 stereo console 8.2 plus effects in flight case, new, \$795. J Price, Price Recdg Std, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Shure FP-32 location prod mixer, battery operated w/tone gen, VU meter, roll off filters, phantom & AB power, 3 inputs & 2 outputs mic or line w/case, \$675. T Bois-seau, Sound Works, 2500 Beech Tree Ct, Conyers GA 30207. 404-922-6831.

Electro-Voice BK-2432 24-chnl mixer, vgc, \$1200. G Arroyo, 407-830-0800.

BE BE-4M50A w/1/4" patch panel, new, \$625. G Grassie, RNTC Bdcg, POB 146, Dexter NM 88230. 505-734-5565 before 7AM/after 6PM.

Audionics 501 28 input 16 return recdg console, 4 effect send/returns, built-in patch bay, \$5000. T Burr, Spot's Prod, 230 Teresita Blvd, San Francisco CA 94127. 415-731-4221.

Harris Stereo-5, gd cond, clean, \$375. G Finney, WPWB, 7137 Heather Ln, Macon GA 31206. 912-788-2124.

Tascam 688, Midistudio, new in 8/92, vgc, \$1500; Howe Audio Series 7000, 12-chnl stereo console, needs some work, missing 2 input modules w/manual, \$800. T Backer, WXHC, POB 386, Homer NY 13077. 607-753-6182.

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Gates Dualux vintage, great for pots, parts, meters, etc, pwr supply fine, BO. C Hahn, WNNZ, POB 30064, Springfield MA 01103. 413-562-7666.

Pacific Recorders BMX-22 in excel cond, BMX 22 chnl mainframe, 17 line modules, (2) mic modules, digi-timer, digi clock, \$9500/BO. S Horner, KMRO, 2310 Ponderosa, Camarillo CA 93010. 805-654-0577.

Gates Stereo Yard, all original faders, meters, paint, tube type, worth upgrade to solid state, \$200. G Gibbs, KMNS, 901 Steuben St, Sioux City IA 51102. 712-239-3966.

Collins 212H 3-chnl mic in, switchable lin in on 2-chnl hdpone amp, 3 tone generator roller faders, battery pwr, solid state, gd cond, \$275 + shpg; RCA BC8-A solid state, mono, dual output complete, all self contained w/manuals, BO. G Gibbs, KMNS/KXEZ, 901 Steuben St, Sioux City IA 51102. 712-239-3966 pm.

Ramco 5-Chnl stereo mixer board DC-55, 2 inputs/mixer except #5 which offers 5 inputs, \$450. R Chambers, 916-257-2121.

Ward Beck 26x9 fully parametric EQ, comp-limiters & patch bay, \$6000. R Friedman, 1137 Recording, 1137 Fillmore St, Baltimore MD 21218.

Harris Medelast 10-chnls stereo, needs work, cosmetically good, \$1200. G Arroyo, 407-830-0800.

Autogram LA-1 line amp modules (5) working. H Kneller, WKII, 3151 Cooper St #56, Punta Gorda FL 33950. 813-639-1112.

Tascam mdl 15 mixing console, excel cond, \$2500. Music Prod Co, 318-636-0545.

BE 85150 8 channel stereo board in good condition with new output cards, \$800 plus shipping; Harris Gatesway 80 8-channel mono board in excellent condition, \$800 plus shipping. J Rowland, WZIO, POB 478, Wheelersburg OH 45694. 614-574-6255.

Rockwell/Collins IC 10A real good cond, BO. B Lacy, KARX, 3611 Soney 6-A, Amarillo TX 79121. 806-359-4000.

McMartin B502 5-channel stereo console, rotary faders, complete manual & schematic, gd cond, \$700/BO; Shure M267 mixer, never used beyond testing, including tone gen & AGC, \$275. J Winters, Wintersound, 45 E Washington St, Elizabethtown PA 17022. 717-367-1119.

Allen & Heath modular series mixing console, 8-chnl input 4-chnl output, slide-pot console w/mixdown section, patch bay, booster line, expandable to 16 inputs, clean, \$750. B Sitzman, MFAS Prods, 110 County Rd 146, Trumansburg NY 14886. 607-273-2970.

Consoles, \$500 & up. Call Mark at 619-758-0888.

Want To Buy

Arrakis 2000SC in gd cond. D Koehn, KKPR, Box 130, Keamey NE 68847. 308-236-9900.

Ampex MX10 or MX35 mixers for cash or trade. W Gunn. 619-320-0728.

Gates Solid-State Yard good condition, prefer transistorized but will consider tube mdl, no "for parts only" boards. E Allmon, WFVI Radio, POB 555519, Orlando FL 32855. 407-425-0623.

DISCO & SOUND EQUIPMENT

Want to Sell

Ampex ADD-1 stereo DDL for variable pitch lath, vgc, \$500; Lang PEQ2 (2), \$1500 for pair/BO; Sony PCM-10 digital processor WITH +4 mod, vgc, \$450; Neuman PEV-518 EQ (4), \$50 ea. D Humphreys, Masterwork, 1020 N Delaware, Philadelphia PA 19125. 215-423-1022.

JBL 4311 (2), \$500/BO pair. J Diamond, Blue Diamond, Box 102C Chubbic Rd RD 1, Cannonsburg PA 15317. 412-746-3455.

dbx 208 NR system, \$895, plus 216 & 224 systems; stereo noise scratch & pop filter for old 78 records, etc, \$125; Conn strobe tuner, \$250. J Price, Price Recdg Std, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Altec 1592B mixers (3), 5x2, \$250; Soundcraftsmen AE2000 scanalyser/dual EQ, \$550. W Slaten, Audio Intl, 424 Grant Ave, Scotch Plains NJ 07076. 908-322-4466.

Duntech Sovereigns 2001, light oak, fine condition, local Miami pickup or buyer pays shipping/packing, \$6000/firm. Insight Productions, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-6048.

Teac 4-chnl recdg studio w/Teac-5 mixer, Teac A-3440, Teac X-10, Teac 550RX, Sound Workshop 242-A, Harris CB1201, Teac PB64, \$1200 FOB Springfield IL. D White, Cineco-Centriil Media Prod, 2425 W Iles #2, Springfield IL 62704. 217-787-3800.

Yamaha QX-5 MDF-1 MIDI sequencer, \$125, MDF-1 disk drive also, \$100 or both/\$200; dbx 155 4-chnl type 1 NR (2), \$200 ea or \$350/both. P Cibley, Cibley Music, 138 E 38th St, Nyny 10016. 212-986-2219.

SAE 5000-A impulse NR system, click & pop filter (2), \$100 both or \$80 ea. S Lawson, KAK Productions, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

JBL D16R2405 brand new replacement diaphragm for JBL 2405 slot tweeter, as used in 4350, 4343, 4315, 4663, JBL speaker systems, \$50. E O'Brien, Imperial Sound, 383 N Studio St, Terre Haute IN 47603. 812-877-2663.

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Technics SH-9010 stereo paraphractic EQ, rk mt, 2 chnl, 5 bands/chnl, adj freq & bandwidth ea band, 12 dB/band, unbal in/out, \$225/BO plus shpg. E Helvey, Ed Helvey Prod, 461 Layside Dr #100, Winchester VA 22602. 703-877-2717.

8-trk studio equipment, complete, call for all info. L Sawyer, Crossfire, 2001 Elton Rd, Haltom City TX 76117. 817-838-7623.

Duntech Sovereigns 2001, light oak, fine cond, \$6000/firm, local Miami pickup or buyer pays shipping/packing. Insight Productions, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-6048.

Want To Buy

Studio Technologies AN-2 stereo synthesizer. D Jackson, 203-762-9425.

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LIMITERS

Want to Sell

dbx 166 limiter/compressor, \$500/BO. P Drake, 312-392-4618.

Orban 8100A Optimod, one owner, excellent working condition with manuals, \$2400. J Conesa Jr, Ponce Bldg, POB 7213, Ponce PR 00732-7213. 809-840-3160.

Modulation Sciences CP803 composite clipper, like new w/manual, \$675. J Addie, WLTL. 708-579-3749.

CRL SGC-800 audio processor, 1 yr old, \$950. C Fletcher, WLJE, 2755 Sager Rd, Valparaiso IN 46383. 219-482-8125.

ART MDC-2001 comp/exp/de-ess/gate/aural exciter, new, \$450; dbx 163X comp/lim, full rack mount, new \$140. T Backer, WXHC, POB 386, Homer NY 13077. 607-753-6182.

CBS 4440A Audimax volume leveler, \$225. W Slaten, Audio Intl, 424 Grant Ave, Scotch Plains NJ 07076. 908-322-4466.

Optimod 8000A, excel cond, \$1700. R Micheals, KQFX, Amarillo TX. 806-355-1044.

CBS Labs Volumax 4110, 4300, 410 (2), Audimax 4440A, 4450A, \$125/ea or \$650/all. C Arnold, KIPR, 415 N McKinley Ste 290, Little Rock AR 72205. 501-663-0092.

Mod Sci Stereo Maxx MYB-2 stereo enhancer, \$1900. B Dickerson, WEAG, 1421 S Water St, Starke FL. 904-964-5001.

dbx 155 4-chnl type I encode/decode NR, \$200/ea or \$350/2. P Cibley, Cibley Music, 138 E 38 St, NY NY 10016. 212-966-2219.

Orban 8000 stereo gen/processor currently on air, \$1695. C Sigmon, WDKZ, POB 398, York SC 29745. 803-684-4241.

CRL Systems PMC 450 peak modulation controller, \$500; Inovonics MAP-2 8 band AM processor, \$500. S Spencer, KZ106, 99 W First St, Coming NY 14830. 607-962-2424.

Aleis 3630 compressor/limiter, new w/warranty card, \$275. Music Prod Co, 318-636-0545.

Compression limiting device for lw pwr AM mono travelers info radio service in useable cond. 813-933-6009.

Want To Buy

Aphex Type III or C2 aural exciter, either model. D Jackson, 203-762-9425.

Optimod 8000 in any cond for non-comm station. V Zandt, WJLU, 4295 Ridgewood Ave, Port Orange FL 32168. 904-756-9000.

Optimod fairly late-mdl AM in gd cond. E Allmon, WFIV Radio, POB 555519, Orlando FL 32855. 407-425-0623.

CRL SGC-800 limiter in good condition. B Barry, WAMB, 1617 Lebanon Rd, Nashville TN 37210.

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Optimod 9100-B AM audio processor. K Thompson, WWIC, POB 759, Scottsboro AL 35768. 205-259-1050.

Optimod XT 6 band audio processor chassis for use w/8100-A. C Cage, WERK, 6510 S State Rd #3, Muncie IN 47302. 317-289-9375.

MICROPHONES

Want to Sell

HME-WM 252 wireless w/SM58 mic, \$195; Audio Technica ATM31R condenser, \$100. J Price, Price Recdng Std, 2651 Globe Ave, Dallas TX 75228. 214-321-8576.

Neumann UM-57 condenser w/pwr supplies, BO. J Steele, WKXB, POB 2525, Kingsland GA 31548.

Sennheiser 441, new w/all papers & response curves, \$450. R Payne 313-786-1767.

EV RE-20, rough looking, still sounds great. \$100. T Backer, WXHC, POB 386, Homer NY 13077. 607-753-6182.

EV 644 sound spot mics (4), shotgun, \$200 ea. W Slaten, Audio Intl, 424 Grant Ave, Scotch Plains NJ 07076. 908-322-4466.

AKG D-900 dynamic shotgun mics (2), \$125 ea or \$225/both; AKG N46E 2 mic AC power supply, \$50; Lectrosonic quad box, new, \$1175. E Toline, Audio Etc, 525 W Stratford Pl, Chicago IL 60657. 312-975-8598.

Neumann U67 re-tubed with original power supply & cable, \$1850. C Foster, WFOV FM, 727 Hammond St, Bangor ME 04401. 207-947-4487.

Gefell Neumann UM57 tube mics, New capsules for SM2 & many others, New AC701 tubes for Neumann mics, \$275. W Gunn, 619-320-0728.

RCA 77DX & 44 ribbon mics. P Davis, 804-980-2940.

AKG 414's, \$695, original D12 like the Beatles used, \$295, Sony ECM54, \$150, Beyer M500 lk new, \$300, Demeter 4-ch tube DI rack mount like new, \$875. W Gunn, 619-320-0728.

Want To Buy

Neumanns, AKG, RCA, EV, Sennheiser, any cond for parts, etc. J Price, Price Recdng Std, 2651 Globe Ave, Dallas TX 75228. 214-321-8576.

Will trade (1) RCA 77-D for (2) used EV RE-20 or EV RE-27, RCA microphone in good condition with complete yoke, will consider other cash/trade arrangement, send details. T Heathwood, Heritage Radio, POB 16, Bostox MA 02167.

77-DX's, 44-BX's, KU-3A's On-Air lights. Top price paid. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131.

RCA 77DX's/44BX's ribbon, chrome/TV grey, gd cond, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

MISCELLANEOUS

Want to Sell

Topaz ES153 15 KVA UPS, 120V/208V single or 3 phase w/internal batteries & service bypass switch, \$7950. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Onan 12.5JC-18R 12.5 kW standby generator, propane powered w/60 A 3 phase transfer panel & all access, \$5000. J Hunter, KBRE, Box 858, Cedar City UT 84720. 801-590-1277.

Model T-10,000 rotary phase master, \$2500. R Allen, KLAD, POB 339, Kiamath Falls OR 97601. 503-882-8833.

Alphone NEM-40A 40 station intercom master & access, \$650; (2) ElectroSound 100-48/200 cass winder/splicers, \$450 ea. W Slaten, Audio Intl, 424 Grant Ave, Scotch Plains NJ 07076. 908-322-4466.

Anvill cases in various sizes w/rack rails. J Hunter, KBRE, Box 858, Cedar City UT 84720. 801-590-1277.

UTC A-20 audio transformers, primary 50, 125, 200, 333, 600 ohms secondary same (2), \$40. S Lawson, KAK Productions, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Onan 5 kW pwr gen, natural gas, only used 4 hrs, \$2200. C Arnold, KIPR, 415 N McKinley Ste 290, Little Rock AR 72205. 501-663-0092.

Proco 16 chnl FBX snake, 12 xlr & 4-1/2" phone, all balanced connections, excel cond, \$265 firm. J Gill, Onetree PProd, 103 Redwing, Hot Springs AR 71913. 501-321-3080.

Katolite 12.5 kW 3 phase standby generator trailer, mounted w/3 phase transfer panel, runs on natural gas/gasoline, \$4500. R Shelar, WYWR, 710 Columbus St, Leetonia OH 44431. 216-427-2303.

Gates 30V PS module 994-6551-002; HP 120AR scope, no manual, no HV; Gates ACC-2 audio cntl cir; Harris MSP-90 module extender, telephone type patch cords (3) & 5 plugs; RCA BA 33 amps & rack shelf; Lima 20 kW diesel power gen. H Kneiter, WKIL, 3151 Cooper St #56, Punta Gorda FL 33950. 813-639-1112.

Ampex 15095 audio input transformers, plug in octal 8 pin type, 150/600 ohm input, 15K ohm output (4), \$10 ea; Ampex 4580116-20 audio input transformers, plug in octal 8 pin type, 600 ohm input, 15K ohm output (9), \$10 ea. S Lawson, KAK Productions, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

ADC 6' 1/4" patch cords PJ76 new \$5, ADC TT jacks PJ839, new, \$85; Ampex ATR 800 2-channel electronics, \$400. M Santiago, 510-525-5947.

INVENTORY REDUCTION SALE! Over 500 item list (fax or mail). Call Mark at 619-758-0888.

Baldwin EX-20 66 full size keyboard, w/pedals, new condi, \$300; Radio Lab stick-on attenuators, \$15 ea; Henry Matchbox interface, new, \$100. G Grassie, RNTC Bldg, POB 146, Dexter NM 88230. 505-734-5565 before 7 AM/after 6 PM.

Want To Buy

Old studio gear, record cutting machines, audio tube amps, limiters, 45/78 records. Kim, 612-866-6183.

Teac RC-170 remote control for 80-8. D Humphreys, Masterwork, 1020 N Delaware Ave, Philadelphia PA 19125.

Broadcast clock desktop model to be used by state radio network, must keep perfect time. J Roberts, IL News Network, 312-943-6363.

Bdct catalogs, promotional materials & sales literature from the '30's thru '70's Collins, RCA, etc. any help appreciated. G Lee, POB 5786, Beverly Hills CA 90209. 310-696-0177.

Radio transformers by Chicago, UTC, Triad, Peerless, Freed, Sola, send list. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

Ampex tube recorders and mixers. W Gunn, 619-320-0728.

Jazz record collections, 10" LP/12" LP be-bop, swing, dixie, highest prices paid. B Rose, Program Recdgs, 228 East 10th, Nyny 10003. 212-674-3066.

MONITORS

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McMartin

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Belar RFA-1 RF amp for 107.9 but consider any freq. M Shafer, KEKB/KBKL, 315 Kennedy, Grand Junction CO 81501. 303-243-3699.

McMartin FMR-1 FM mono monitor rcvr, working. S Keefe, WCNI, Box 4972, New London CT 06320. 203-439-2853.

McMartin (buy & sell) any model. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886 or fax 402-493-6821.

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Professional SCA demod card with excellent crosstalk rejection. \$20. Superadio III with SCA, \$85, performance guaranteed. 1-800-944-0630.

Floral Park NY 11001. 718-347-2940.

SCA tuners 67 kHz subcarrier, very low crosstalk, xtal tuned, gd cond, \$75 ea/BO; (2) Johnson xtal tuned, as new, \$150 ea/BO. L Snyder, Madera Bdcg Inc, Box 182, Floral Park NY 11001. 718-347-2940. Lafayette MA 08008 6-band, 6-80 meters shortwave rcvr, \$100. G Erway, EB Corp, 3450 SE Martinique Tr, Stuart FL 34997. 407-283-6871.

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Gentner SPH3A telephone interface, \$300. J Hunter, KBRE, Box 858, Cedar City UT 84720. 801-590-1277.

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Micro Controls multi chnl remote control, either phone line or SCA telemetry, both studio & xmttr units, factory checked, \$500. S Homer, KMRO, 2310 Ponderosa, Camarillo CA 93010. 805-654-0577.

Trade Gentner EFT-900A & EFT-100 for Comrex single line freq extend xmttr & rcvr. R Stanley, KETR, POB 4504, Commerce TX 75429. 903-886-5848.

VRC-2000 compatible data terminals, Qume QVT-101, gd cond, \$1400 ea. G Finney, PFWB, 7137 Heather Ln, Macon GA 31206. 912-788-2124.

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Integrated Network Corp 1056R switched channel data service unit, two separate modems in single 3-1/2" rack unit, no CODEC or V.35 cable, new in box, \$1475. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

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Marti STL10 receiver/transmitter with antennas, on 94.8 MHz in good condition, not compliant w/493 rules, \$1000 plus shipping; Marti RY-15/RMC-15T with digital telemetry, for use through STL path with metering return through sub-audible on AM transmitter, needs work, \$250 plus shipping. J Rowland, WZIO, POB 478, Wheelers-burg OH 45694. 614-574-6255.

Anixter-Mark 10' & 6' STL dishes, grid style w/950 MHz feeds, call for price. J Hunter, KBRE, Box 858, Cedar City UT 84720. 801-590-1277.

Moseley TRC 15 (2), one w/Hallikainen digital readout, both work well, analog \$600, digital \$700. S Horner, KBBY/KKVR, 6150 Olivias Pk, Ventura CA 93003. 805-654-0577.

Marti RPT-40; rcvr RR 50/450; rcvr R 30/150, \$1300/all; Terado mdl 50-202-3A DC converter 450/550 W, \$150; MicroTrac Sport III works, \$150; Mini-Grid MG 9A44GM antenna assembly, brand new in box, \$200. C Arnold, KIPR, 415 N McKinley Ste 290, Little Rock AR 72205. 501-663-0092.

Symetrix IT-101 telephone interface (2), \$250 ea. C Fletcher, WLJE, 2755 Sager Rd, Valparaiso IN 46303. 219-462-8125.

Marti studio & xmttr units RMC2-AXT(A) RMC2-AXT(10) need repair, \$350. C Sigmon, WDKZ, POB 398, York SC 29745. 803-684-4241.

Marti RPT 40; TFT 7610; Moseley TCS-2. D Nelson, 619-758-0888.

Mark P972GN 2 6' 950 Mhz STL grid antennas, one dish will need a new feed assembly, \$1300. J Hansen, KFMG-FM, 108 3rd St #103, DesMoines IA 50309. 515-282-1033.

Moseley 505 STL xmttr, does not meet new specs, \$750 or trade. T Hodgins, KLYK, 14 E Main, Walla Walla WA 99362.

TFT 8610 control terminal & 8611 remote control, \$1500. Jerry, WLTO, POB 499, Harbor Springs MI 49740. 616-526-8730.

Moseley 505 composite xmttr & rcvr, A-1 condition, confirmed upgradeable by Moseley, \$1600/BO. K Reising, WRZQ, 825 Washington St, Columbus IN 47201. 812-379-1077.

Want To Buy

Scala MF-960, pair miniflector STL antennas. D Jackson, 203-762-9425.

Marti used receiver, preferably 161.70 and/or 161.76 MHz, no tube types. D Moore, WDUX, Box 247, Waupaca WI 54981. 414-468-4100.

Marti 160 MHz rcvr & xmttr, old tube xmttr OK. G McCintock, WNCM, 1300 WWCOR Ave, Nashville TN 37218. 615-255-1300.

Marti RPT-30 in 450 MHz band, also YC-450 yaggi antenna; pneumatic telescoping mast, min 20' extension. J Steele, WKBX, POB 2525, Kingsland GA 31548.

Comrex PLX Micro portable one-line encoder. D Jackson, 203-762-9425.

Marti STL 8 or 10 looking for complete syst incl antennas. B Moede, WEMI, 1909 W Second St, Appleton WI 54914. 414-749-9456.

SATELLITE EQUIPMENT

Want to Sell

California Microwave analog satellite rcvr w/all cds required to rcvr Mutual network before they switched to digital, exc cond, \$500. J Kimel, WLFE, 102 Swanton Rd, St Albans VT 05478. 802-524-2133.

Microdyne 1100 FFC downconverter SCPC, 3.7-4.2 GHz, 50-90 MHz, self contained w/built in p/s, preselector & multiplier/mixer/F ckt, \$500. G Gibbs, KMNS, 901 Steuben St, Sioux City IA 51102. 712-239-3966.

Wegener Panda 1601-50 sat rcvr for SMN, mainframe w/numerous cards & manual. \$1500. J Kimel, WLFE, 102 Swanton Rd, St Albans VT 05478. 802-524-2133.

Harris 6550 rcvr w/following cards, (4) audio dist amp card, SLD baseband demod card, RBPS QPSK demodulator, prog audio processing, \$400/all. G Hoppe, WVAL/NHMH, 1010 2nd St N, Sauk Rapids MN 56379. 612-252-8200.

Microwave Alter Co 5045A-2, 5045A-3 interdigital TI filters, protect your S-A or Fairchild from interference, \$2000/both or BO. C Bullett, WGAN/WMG/WYNYZ, 420 Western Ave, S Portland ME 04106. 207-774-4561.

One 3-meter Prodelin satellite antenna, assembled w/polar mount, \$600. NE Cable, 216-793-7434.

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Want to Sell

Bauer 682 stereo generator. D Nelson, 619-758-0888.

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Audiopak blue, 1000 plus; Dynamax cobalts, 600 plus, 3.5-4.5 min, \$1-2 each. A Tranmer, KRXR, POB 545, Goosing ID 83330. 208-934-8630.

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Audiopak A-2 carts, appx 80 lengths .20 to 2.5 min, most have little use, \$2/ea or \$100/all. J Winters, Wintersound, 45 E Washington St, Elizabethtown PA 17022. 717-367-1119.

Empty reels (160) 7" in clean white boxes, \$.35 ea, \$10/ctn (40), \$35/4 ctns plug shpg, 10" metal reels w/o boxes, \$1 ea, \$.75/10 plus shpg. E Helvey, Ed Heivley Prod, 461 Layside Dr #100, Winchester VA 22602. 703-877-2717.

Nems-Clarke 108E 4 tower monitor, all meters intact, BO. G Gibbs, KMNS/KXEZ, 901 Steuben St, Sioux City IA 51102. 712-239-3966 pm.

HP 3550B portable xmission test set, oscillator/patchpanel attenuator & impedance matching xformers, AC level meter, \$200. R Walsh, WHCN, 1039 Asylum Ave, Hartford CT 06105. 203-247-1066.

Shure SE30 3-chnl mixer w/gated compressor, AC/DC, good remote unit, exc cond, BO. N Alexander, Loomis Prod, 1015 N I-35E Ste 200, Carrollton TX 75006. 214-242-7774.

Ithaco 4302 dual 24 dB/octave hi-lo-pass filter 1/10 to 1 MHz, \$295; Weston 666 multimeters, \$45; Eco 150 solid state signal tracer, \$100; Heath audio gen 1G-72, \$85; Tentelometer tape tension T2-V20, \$200. J Price, Price Recdg Std, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

Ampex 406 10" reel tape, new, only \$11.95 each. Call Mark at 619-758-0888.

Pams Jingles ref tapes, 1951-1976, BO. R Kaulman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625.

Want To Buy

Any 10" tape formats from TM programming, especially stereo rock, also interested in Rick Dees weekly Top 40 records or CD's. J Eglloff, TKR Cable, 5582 Rapid Run Pk, Cincinnati OH 45238. 513-922-7049.

AC Gold library, need up-tempo hits from '80s & late '70s, carts or CD's. P Posen, KEZN, Box 291, Palm Desert CA 92261. 619-340-9383.

Looking for following: 12" or 16" SESAC rcdngs for programming museum, must be SESAC, negotiable. P Sawell, MFAS Prod, 110 County Rd 148, Trumansburg NY 14886. 807-273-2970.

Any 16" old transcription library music discs for radio museum being established, will crate & pickup, Langworth, Standard, Thesaurus, Capitol, etc. E Allmon, WFIV Radio, POB 555519, Orlando FL 32855. 407-425-0623.

TAX DEDUCT EQUIP

W Africa educational, Christian station needs FM, AM & SW xmttrs & studio equipment. K Leatherwood, Grace Intl 2111 Griffith Ave, Terrell TX 75160. 214-503-1956.

Non-Comm Educ FM station needs any equip. B Tyson, WSSD, 11026 S Wentworth Ave, Chicago IL 60628. 312-928-8800.

High school radio station in Ohio looking for tax deductible donation of 1 kW xmttr or amp, will pay shipping or pick up. B Long, WSTB, 1900 Annalene Dr, Streetsboro OH 44241. 216-626-4906.

Educational station in Mexico seeks donation of Continental 500 W xmttr. Inge Dunham, 120 Wells Hill Rd, Lakeville CT 06039. 203-435-2170.

State historical society seeks donation of turntable for 16" transcription record collection. S Oliner, 1300 Broadway, Denver CO 80203. 303-866-4603.

TEST EQUIPMENT

Want to Sell

Soar MS 60-40 oscilloscope, \$100; Dynascan sweep function gen, \$75; Soar FC-884 multifunction counter, \$75. J Vavrick, KSYZ, Grand Island NE. 308-382-0108.

Tektronix 5441 storage scope w/on screen numerical display w/dual 5B42 timebase & 5A22 differential input amplifier, high gain & selectable lo/hi pass filters for audio work, \$345. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 802-258-6161. MST.

Tektronix DC505A freq counter, \$250; Tektronix digital multimeter DM502A auto range, \$295; Tektronix digital multimeter DM501A, \$295; HP dist analyzer 333A, \$695; HP 353A, 110B attenuator, \$75; Waveform 520-A RMS/DBM sensitive volt meter, -60 dB to +50 dB, \$100. J Price, Price Recdg Std, 2651 Globe Ave, Dallas TX 75228. 214-321-6576.

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Potomac QA100 Quantaural audio analyzer, mint condition, \$2500. J. Loughridge, 804-550-2202.

Want To Buy

AM field intensity meter. A Sutton, WBCU, POB 70, Union SC 29379. 803-427-2411.

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TTC 2500E 1984 FM, single phase, spare tube, available 9/1/93, \$8500; Moseley 505 STL transmitter, does not meet new specs, \$750 or trade. T Hodgins, KLYK, 14 E Main, Walla Walla WA 99362.

RCA BTA-5T 5 kW AM xmttr, \$2100; Bauer 603 5000 W FM xmttr less exciter, \$4700. S Spencer, K2106, 99 W First St, Coming NY 14830. 607-962-2424.

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Gates/Harris TE-1 FM stereo exciter, w/spare stereo gen & interface panel for Optimod, gd working cond, \$1000. J Kimel, WLFE, 102 Swanton Rd, St Albans VT 05478. 802-524-2133.

TTC UST-106 on channel 61, recently rebuilt, tuneable, \$14,000/BO; Bext NS1000 1 kW amp on channel 61, tuneable, 2 years old, very clean, solid, \$24,000/BO. S Kafka, K62CO-TV, 945 S 12 #4, Lincoln NE 68508. New phone #: 402-466-5785.

RCA 10 kW's AM mdl BTA 1002 tuned to 1030 kHz, needs modulation transformer, vgc, workhorse, \$10K; CCA AM-1000D 1 kW transmitter tuned to 1190 kHz, vgc, presently on air, \$3000; Harris SX-1A 1 kW AM xmttr tuned to 1190 kHz, vgc, presently on air, \$12K. G Arroyo, 407-830-0800.

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Bauer 1 kW AM minor repair, \$1300. F Willis, WKXH, POB K, Alma GA 31510. 912-632-0104.

CSI T-1-F '78 1 kW FM transmitter, excellent condition, currently on air, comp with exciter, \$6100. C Sigmon, WDZK-FM, POB 398, York SC 29745. 603-684-4241.

Gates/Harris FM-20H with power supply, low pass filter, exciter/tubes not included, as is but worked til replaced, \$6000. P Tuck, Eagle Bldg, 10592 E Balmoral Cir #1, Jacksonville FL 32218. 904-696-1015.

Harris FM20K/MX15 w/exciter, excellent condition, 8 years old, very clean, \$15,000. B Victor, Premiere Radio, 15260 Ventura Blvd, #500, Sherman Oaks CA 91403. 818-377-5300.

TTC UST-106 on channel 61, recently rebuilt, tuneable, \$14000/BO; Bext NS1000 1 kW amplifier on channel 61, tuneable, solid, very clean, 2 yrs old, \$24000/BO. Steve, V6100-TV, Lincoln NE. 402-466-5785.

RCA BTE 20E1 gd cond, only used by WSM, BO. B Lacy, KARX, 3611 Soncy 6-A, Amaniolo TX 79121. 806-359-4000.

ERI 3-bay Rototiller Antenna, 1-5/8" Model 92.1 MHz, \$2500, excellent condition. 816-635-5959.

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Technics SL1200 MK II w/cover & vg cartridge, \$325. J Vukelich, Am Best Svc, 4551 Flag Ave No, Minneapolis MN 55428. 612-537-1431.

JVC 4-DD-5 quadraphonic disc demodulator, never used, \$125/BO or trade for Teac or Tascam 2-chnl cassette deck. D Putwers, 703-751-9346.

Russco turntable good condition, \$75. R Chambers, 916-257-2121.

Russco Cue Masters TT's (2) in gd cond, 3-speed, \$90 ea plus shpg; Stanton 310 phono preamps (2) in gd cond, \$100 ea plus shpg; Micro Trak phono preamps (2) in gd cond, \$100 ea plus shpg; Russco Studio Pro mdl B TT's (2) in gd cond, 2-speed w/tonerms & cartridges, \$190 ea plus shpg. J Rowland, WZIO, POB 478, Wheelersburg OH 45694. 614-574-6255.

Stanton 310 stereo preamp, like new, \$95; (2) Harris CB 1201 3 speed, gd cond, \$100 ea; Russco Fidelity Pro, stereo, like new cond, \$125. G Gibbs, KMNS, 901 Steuben St, Sioux City IA 51102. 712-239-3966.

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Technics 1200 TT, \$200; (2) Audiometric TT pre-amps. Jerry, WLTO, POB 499, Harbor Springs MI 49740. 616-526-8730.

Want To Buy

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Microtrak 303 cartridge shell, need several. B Hoisington, 33 John Sims Pkwy, Valparaiso FL 32680. 904-678-8943.

Needed for 2 Technic SP10MKII: manuals, prepamps, prefer ATI #P-1000-1 or Logitek #BPA-200, Henry Univ TT cntr, bases, fancy or plain, SME Series IIS tone arm assembly or just the wand, arm & headshell section, any road cases fitting 1 or 2 TTs. E Barrett, 412-621-8000. FAX 412-682-2665.

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