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Radio World



Studio Sessions
See pp. 15-32

Vol 18, No 4

Radio's Best Read Newspaper

February 23, 1994

Universe of Broadcasters Returns to Vegas

by T. Carter Ross

LAS VEGAS, Nevada Broadcasters, manufacturers and others from across the country and from around the world are expected to converge on the 1994 National Association of Broadcasters (NAB '94) convention here March 20-24.

The theme for the show, hosted at the Las Vegas Convention Center, is "Innovation Everywhere You Turn!" Emphasis will be on new products, innovative technologies and fresh ideas in both the seminars and the exhibition.

Approximately 250 technical seminars and workshops are scheduled, while more than 800 exhibitors will show their equipment at the NAB '94 exhibition, which covers 500,000 square feet.

The separate Radio/Audio Exhibition will offer a variety of radio and audio equipment, including radio transmitters, studio and audio equipment, consoles, CD players, digital production workstations and DAT machines.

In 1993, 64,510 people attended the show, and 11,523 came from outside of

the U.S. Based upon early registration indications, NAB officials expect even larger crowds to attend NAB '94.

The All-Industry Opening Session keynote address will be delivered Monday morning by FCC Chairman Reed Hundt.

On Tuesday, Peter Coors, vice chairman and CEO of Coors Brewing Co., will deliver the radio keynote address at the NAB/RAB luncheon. Also at the luncheon, The Crystal Radio

Awards will be presented for the best in community service radio, and Chicago Cubs sportscaster Harry Carey will be inducted into the NAB's Broadcasting Hall of Fame.

A number of seminars, workshops and special meetings are on the agenda for NAB '94. There are also numerous luncheons, receptions and other opportunities to network with broadcasters, engineers and manufacturers from across the U.S. and around the world.

The NAB Broadcast Engineering Conference will explore issues relating to digital technology, HDTV, data broadcasting, radio transmission, satellite and

auxiliary services and more. Meetings will be held Sunday through Thursday.

The Radio Advertising Bureau Sales and Marketing Conference offers a series of interactive sessions to help expand

sales and promotions goals. Meetings will be held Tuesday and Wednesday.

The NAB Radio Management Conference offers seminars and workshops to

continued on page 33 ►



Audio Recording of Chicago installed the SSL SoundScreen. For information on this and other DAWs, see **Buyers Guide**, pp. 83-103.

in depth

All Problems Solvable Say Algorithm Experts

by Randy Sukow

WASHINGTON Much of the radio industry discussion of digital audio data compression over the past year has centered on the various ways compression damages the sound.

Concern among broadcasters has diverted at least some of the effort that has in the past been devoted to developing new, more sophisticated and applications-specific compression algorithms to searches for ways to prevent current, sometimes incompatible systems on the marketplace from unduly damaging studio and broadcast audio quality.

The searches already seem to be yielding results. About a half dozen possible solutions, ranging from individual station testing before purchasing compression equipment, to the ultimate goal of a "lossless" compression algorithm are being discussed. (See story, page 69.)

Also, expect considerable attention to be paid to a technology approach that will be unveiled at the coming NAB spring convention by a new West Coast company, California Digital Audio Systems Inc. (CDAS).

CDAS's "digital audio Xpress" (daX) system could potentially cure many compression artifacts by eliminating most of

the digital/analog and analog/digital conversions in the studio and in RF routing. (See story, page 68.)

Nearly a year has passed since the 1993 National Association of Broadcasters Convention, where the term "dueling algorithms" became an in-vogue term for many radio engineers.

Herb Squire, chief engineer, WQEW (AM)-WQXR-FM New York, suggested during an NAB technical session that incompatible compression systems will create audio impairments—transcoding artifacts—and played tapes of his test results to demonstrate. (See story, page 66.)

Most equipment vendors say the dueling algorithm issue has not hurt sales. The benefits of compression still appear to far outweigh all other concerns.

"A vast majority of our customers have real straightforward operations and the possibility of compression stacking never really comes up. On a weekly basis, I am discussing the situation, but it's generally with about 10 percent of the people I'm talking to," said Brad Harrison of Register Data Systems, Perry, Ga., manufacturer of The Phantom recording and playback with AC-2 compression.

continued on page 64 ►

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NEWSWATCH

DCI Joins With Metro Info Services

SAN FRANCISCO Differential Corrections, Inc. (DCI) has joined forces with Metro Information Services to provide real-time traffic reports to commuters equipped with vehicle navigation systems.

According to DCI, the initial site will be the San Francisco area, but will later include the 50 other U.S. cities served by Metro.

The combination of the Radio Data Systems (RDS) technology and the satellite-based Global Positioning System

(GPS) enables users to receive accurate traffic information with regard to their location. The tracking system, using RDS and GPS, is accurate to within 10 meters, according to DCI.

Quello to Be Honored For FCC Service

LAS VEGAS Longtime FCC Commissioner James Quello, who served as interim FCC chairman in 1993, will receive a distinguished service award at NAB '94.

Quello, who has served on the FCC for 20 years, is being recognized for his ser-

vice as interim FCC chairman and his many years of service as a commissioner.

"Commissioner Quello has always had a deep understanding and appreciation for the special role broadcasting plays in American society," NAB Joint Board chairman Wayne Vriesman said.

CBS Awarded Rights To '98 Winter Games

NEW YORK CBS was awarded the broadcast rights to the 1998 Olympic Winter Games, including radio and TV coverage. The games will be held in Nagano, Japan.

CBS Radio was the broadcaster of the 1992 Winter Games and was scheduled to broadcast more than 300 reports for the 1994 Games in Lillehammer, Norway,

which began February 12.

CBS's 1998 TV and radio right package cost the network \$375 million.

Sony Sponsors 'JazzSet' Program

NEWARK, N.J. Sony is sponsoring the syndicated jazz program "JazzSet with Branford Marsalis," by providing DATs and analog cassette to WBGO-FM, where the show is produced.

"JazzSet" is produced entirely on Sony Pro DAT Plus. "We are delighted to assist WBGO in its capture and presentation of some of the finest jazz performances today," said Tom Evans, promotions manager for Sony's Professional Media Division.

continued on next page ▶

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

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

The PHANTOM Digital Audio Automation

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

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



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

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

While other systems tie your hands and limit your flexibility by only offering 3 or 4 inputs, the Phantom gives you 6 stereo inputs, using its AMX-84 solid state switcher, with the option of increasing the number of inputs to 14 or more. If your station is News/Talk, you know how important this can be.

The Phantom allows you to change the sampling rate, digital format, and stereo/mono settings at will to meet your needs for an individual spot. The Phantom offers a number of digital formats, including the new Dolby AC-2 format, as an option.

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RDS/RBDS Slowly Gains Acceptance

by John Gatski

LAS VEGAS Carrying over the momentum of 1993, acceptance of the Radio Data System technology continues to grow at slow, but steady pace. The 1994 Consumer Electronics Show (CES) in Las Vegas saw consumer radio receiver companies displaying new and improved models. Many of them are promising delivery of the new products as early as next month.

RDS is a 57 kHz subcarrier technology, developed and used in Europe for nearly ten years, that allows stations to transmit numerous types of information to equipped receivers including: call letter display, name of artist/song title display, traffic alert, EBS alert, station selection by format, relay of transparent technical information from studio to station and vice versa and automatic transmitter/translator switching.

The U.S. approved an RDS standard in early 1993 called Radio Broadcast Data Service (RBDS). Between 90-100 stations are now on the air with RDS. Although the cost of adding the subcarrier is less than \$2,000 for a basic encoder, many stations say they are waiting for more receivers to become available.

Some receiver companies have responded with promises of more RDS radios this year. The latest RDS receivers shown at CES are less costly and have added features such as scrolling radio text (64

characters). The new Denon TU-380RD home tuner will list for under \$300 when it begins shipping next month. The TU-650RD will list for about \$50 more but offer slightly better tuner performance, according to Denon. The company also makes two auto RDS receivers; none with radio text yet.

Blaupunkt showed its Houston RCM84 car receiver which has the radio text feature. Availability is summer 1994,

Some receiver companies have responded with promises of more RDS radios this year.

according to the company. Panasonic will have five RDS model available this year, and Goldstar will have three models.

Onkyo has manufactured a home tuner since last year, and now has another model. Grundig has a shortwave/AM-FM portable that is RDS-equipped. Philips also makes RDS radios for the U.S. market as do several other companies.

Although there were more receivers at this year's CES, many companies have said they were waiting for more broadcasters to go on the air before they make a big RDS marketing effort.

The EIA is trying to help move broadcasters toward RDS. The association

announced at CES 1994 that it would launch a new promotion aimed at stations in top radio markets, including: Atlanta, Boston, Dallas, Los Angeles, Miami, New York, Philadelphia, San Francisco, Seattle/Tacoma and Washington.

Each station will get a chance to try out an RE-533 encoder, (courtesy of Harris Allied) for 30 days. EIA will work with the station on RDS promotions and survery them at the end of 30 days.

Denon is conducting a similar program for major market stations to help stimulate the fledgling technology. EIA and Denon will coordinate in markets they are both pushing RDS. A similar effort was made in Las Vegas last year during the CES. RE America also offered a 60 day RDS trial to Chicago stations at the summer CES.

At CES 1994, there were a number of RBDS service providers including CouponRadio and Sage Alerting, an RDS EBS system, hardware and software manufacturer.

Musicboard software was demonstrated on a small scale at the Convention Center. The software allows stations to transmit the song, artist and other text information to RDS receivers while the music is playing. The Musicboard service also can be used on radio station billboards.

NEWSWATCH

► continued from previous page

NAB Endorses Proposed RF Radiation Standard

WASHINGTON The National Association of Broadcasters (NAB) endorsed the Institute of Electrical and Electronics Engineers (IEEE)/American National Standards Institute (ANSI) RF radiation standard (C95.1 1992), which is being considered by the FCC.

The NAB also urged the FCC to confront the "widespread and growing problem of state and local regulations (regarding RF radiation) that have delayed or halted the construction or use of FCC-licensed stations."

For Your Information

Due to space limitations, Radio World will feature coverage of radio's involvement in the Los Angeles earthquake in the March 9 issue.

Also due to space limitations, Steve Rowland's final installment of "Producing a Radio Documentary" will run in the March 23 Studio Sessions.

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Marching to a Positive Drumbeat

WASHINGTON It's NAB time again. It seems like only yesterday I was writing my first *Page Four* and telling you about the great **RW** flood of 1993. Here it is, February 1994 and suffice it to say, NAB preview time has struck again. This year, the storm was ice (I'm sure many of you were iced under as well) and the end result—at least in my case—was a fractured elbow.

That's right, **RW**'s reigning klutz (me) broke an elbow whilst trying to purchase a dozen donuts for the office. 'Nuff said. My typing is a kind of one-handed "hunt and peck" routine, but it hasn't otherwise stopped the onslaught of good information from getting passed on to you.



And as the NAB show approaches, a steady stream of good news continues to pour in. At last year's writing, I remember mentioning that better times must be ahead because of the wealth of new products being introduced, and because companies like Sony were unveiling entire product lines targeted to radio. The soothsayers appear to have been right: Business is booming.

The Radio Advertising Bureau (RAB) reports that 1993 was a banner year for the industry. Radio advertising revenue grew at a rate of 9.3 percent in 1993 to an estimated \$9.568 billion, up from \$8.755 billion in 1992.

The RAB breaks out its numbers by local spot, national spot and network.

Local spot accounts for roughly three-fourths of all radio ad revenue. Last year, local spot grew at a rate of 9.2 percent, national at 10.2 percent, and network ad revenue at 8.1 percent.

I mention these figures to you because they represent the industry's best year of growth since 1985, when radio ad revenue grew at a rate of 11.5 percent, according to the RAB.

★ ★ ★

Analyzing revenue growth from a different perspective yields other interesting data. BIA Publications recently published *Investing in Radio 1994*. According to BIA's projections, there are now 13 radio markets that will have revenues of more than \$100 million in 1994.

In spite of the earthquake, Los Angeles still is projected to rank No. 1 with \$460 million. In descending order, the other markets are as follows: New York \$375.2 million; Chicago \$291.4 million; San Francisco \$176.8 million; Dallas \$174.9 million; Washington \$174.1 million; Houston \$153.7 million; Philadelphia \$152.3 million; Boston \$149.7 million; Detroit \$141.8 million; Atlanta \$131.1 million; Miami \$116.7 million, and Seattle \$109.2 million.

As owners continue to consolidate stations, the now-growing revenue pie will be shared among fewer operators, hopefully ensuring better economic health for those of you who managed to hang on through the rough times.

★ ★ ★

What to do with all that money? The NAB spring convention is certainly a good place to spend it. Peruse this issue before

you go to the show. The NAB expects a record turnout this year, once again, including a record international contingent.

For those of you unable to attend the Vegas show, we at **RW** will scout out the new and exciting stuff on the floor for you. We are so determined to root out the bold and the innovative that we've put together a panel of experts whose mission at the NAB is to find the *Cool Stuff*.

The **RW** panel of experts will walk the floor the entire week of the show and make note of any product (small or large,

simple or complex) that stops our experts in their tracks and makes them exclaim, "cool stuff!"

On the last day of the show, we'll be stopping by to let you know if your product has been awarded a *Cool Stuff Award* (CSA). All winners

will be pictured in the May 5 **RW**, in our NAB product wrap-up. Good luck! (I'll let you in on who the experts are after the show.)

On another convention-related note, Computer Concepts' Sean Bowers, the driving force behind the **RW** Dream Team, informs me that game No. 4 is scheduled for Thursday, March 24 at 6 a.m. The Dream Team consists of distributors versus manufacturers in a game of basketball, and is a trade show ritual.

Once again arrangements have been made for the game to be held at the Las Vegas Sporting House at 3025 Industrial Ave., just west of the Stardust Hotel. The game is open to all. The gym will charge a one-time \$15 fee per player, but that will entitle you to access to all of the club facilities. Hope to see you there!

The RW experts will walk the NAB Show floor and make note of any product that stops them in their tracks and makes them exclaim, "cool stuff!"



LATEBREAK

Corinne Baldasano joined the Unistar Radio Networks as vice president of programming in the company's Valencia, Calif., office. Baldasano most recently was vice president of programming for ABC Radio Networks and has 24 years of programming experience. Her various roles in the business include programming radio stations as well as her network experience.

National Public Radio (NPR) President Delano E. Lewis was appointed co-chair of the U.S. Advisory Council on the National Information Infrastructure (NII). The NII Council is an initiative of President Clinton, and was created to advise the administration on building and operating the NII.

Frank DiMatteo was named regional vice president and general manager of Beasley Broadcasting's WRXK-FM, WXKB-FM and WWCN(AM) in western Florida. DiMatteo relocates to Fort Myers, Fla., from Chicago, where he was vice president and general manager of the company's WBIG(AM)-WYSY-FM.



Norm Pattiz and Mel Karmazin

Westwood One Inc. and Infinity Broadcasting completed the previously announced purchase of the radio network business of Unistar Radio Networks for approximately \$101.3 million.

In a related transaction, a subsidiary of Infinity Broadcasting acquired (1) five million newly issued shares of common stock of Westwood One for \$3 per share, and (2) a warrant to purchase an additional three million shares of Westwood One common stock also at \$3 per share.

Infinity will manage Westwood One pursuant to a management agreement. Infinity/Unistar Chief Executive Officer Mel Karmazin (pictured above right) has become CEO of Westwood One, and Norm Pattiz (pictured above) will remain chairman of the board of Westwood One.

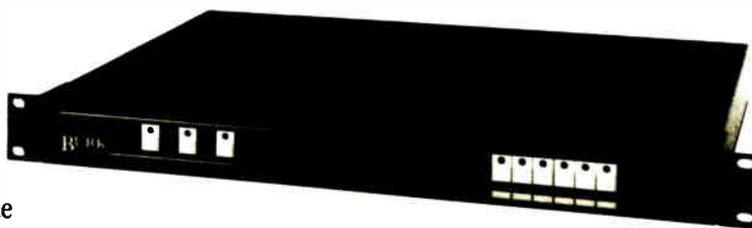
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GUEST COMMENTARY

by John Abel
Executive VP/Operations
National Association
of Broadcasters

The digitization of human communication is creating a revolution. The concept of the "information superhighway" would not be possible without digitization. Today, voice, video, audio, photographs, print, are created and manipulated digitally, and are being stored and retrieved using digital devices. When we couple digital with the tremendous benefits of wireless communication, it becomes possible for broadcasting to participate in the future information infrastructure. Radio broadcasters have a chance in the transition to digital to reinvent themselves and become multimedia broadcasters—broadcasters who can provide multiple services on a flexible basis. Who says that digital radio broadcasting must be limited to sound?

When we digitize the transmission path, broadcasters have a chance to make a quantum leap over analog transmissions. We can gain the ability to provide multiple mass and personalized services within the same transmitted bit stream. Because of the ability to intermix the bits related to different services in the same broadcast bit stream, these services can be simultaneously supplied to different kinds of digital receivers, including desktop and laptop computers, fax machines, personal digital assistants, pagers, and so on.

Because all human communication can be reduced to bits, compressed and then broadcast, it really comes down to how much information we can cram into a channel. Obviously, it requires more bits to represent some forms of communication than others. Voice takes far fewer bits to represent the communication than does full motion video. A page of text takes far fewer bits to represent the communication than a photograph.

The more bandwidth, the more bits or

information we can broadcast. Radio is somewhat limited in bandwidth relative to television broadcasting. The entire AM band is just over 1 MHz, while the entire FM band is 20 MHz and the TV bands occupy about 400 MHz. Using current technology, we believe that if there were no analog signals occupying a channel, in a single vacant AM channel (10 kHz of bandwidth), using digital transmission, we could broadcast between 30 and 80 kilobits per second (kbps). In a vacant FM channel (200 kHz of bandwidth) we could transmit between 600 and 800 kbps and in a TV channel (6 MHz) we could transmit between 18 and 24 megabits per second (Mbps) (or between 18 and 24 million bits per second). To put this in perspective, a page of text is about 2 kilobits; therefore, an AM station could transmit between 15 and 40 pages of text in a second, an FM station could transmit between 300 and 400 pages of text in a second, and a TV station could transmit between 9,000 and 12,000 pages of text in a second.

Now, let's consider the digital receivers of the future. We need to think of the differences between computers and broadcast receivers. A radio receiver is a "real time" appliance. The listener can hear only what is being broadcast, when it is being broadcast. In contrast, computers are non-real time appliances. But, when we transition to digital broadcasting, we will have digital receivers that are computers. The new capabilities make possible additional processing, storage and manipulation of information that can take place in non-real time for retrieval and display at the will of the consumer.

The new receiver may have outputs for audio, the fax machine, the computer, etc. If a consumer is interested in following four stocks listed on the NASDAQ, the consumer programs his/her computer to "capture" the stock information for these stocks out of the bit stream coming to the special digital receiver attached to the computer. The computer then displays the information on these stocks at the will of the consumer. Certainly advertising can accompany this captured broadcast (for those of you stuck on how to make a buck) or the broadcaster could charge a subscription fee, or you could do both.

The possibilities are endless and are limited only by imagination and creativity not by technology. Here are some potential applications for multimedia broadcasting using the limited bandwidth of radio broadcasting:

- multiple audio signals could be embedded into a digital data stream.
- separate bit streams could be allocated to e-mail, paging, PDAs, signaling devices like utility load management, data transmissions, fax machines, differential global positioning system (DGPS), RBDS.
- real time traffic updates, weather updates, other emergency announcements to be displayed/played at the will of the consumer.

In addition, broadcasters could distribute services that are packaged by others, just as you do today when you carry a network broadcast. Many of these service packagers exist today, such as CompuServe, America Online, Dow-Jones, Prodigy, etc. Many, if not most,

Broadcasters Are Willing To Ride

As recently as last month, the NAB and associations representing such media as land-mobile radio and direct broadcast satellite services worried that Congress and the administration were paying too little attention to the new infrastructure's wireless components.

"The NII has failed to include broadcasting as an integral part of its vision of the nation's information infrastructure," the NAB Joint Board said last month in a resolution asking the government for "flexibility to utilize allocated broadcast spectrum to offer competitive digital services."

One way to insure broadcaster participation is to review and relax the FCC's radio and TV station ownership limits, beyond the deregulation of 1992, which boosted the radio industry so well.

Presidential policy advisor Larry Irving said the administration favors such a review. Earlier this month, Senate Commerce Committee Chairman Ernest Hollings (D-S.C.) introduced a bill that would direct the FCC to eliminate all ownership rules that are not needed to maintain "media diversity."

These are exciting developments. Consumers will want access to the superhighway through mobile receivers—the kind of access broadcasters can provide if given the chance.

The radio industry has already begun preparing for the future by actively working for a DAR standard and exploring the possibilities of RBDS and other data transmission systems.

FCC Chairman Reed Hundt estimates that communications will be a \$1 trillion industry by 1996, if NII bills now before the Congress are passed. It could represent about a sixth of the U.S. economy by the year 2000, he said.

Broadcasters will be glad to accept the chance to become major contributors to this new GDP growth.

—RW

networks have already digitized their distribution system. Tomorrow they will be adding additional bits that represent other forms of communication.

The marriage of digital technology with wireless communication opens up remarkable advantages:

- Wireless broadcast transmissions provide near universal coverage. Broadcasting is more universal than any medium. ninety-nine percent of households have a radio, 93 percent have a telephone, 63 percent have cable.

- Wireless is mobile. Unlike wired technologies, wireless transmissions can be where the customer is. The benefits to consumers who use laptop computers, personal digital assistants, or portable televisions and radios are obvious.

- Wireless is inexpensive. Wireless transmission is the most efficient form of transmission. There is no need for expensive fiber, coaxial or copper cable.

- Wireless can involve a mix of support mechanisms. Wireless can be totally free, it can be advertiser supported, it can be addressable for subscription fees, or it can be encrypted for specialized rates. It is very unlikely that any wireline provider can meet the standards of wireless.

For all of what I have discussed here to happen, there are some very complicated public policy and business issues that need to be addressed. Here is my list:

1. The current public policy on digital broadcasting has a very specific and limited vision of what our role in the digital world of tomorrow is going to be: DAB. We should ensure that policymakers allow us to be full citizens in the digital media marketplace. This involves both flexible uses of the spectrum and the adoption of appropriate transmission standards.

2. There are a variety of outdated regulatory restrictions on broadcasters' ability to participate fully in the new information infrastructure. Even though it is technically possible to do multimedia

broadcasting, the outdated regulatory restrictions that prevent us from doing so need to be changed.

3. In the digital world new economic and business models will be created as we have already seen in related industries (cable and telco, in particular). Few of the multimedia deals announced in 1993 involved broadcasters. Why? Because of harsh and limiting ownership restrictions which apply only to broadcasting.

4. From the consumers' perspective, the keys to whether convergence makes sense is how it affects their choice, control and connectivity. Broadcasters need to get involved in the cross industry working groups now determining the standards of consumer devices and software. We need to ensure that the offramps and garages on the information highway are compatible with what we broadcasters do and can do in the future.

5. Broadcasters need to rethink what business we are really in. I'll end with these suggestions:

- Think content, not channel. Consider yourself an information/entertainment provider and get to your customers however you can.

- Rethink over-the-air distribution systems.

- Think value, not commodity. Bandwidth on demand is increasingly a commodity. In the information marketplace, one more broadcast channel won't make a difference, unless it adds something unique to the mix.

- Think multiple revenue streams. Advertising revenue alone may be insufficient as competition for a limited supply of ad dollars increases.

- Think demand, not supply. Consider not just what you have to sell now, but what your customers want. Then work to provide it.

- Think strategically, let the tactics follow. Broadcasters are great tacticians, but probably the familiar tactics of the past will not be very helpful in the future. We must develop strategies.

Radio World

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Next Issue of
Radio World
March 9, 1994

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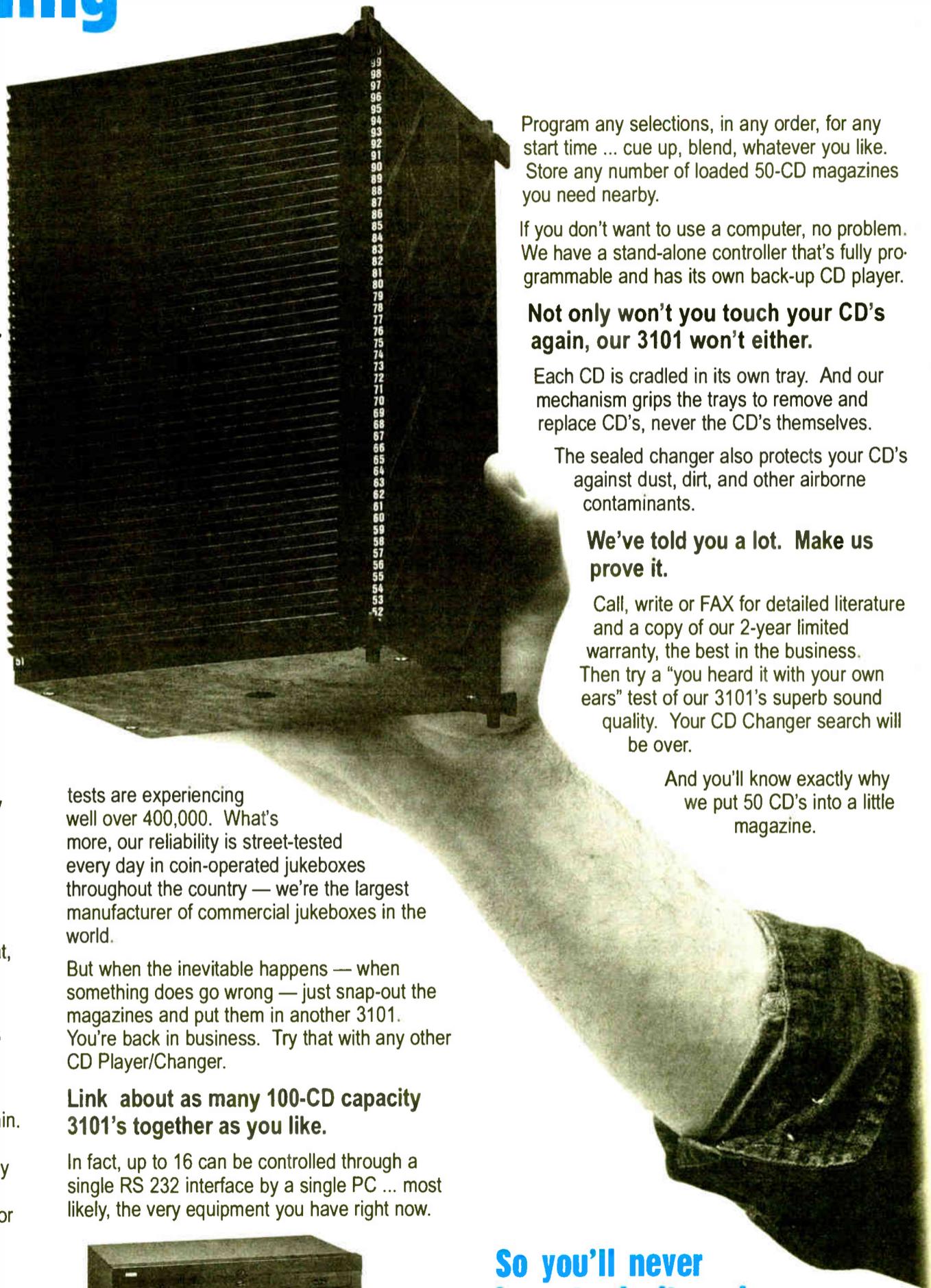
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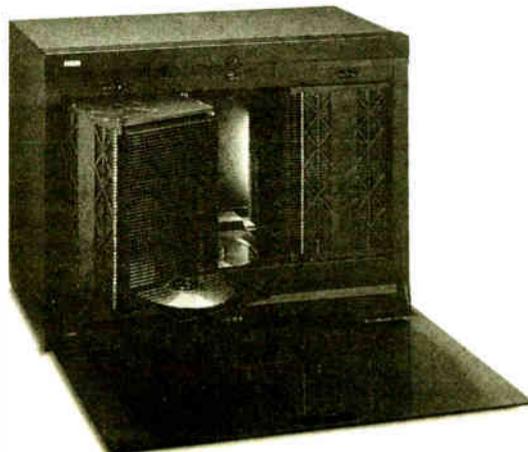
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DAB Testing Begins a Little Behind Schedule

by Randy Sukow

CLEVELAND As of the end of January, all five digital audio radio (DAR) transmission system developers had almost finished installing their equipment at NASA's Lewis Research Center in Cleveland and were ready to begin the months-long testing process.

Testing started a little late, nearly a month after the original Dec. 31 installation date set by the test sponsors, the Electronic Industries Association (EIA) and National Radio Systems Committee (NRSC). The delay was blamed on holiday conflicts and other minor factors.

At the end of the testing, EIA and NRSC are expected to submit their separate recommendations for an FCC-approved DAR transmission system to the FCC.

There is no exact target date for the end of testing, although laboratory tests in Cleveland are likely to last well into the third quarter of 1994. Subjective tests will be held concurrently at the Canadian Research Center (CRC) in Ottawa.

By the time broadcasters reach the National Association of Broadcasters (NAB) Convention in Las Vegas next month, the DAR lab tests are expected to be through the initial, set-up phase, which involves calibration of power-level, spectrum-measurement, point-of-failure and other test systems.

As published last fall (RW, Sept. 8, 1993), about 50 separate tests in 13 different test categories will be conducted in the months to follow. Among the more important tests planned will be DAR-to-DAR and DAR-to-analog measurements, both with and without multipath; the effectiveness of digital error correction at the receiver end when noise is injected into the signal, and the robustness of radio broadcast data systems and other

subcarrier signals under various conditions.

EIA/NRSC has not yet announced a schedule for field tests, which are to follow the laboratory rounds in Cleveland.

The system proponents' attentions will be dominated by the testing in Cleveland this spring, so they will not as prominent in Las Vegas as they usually are at NAB conventions. None of the five announced plans for system demonstrations in Las Vegas.

"Las Vegas is just too far away" to transport the necessary equipment for a demonstration, said Don Messer of Voice of America, speaking for the developers of VOA/NASA Jet Propulsion Lab (JPL) system. VOA/NASA has very tentative plans to make the shorter trip from Cleveland to Toronto for a demonstration at the Second DAB Symposium, scheduled for the week before NAB. But time and equipment for that trip also appears to be scarce.

All proponents, however, are planning to present updates on their systems during an NAB technical session, scheduled for Wednesday afternoon, March 23.

DAR speakers will include: Paul Ratliff of the BBC, for Eureka 147; Messer for VOA/JPL; Nikil Jayant of AT&T Bell Labs for the AT&T in-band, adjacent-channel system; John Bingham of Amati Communications Corp. for the Amati/AT&T in-band, on-channel (IBOC) system, and Paul Donahue of Gannett Radio and E. Glynn Walden, Group W Radio, on U.S.A. Digital's FM and AM IBOC systems.

Representatives of EIA and NRSC will hold a Wednesday morning NAB session to give a full update on the Cleveland test and new details on future testing plans.

Digital DJ Sets Up Demo

LAS VEGAS As announced last fall, Digital DJ (DDJ), San Jose, Calif., will set up a field demonstration of its high-speed digital data transmission system for FM subcarriers.

DDJ is the U.S. marketer for the Japanese-developed level-controlled minimum shift keying (LMSK) technology, which transmits 16 kilobits per second (kbps) over the 76 kHz subcarrier, compared to current RDS/RBDS systems, which transmit 1.2 kbps over the 57 kHz subcarrier.

A special working group of the National Radio Systems Committee (NRSC) is currently studying a number of high-speed data technologies, including DDJ and a system developed by Seiko Telecommunications Systems Inc., Beaverton, Ore., which is now serving 10,000 subscribers in the Portland, Ore., area using a network of FM stations.

The Seiko system, which was demonstrated at NAB 1993, will not be demonstrated this year, but Seiko's Gary Gaskill will present a technical paper, updating the latest improvements in the system, including refined techniques for smooth coordination of data signals between FM stations, and ways to transmit multiple data streams.



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Mercury Plunges, Radio Is There

by Bob Kirby

KANSAS CITY The third week of January brought rumbles to Los Angeles broadcasters and shivers to stations in the upper-Midwest. The severity of invading arctic air, by midweek, had frozen the federal government's gears in Washington and provided plenty of overtime for many stations' staffers.

"This weather was remarkable even for our location," said John Vigested, farm news director for KCJB(AM)-KYYX (FM) and KXMC(TV) Minot, N.D. "In the 20 years I've lived in Minot, I don't remember having a wind chill of -91 degrees (fahrenheit). That's what we had, with the winds continuing for several days," and overnight readings of -30 and daytime highs around -20 degrees, he said.

Such severe cold poses immediate risk to life. "The National Weather Service said with wind chills of -90 degrees, frostbite occurs in seconds, and you'll freeze in minutes," Vigested said. "Amazingly, I don't think we've had one storm-related death. People here are used to it. We don't do as many dumb things as people might do who aren't familiar with cold weather."

Many announcements

For four or six days, Vigested's stations aired many cancellations and postponements. "On a continual basis, you'd spend a couple minutes every half-hour announcing cancellations. But we didn't encounter situations requiring broadcasting emergency announcements," he said.

Vigested lives in the country and missed work two days before the snow plows could clear the roads, "but most of the staff live in town and were able to get here," he said.

The cold's effect

Small market stations weren't the only broadcasters airing programming as pro-saic as school closing announcements.

"We broadcast school closings Monday afternoon (Jan. 17) continuing through Wednesday," said Wes Bleed, assignment editor at WGN(AM) Chicago. "It almost turned into a constant thing. When the lists got so voluminous, we ended up reading them in entirety three or four times during peak drive periods. Each of those times took a half-hour to read if not more," Bleed said.

Chicago has a centralized school closing reporting service for media and individuals. "We have a service owned by another segment of our company (Tribune Broadcasting)," Bleed said. "It's a sister relationship, but most of the other broadcasters also subscribe. The Emergency Closing Center is a Touch Tone entry by the members, the school superintendents and principals involved in announcing closings. Also, any faculty member, and I think parents, can call the system and determine whether school is closed," he said.

WGN news staffers reported traffic problems and broken water mains and followed the mayor, who held regular briefings on city services affected by a record low of -21 degrees Tuesday

(January 18). "With power outages, airport delays, shelter issues and weather warnings, the stories were filled without having to think about enterprise reporting," Bleed said.

WHK(AM) Cleveland morning news anchor Cliff Baechle complained that the all-time record low of -20 degrees early the morning of Wednesday (Jan. 19) only added to this winter's misery. "For the past month, every week it's been either snow or cold with no let up. Since before Christmas in many areas, we've had a couple feet of snow on the ground," he said in late January.

School closing announcements faxed to media subscribers by Cleveland's Metro Traffic Service occupied most windows at top and bottom of the hour in WHK's talk programming.

Poised on the eastern shore of Lake Erie, Buffalo, N.Y., residents were spared the worst of the bitter cold owing to the lake's moderating effect on the weather. It only dipped to -8 degrees.

Still, "at the height of it all, we had about 400 cancellations," WBEN(AM)-WMJQ(FM) News Director Tim Wenger said. He praised the closing and cancellation software that was written in-house.

"It's funny. I was listening to winter storm broadcasts out of New York City and earthquake reports from KNX in Los Angeles on satellite. Some of the biggest markets, and when they do cancellations it's an absolute mish-mash. Our cancellation reports are even alphabetized," Wenger said.

Nothing moved

In Tomah, Wis., 40 miles east of La Crosse, wind chill reached -96 degrees on Jan. 18. "Everything here was just locked up," WBOG(FM) Owner/General

Manager David Magnum said. "All you saw was smoke coming out of chimneys. That was the only movement."

Magnum reported the customary school closings and postponements. He sees that sort of public service reporting not as a necessary evil, but rather as an opportunity.

"We've got to understand, as frustrating as it is answering that question 'Is there school today?' for the bazillionth time, that this is one of radio's real opportunities to show off," Magnum said. "Radio listenership is at its highest, obviously, during these times when this hot information is only available on radio....This is one of radio's shining moments," Magnum said.

Small market broadcasters are especially hampered when weather makes it impossible for the sign-on crew to get to work. Magnum is convinced anticipation, by owners and managers, is key to providing reliable service during intensive listenership periods when the weather is disruptive.

"Book rooms for your staff at a nearby motel. That's what we did. Make it a social event. Arrange taxi service to the station for your key morning people. Don't let them go home, because you know their cars won't start the next day, and you'll be sitting there without staff," he said.

Magnum, also a representative of Jones Satellite Network, suggested that broadcasters provide auxiliary heating for transmitters. "I've had a lot of my JSN clients up in this neck of the woods who didn't do that, and they've really had some problems. They assumed, wrongly, that if they lost building heat that their transmitters would generate sufficient heat," he said.

□ □ □

Bob Kirby is a free lance writer and public radio news producer in Kansas City, Mo. He can be reached at 816-941-4356.

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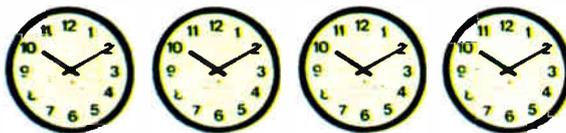
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World Radio History

Orban: 25 Years of Audio Ideas

by Dee McVicker

LOS ANGELES In the late 1960s, Neil Armstrong set foot on the moon, pop art was in and many listeners were tuning into the FM band for the first time.

Also, a young Robert Orban was just striking out into the broadcast world after graduating from Princeton University

with a bachelor's degree in electrical engineering.

A few years later, after moving to California to study at Stanford University for his master's, Robert Orban founded Orban Associates, now part of AKG Acoustics. He developed many products for the professional audio and broadcast industries, including parametric equalizers and most

notably, audio processing.

Orban delivered his first product to a radio station in New York City. The station was WOR-FM, an early album rock station, and the product was a stereo synthesizer—the first of Robert Orban's 24 patents. That visit marked the beginning of Robert Orban's 25 years in broadcast equipment manufacturing.

Here is a recent interview with Orban conducted for *RW*.

RW: You're sometimes credited with being the grandfather of FM processing. Are you?

Orban: I wouldn't call myself the grandfather. If anyone was the grandfather it was the team at CBS Laboratories. They did deal with the pre-emphasis problem the first time with a sliding filter, and got a patent on that. I also have to give credit to Mike Dorrough, who had the DAPs out in the early '70s.

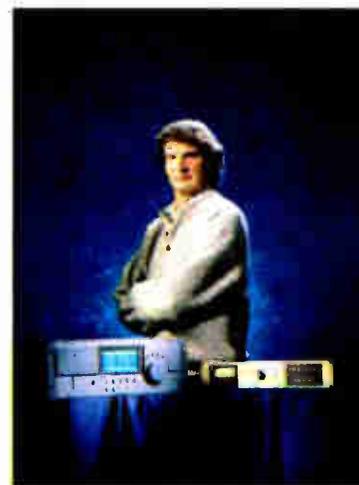
RW: That was also about the time you started development on the Optimod 8000. What encouraged you to introduce a new processor for FM at that time?

Orban: What I recognized was that all these devices that claimed to prevent overmodulation actually didn't. And the reason wasn't that they weren't doing their job, but the filters in the pre-emphasis in the stereo generator were messing up the peak levels.

RW: How did you develop the first 8000?

Orban: A friend of mine, after we got out of school, had bought a small Class A in California, so I did some engineering for him and actually built my first FM level controller for that station. In the course of trying to figure out why we were getting overmodulation on this little Class A when I knew that the peaks coming out of my first audio processor were properly controlled, I was talking to Arno (Arno Meyer, founder of Belar) and he said, "Well, the filters are overshooting in the stereo generator."

So I went up to the top of the mountain with an oscilloscope and poked around up there and sure enough, that's what was happening. So then it occurred to me that the only way to solve



Bob Orban

this problem any graceful way is to make a system where you have an audio processor and a stereo generator, and put it all in one box.

So I worked on this for a while and made a little vector board and got it working well. (I took) it to (Eric Small, who founded Modulation Sciences), who had some major market experience at that point. (I told him) to hook this thing up to your Belar and watch what happens. And he was very impressed because the meter was going up a lot further than he had ever seen and the (monitor) lights weren't going on.

RW: Certainly "loudness wars" were prevalent even then. What is your personal opinion on the loudness wars?

Orban: I always thought the

continued on page 12 ►

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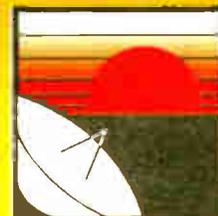
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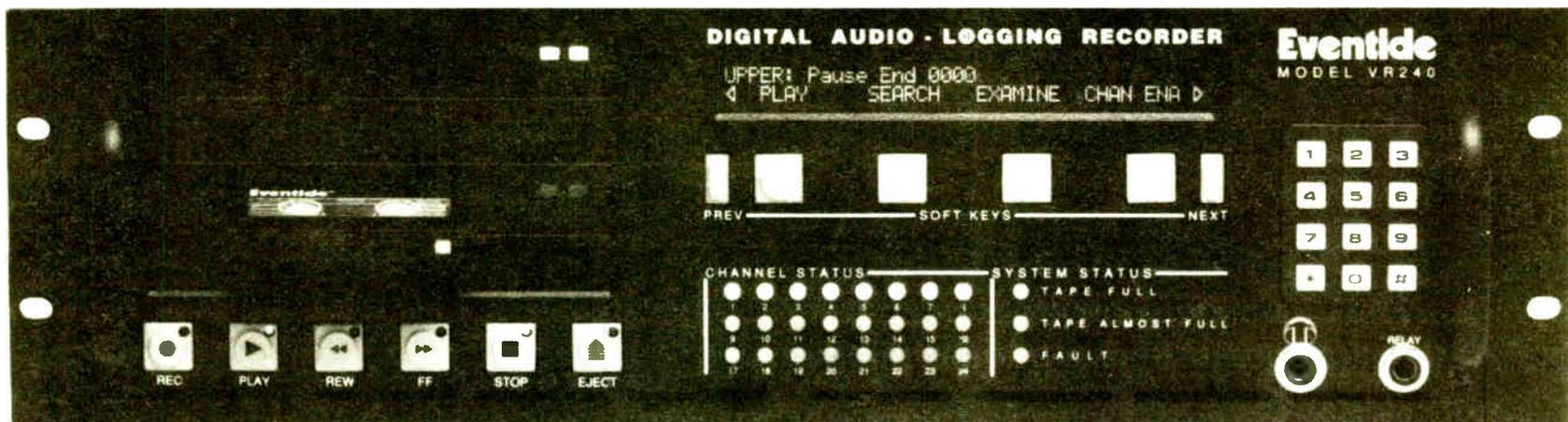


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Orban Analysis of Digital Future

► continued from page 10

whole concept of loudness wars was pretty peculiar because when you think about it, radio is really the only popular mass medium that consciously degrades the technical quality of its finished product.

RW: Why is that?

Orban: I think that there is a paranoia built into the system. Being the program director of a radio station doesn't translate to job security, and so if a program director believes that being louder is going to help him with the next book, he's probably not

inclined to take the risk that that might not be true.

RW: Do you think one station being louder than the next has a favorable impact on ratings?

Orban: If stations have equivalent audio quality, the louder one is probably going to get a little bit more attention from the listenership. But it's a very fleeting thing, because you only hear the comparison when you punch the button on your car radio. And some people think that that translates to the notion that it's a more powerful radio station.

RW: Is there such a thing as listener fatigue?

Orban: I think that Jim Schulke, back when he was syndicating his beautiful

the audio quality. The more degraded, the shorter the time spent listening.

RW: But certainly compact discs have brought some quality to the radio station?

Orban: My impression is that, mostly, the compact disc has allowed people to

"Some people think that (loudness) translates to the notion that it's a more powerful radio station." —Bob Orban

music format back in the late '70s, did more research than anybody else. At least in that format, (he) showed that time spent listening was proportional to

process harder. I think there have been attempts at clarity wars from time to time, but I think this all has a very secondary effect compared to the actual programming of the radio station.

RW: You're viewed as bringing audio processing to the digital age, so naturally we're curious where you think digital will take radio. And second, how will processing fit into the digital age?

Orban: First of all, I think that digital audio radio is going to happen, but it's going to happen fairly slowly because it's going to be fairly costly to build into the radios at first. And it's also going to be a hard sell to convince (people) it sounds that much better than FM. It's certainly not going to be the big leap that FM was over AM. But I think it's going to happen eventually, mostly because it's going to eliminate the picket fencing in mobile FM reception.

I strongly suspect that, at least in the U.S., we're going to see loudness wars on digital. The reason is that people are probably going to have a little bit more signal parity than they did on FM, and the only thing left to get people's attention is how the audio sounds.

I think that it's really naive to think that because suddenly we're on a digital delivery medium, people are going to stop processing. I mean, people have been saying for 10 years that the compact disc is going to cause people to stop processing. Of course, that isn't true, because CD and radio are entirely different media. They are consumed in different ways.

RW: What about RBDS?

Orban: I think it's going to be a valuable ancillary service for FM. It doesn't cost that much to add, and it's going to provide the consumer with very useful information and features. I think it's very practical. It's eventually going to be obsoleted by the digital delivery media; they're going to have the opportunity to embed whatever data they want in the digital bit stream.

RW: Any other technologies on the horizon that you see affecting radio?

Orban: I know that existing broadcasters are worried about the possibility that they're going to have competition from satellite delivered DAB, for example. That's an understandable and reasonable concern because the country doesn't seem to be able to support even the number of radio stations it has right now. So I think (if) you have that sort of service, you're going to hurt a lot of the local broadcasters and probably result in overall quality degradation because there's going to be less money to do good programming.

□□□

Dee McVicker is a free-lance writer and regular contributor to **RW**.

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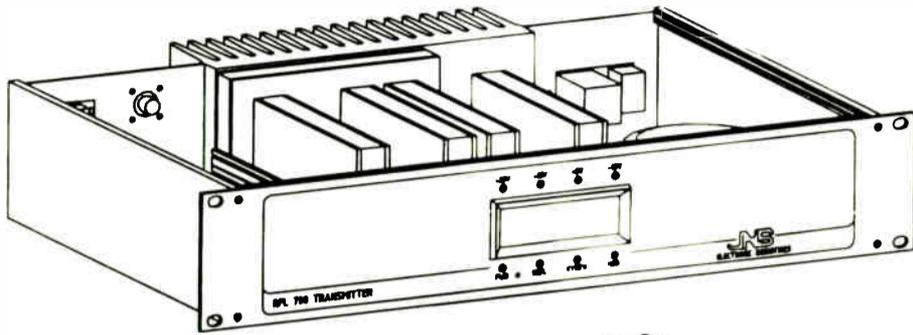
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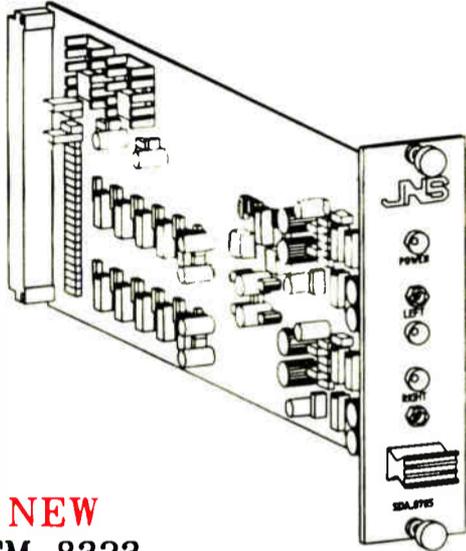
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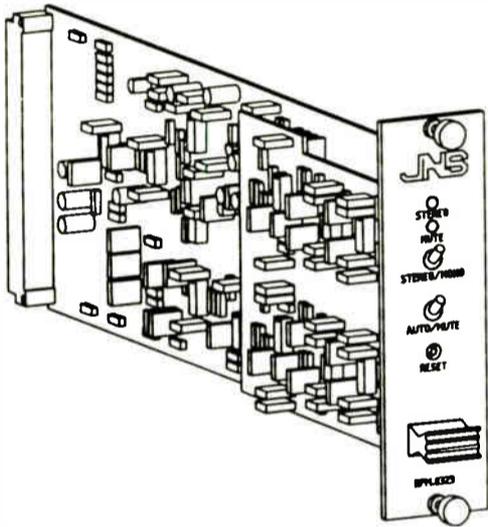
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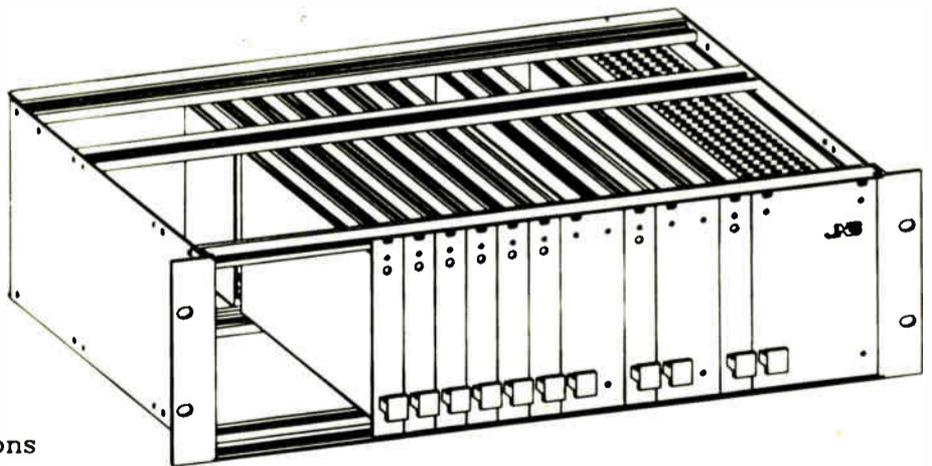
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See Page 27

Equipment and Applications for Radio Production and Recording

PRODUCT EVALUATION

Second Generation CD-R from Marantz

by Rich Rarey

WASHINGTON At last! An economical means of pressing your own compact disc from an analog or digital source has arrived! The Marantz CDR-610 CD Recorder is a modest-sized box with good sonic performance and plenty of usefulness.

Everyone at your station will want to be

ing, the \$4,500 CDR-610 can do it all. And the finished product is playable on any CD player.

Easy hookup

To speed CD-R into the pro audio workplace, Marantz has made it as easy as possible to get signals in and out of the CDR-610. It accepts AES/EBU or IEC-958-II digital inputs at a balanced XLR connector, or IEC-

format output. Without exception, the CDR-610 digital inputs *must* have a 44.1 kHz sampling frequency.

The CDR-610 requires no formal instruction: the layout is like any CD

player, except for the RECORD button and several related controls.

For instance, the following "Quick Start" steps will produce a CD recording:

- Put a recordable CD in the CDR-610.
- Plug in an audio input.
- Press REC, then PLAY.
- Record the audio.
- Press FIXUP, then the REC button to make a permanent CD.

continued on page 20



The Marantz CDR-610: For Benchtest, see page 22.

able to record audio on a "standard" CD including the production and sales departments. From music stingers, jingles and sound effects, to spots and news archiv-

958-II via an RCA, or via a TosLink optical input. Digital outputs appear on companion connectors, except the output XLR requires the user to choose between IEC and AES

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PRODUCT EVALUATION

Benchmark, dbx: Dueling Mic Preamps

by Ty Ford

BALTIMORE The two best reasons for getting a new mic preamp are that (hopefully) it sounds better than your existing preamp, and it may offer additional features not found on your present preamp; features like phantom power, phase reversal and additional outputs.

I suggest you first narrow down the field by features, check the specs and then go for what sounds best. Unfortunately, most manufacturers wander a bit when establishing specs. I don't have a problem with this editorial privilege, but it does make the direct comparison of similar circuits by spec sheet virtually impossible.

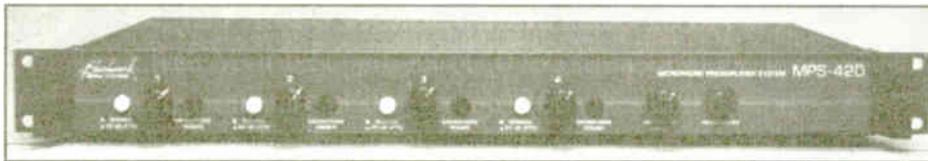
Cost per feature

If you like solid state mic preamps, read on to find out what happened when we evaluated the dbx 760X (\$349) and the Benchmark MPS-420 (\$1295). Direct comparisons are impossible, of course, because of the different features each pre-

L/R outputs and the four-conductor XLR power supply jack. The external power supply is switchable between 110V AC and 220V AC and provides separate 15V

MPS-420 can run unbalanced, there are no unbalanced output jacks.

The left and right mix outputs of the MPS-420 require a bit of explanation.



Benchmark MPS-420 microphone preamp

DC operational power and 48V DC phantom power. The manual provides modification information for 48V, 15V, 12V, AB and T mic powering. Although the

Each mic preamp has its own individual output. In addition, the combined output of preamps 1 and 2 is available at the Left Mix output. The combined output of

preamps 3 and 4 is available at the Right Mix output. So if you want to have any one mic available through both mix outputs, you have to use a splitter mic cable to feed mic preamps 1 or 2 as well as 3 or 4, adjusting their relative levels to obtain the required pan across the Left Mix and Right Mix outputs.

On the front panel, each of the four pre-amp modules has a gain control, a 20 dB pad switch and a phantom supply switch. There is also a headphone monitor module with a quarter-inch TRS jack and gain control. The output of the headphone amp is sufficient to power my AKG 240 phones to my liking, and I do like them loud.

If you're into (or want to be into) the math of gain stages, noise figures and solid state theory behind the design of the MPS-420, the manual provides an extensive

continued on page 19 ▶

Product Capsule: Benchmark MPS-420

	Thumbs Up	Thumbs Down	
✓ headphone output		✓ no clip lights	
✓ 20 dB mic pad			
✓ mix output			

For more information, circle **Reader Service 73**, or call Benchmark at 315-437-6300.

amp offers. Actually, if you add up the cost of their modular parts, the cost of functionality between the two units is about the same. Compared to the dbx 760X, the Benchmark MPS-420 has twice as many preamps (4), plus a head phone amp and a separate semi-mixable output. The only things they have in common are that neither uses tubes or I/O transformers, they both use external power supplies and neither has a power switch.

The 760X

The dbx 760X is a two-channel, single-space, half-rack unit that is designed for table-top or rack mounting. The half-rack size makes it a nice box for portable two-mic DAT sessions. A filler panel is supplied for single rack space mounting. Back panel inputs are XLR balanced.

Outputs are both XLR balanced and TS unbalanced. Pins 2 and 3 of the inputs and outputs are floating, active balanced. The SSM 2017 input chip and input circuit will handle up to a 0 dBu input. The unbalanced output operates independently from the balanced output, allowing both to be used simultaneously. The 18V AC wall wart power supply jack is also on the back panel.

The front panel features gain control, polarity and phantom supply switches, and LEDs for clip level, polarity and the presence of phantom power for each of the two channels. There is also a power LED, but no power switch. The 760X manual is sparse, but does include schematics and thorough information for I/O connections.

The MPS-420

The Benchmark MPS-420, formerly the MIA-4x4+, is a single full-rack space unit that houses four mic preamps, a separate two-channel output module and a headphone amp. The back panel features balanced XLR inputs and outputs, a pair of

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- Tim Pozar, CE, KKSF-FM, San Francisco.

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- Gary Greth, CE, KLON, Long Beach, CA.

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World Radio History

SIGNAL-TO-NOISE

Visual Sound Mixing Now a Reality

by Frank Beacham

NEW YORK For one who grew up behind a coffin-sized RCA console with huge glowing meters and control knobs the size of grapefruit, it's a bit of a leap to enter David Gibson's world, where all the elements of a sound mix float in the air between the stereo speakers in the studio.

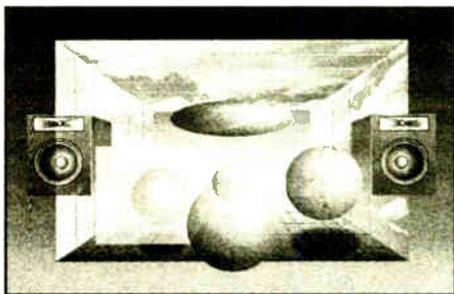
Yet, Gibson, owner of the California Recording Institute in Menlo Park, California, is pioneering a new way to mix sound through the use of visual representations. It started as a better way to help his students understand the dynamics in music and how those dynamics can be created with audio processing equipment in a studio. The idea may end up as a new type of interface to several professional mixing products.

Visual editing

In order to better understand the dynamics that can be created in sound mixes, Gibson devised a system that uses visuals (floating see-through spheres) to represent

the imaging of the sounds between the speakers. These visual spheres are used to create a map that helps one see how the studio equipment can be manipulated to create different types of mixes for different styles of music.

Gibson quickly realized the same visuals that could help teach audio mixing could



Visual representation of Imaging illustrates the whole world of dynamics available to the recording engineer.

also be used to control the audio mix itself. So the visual map has now become the basis of a new kind of user interface for computer-assisted mixing.

By pointing and clicking with a computer mouse, the spheres can be moved around on a Macintosh display screen, controlling the actual sound mix on a MIDI audio board. Thus, the virtual mixer is born.

3-D

As innovative as the visual mixing interface is now, it's the next step, one that Gibson is currently developing, that's the showstopper. It's here that the visuals become three-dimensional and float in the air between the stereo speakers.

The engineer, wearing 3-D glasses and a "data glove," mixes the sound by reaching up and grabbing a floating sphere (which represents a track on the multitrack) and physically moves it around in the space between the actual speakers.

If the engineer wants a track to be near the left speaker, the sphere is simply moved there by hand. The computer will tell the mixing console to make the change, and the engineer will hear it as it moves. Sound mixing with this process, Gibson said, "will be as simple as finger painting."

Gibson's virtual mixer has not escaped the interest of major mixer console manufacturers. According to the inventor, DigiDesign has already approved the use of the interface to control its Pro Tools software and several other companies, including Harrison, Studer, Amec, Sonic Solutions, Mackie, Fostex and Yamaha are interested in using the interface with their products. Also look for the visual interface with the Spatializer 3D Sound Processor.

Multiple uses

As educational tools, look for a series of videos and CD ROM products using the visual mixer to demonstrate a variety of music mixes. Classical, Rock, Easy Rock, Heavy Metal, Jazz, Rap and New Age will each get a treatment in the videos.

With the interactive CD ROM, users will be able to click on any piece of equipment in the control room and get a visual tour through the parameters of the device using different kinds of music.

And now for the rumor of the month. An enticing message gleaned from a popular on-line computer service said a new breed of personal tape recorder is about to come on the market. Check out the size: 2 inches by 3 inches by 0.25 inches; weight is said to be two to three ounces. The media is non-magnetic, PCMCIA compatible (which probably means flash RAM.)

The recorder is said to be impervious to heat, cold or EMF; the record time is 30 minutes to two hours, depending on which "cartridge" is used. Capabilities include instant access to recordings, no rewind or search, no motors or read/write heads and fast and slow audio playback without changing voice timbre (sounds just like you talking fast or slow). It is made in U.S.A and will sell for about \$200.

The audio fidelity of the new recorder, said the writer who has heard it, "is much better than micro-recorders." Stay tuned. I will be on top of this one.

□□□

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

The Benchmark, dbx Duel

► continued from page 17

tutorial, with a component-by-component explanation of what's going on inside and why. It also contains a 19-page supplement called, "A Clean Audio Installation Guide" that you may find useful in sussing out problems in your own studio.

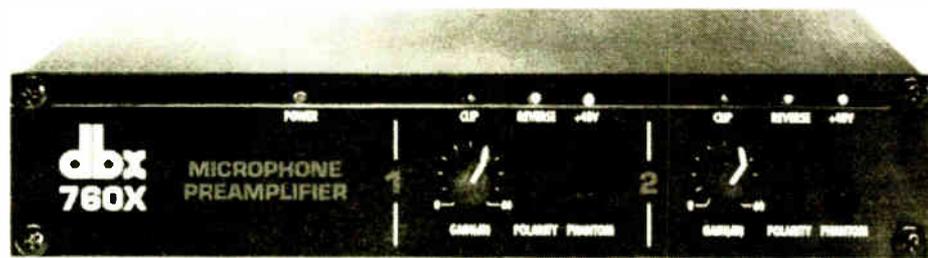
The dbx 760X has clip LEDs, there are none on the MPS-420. The reason, per the Benchmark manual, is that, "The output clip point of the microphone preamplifiers is typically as high or higher than the

that +29 dBu with the 20 dB pad in. Unlike pads on less expensive preamps, the three-resistor mic pad network on the MPS-420 did not noticeably change the frequency response of the preamp.

If you like chip sleuthing, try figuring out what chips are in the input stage. Burdick noted that Benchmark purposely removed the markings from some of the components to obscure their identity.

Burdick also said that the chips used provide lower IM distortion at higher frequencies than the SSM2017 chips

continued on page 30 ►



dbx 760X microphone preamplifier

Product Capsule: dbx 760X

	Thumbs Up		Thumbs Down
✓ easy to carry		✓ no pad	
✓ phase reversal switch		✓ no headphone output	
✓ clip lights			

For more information, circle **Reader Service 152**; or call dbx at 510-351-3500

input of the device receiving the signal in which case the metering is not necessary, and indeed is an expensive redundancy."

Need for LEDs?

In a perfect world, where life is a serene and productive continuum, this is true. In my world, I enjoy the help such an LED can offer, especially if I'm dealing with a lot of inputs.

Benchmark President Allen Burdick confirmed that maximum level to the mic input can be as high as +9 dBu. Make

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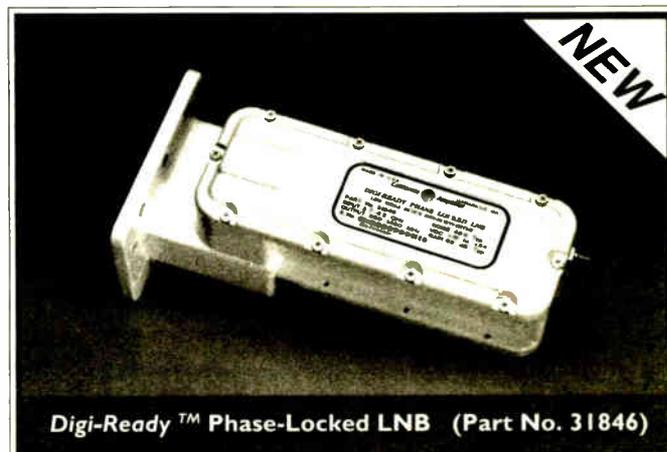
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D.W. Fearn Goes 'Retro' with VT-1

by John Diamantis

WASHINGTON Gotcha hooked for a second look? Great! Just a quick thanks to those of you who called to say hi and talk about tubes after my first column.

For this issue, I've tested a new product from a new company. According to the manual, the D.W. Fearn VT-1 Vacuum tube microphone preamplifier (manufactured by Doug Fearn in Pocopson, Pennsylvania) is a "re-creation of the classic tube preamps of the 1960s, updated with improved modern passive components and computer-aided circuit optimization. Because of the unique sound quality of vacuum tubes, the VT-1 has a warm and musical sound that is different from solid state preamps." While the description of this device is verbatim from the well-written instruction manual, it pretty much sums up what the VT-1 is all about.

The D. W. Fearn VT-1 was originally created to satisfy the curiosity of its designer, who, while listening to some recordings he had produced in the '60s, marveled at their clarity and warmth. After doing his circuit research and determining good parts were available, Fearn set out to build first one, then a second prototype. After several rounds of real world testing, and some minor circuit adjustments, the VT-1 was ready for limited production, which began in 1993. The VT-1 is shipped with the tubes in a separate, cushioned container to prevent damage in transit. After removing the top cover, and installing the tubes in their respective sockets as per the supplied instructions, I buttoned the VT-1 back up, plugged it in and let it "cook" for a couple of days on the bench.

The front panel of this box makes quite a statement! It's three rack units high, has three large black knobs, one each for input, gain and phase, a real "retro," Simpson VU meter, three heavy-duty toggle switches, for AC power, phantom power, meter on/off and a large pilot lamp. The panels are painted with a high gloss red that looks several coats thick.

The case is heavy duty, using thick gauge aluminum sections, held together by machine screws and threaded inserts. Very vintage looking. The audio circuit consists of a four stage r/c coupled (that's tube circuit jargon for resistance/capacitance) amplifier using two miniature (9 pin) 12AY7 medium-mu twin triodes (two matched amplifiers in one tube envelope), with transformer coupling on the input and output. All audio circuitry is hand wired, point to point. All audio coupling capacitors are high quality polypropylene. All four power supplies (filament, phantom power, B+ and meter amp) are solid state

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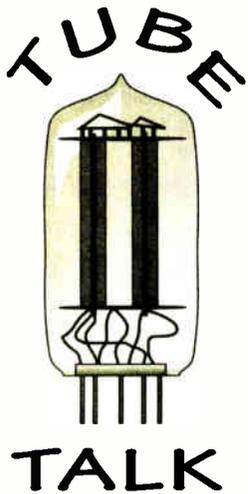
and fully regulated. The input and output transformers are Jensen's best. Overall parts and built quality is first rate.

Bench measurements

I measured performance of the VT-1 with an Audio Precision System One, with DSP installed to allow spectral analysis of the output signal. The unit met most of its published specifications.

Gain was 53 dB. Noise was 72 dB down, set for 50 dB gain. The spec is 74 dB down. This noise was predominantly hiss; there was no noticeable hum.

The THD + Noise was <0.2 percent at +4 dBm out, either terminated into 600 ohms, or bridging at 100 k-ohms. This meets spec. More importantly, when viewing these distortion products spec-
continued on page 25 ►



Make Your Own CDs with The Marantz CDR-610

► continued from page 15

To get the most out of the technology, a rudimentary knowledge of CDs is helpful. Marantz has prepared two informative white papers, "CD-Recordable Basic Principles," and "The Basics of Recording With the CDR-600-610."

To briefly summarize, there are two industry standards observed in audio CD recordable technology: the "Red Book" and the "Orange Book." The "Red Book" defines the standard which conventional CDs must meet to be playable on any CD player. The "Orange Book" defines how the CD-Recordable technique—the method of the CDR-610—can be used to make CDs that, while not erasable, are convertible to the "Red Book."

CD-R technology

To briefly summarize, there are two industry standards observed in audio CD recordable technology: the "Red Book" and the "Orange Book." The "Red Book" defines the standard which conventional

CDs must meet to be playable on any CD player. The "Orange Book" defines how the CD-Recordable technique—the method of the CDR-610—can be used to make CDs that, while not erasable, are convertible to the "Red Book."

Probably the most important feature of the "Orange Book" standard, from the user's perspective, is the ability to record a CD incrementally, track-by-track if desired, instead of having to record an entire CD in one pass.

Until the user invokes the CDR-610's FIXUP function, the compact disc conforms to the "Orange Book," and is playable only on CD players that recognize the "Orange Book" standard (presently, only CD-R recorders do this). After the FIXUP, which is essentially writing the table of contents, the disc meets the "Red Book" standard, and therefore is playable on any CD player.

Real world tests

For our tests of the CDR-610, typical

applications were chosen that a broadcast station or production house might use. We used blank discs manufactured by several companies including 3M (provided by Harris Allied), DIC Digital and Marantz's own brand.

During the CD mastering process, we found that preparing for CD recording requires more care and consideration than for erasable media recording; once audio is recorded on the CD, it cannot be erased, and any mistakes are embedded forever on the \$20 discs.

As our informal tests found, incrementing the TRACK number reliably proved to be more difficult than recording audio onto the CD-R. The track incrementing is analogous to writing an index on a DAT, but is as permanent as writing the audio, and just as important.

If an increment occurs "late," after the audio has begun, the CD will normally cue to the start of the track, and the audio will be upcut. All of the audio is still there, but the end-user must manually cue the CD to a point just before the audio begins, rather than just pressing the number of the desired track.

The track increment dilemma is compounded by the CDR-610 design to give the audio signal processing priority (as it should) over a track increment command. Further frustrating the simple automation of track incrementing is the format difference of a DAT START ID and the CDR START ID subcode; they're not compatible.

Fortunately, there are several techniques that can simplify this tedious process.

Various methods

The easiest method is to make hookups via the analog outputs of the DAT and the analog inputs of the CDR-610—one track at a time. The process is similar to recording a cart; cue up the playback tape, engage the CDR-610 into record, and start the playback. After each track is recorded, pressing PAUSE returns the CDR-610 to the record ready state, and the track number is automatically incremented—ready for the next session.

An attempt to use the CDR-610's AUTO LEVEL SENSE to automatically increment the track had poor results; the level sense is internally set at -60 dB, but the mechanism does not react quickly enough, or reliably enough, to write a track increment. Playback of the final "Red Book" CD showed that the manual method works better than any other for ensuring that the CD audio will have a "tight cue" to the start of a track.

Another recording method is the CD-to-CD clone using a "Red Book" CD player
continued on page 22 ►

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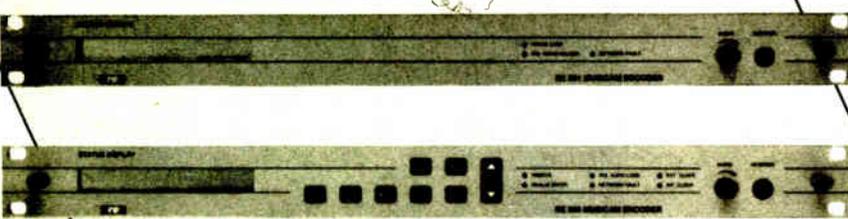
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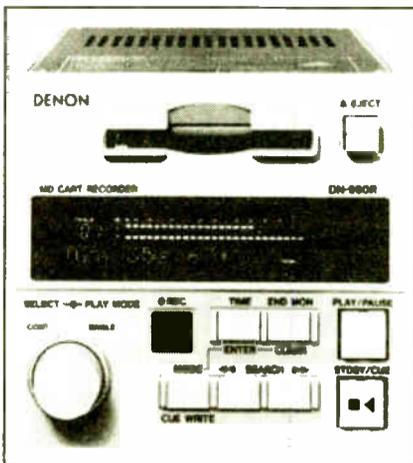
PRODUCT GUIDE

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

Denon DN-990R MD Cart Recorder

Denon has embraced the MiniDisc technology for replacing analog cart recorders with its DN-990R. Boasting CD-like specs, the MD records and plays on the three-inch MD disc with near instant track access. Features include Instant Start and balanced analog inputs. Signal-to-noise is rated at better than 80 dB.

For more information, contact Mike Stelts at Denon, 201-575-7810; or circle Reader Service 170.



Digital Audio Labs Digital Only CardD

Digital Audio Labs has introduced the Digital Only CardD, a digital input/output module that plugs into IBM compatible computers.

The card is designed to allow direct digital transfer from a DAT recorder in the S/PDIF format. The card comes with a Windows audio waveform driver.

For more information, contact Jeff Wilson at Digital Audio Labs, 612-473-7626; or circle Reader Service 211.

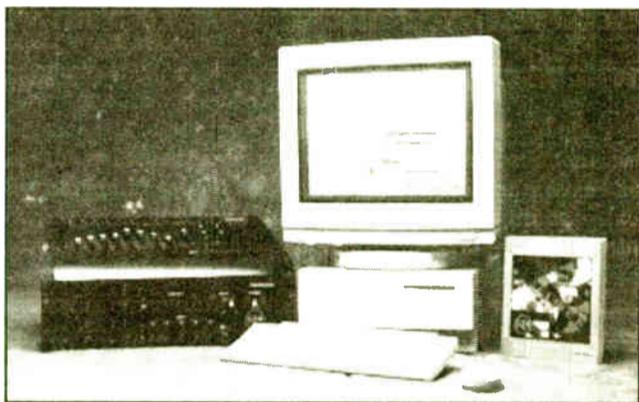
continued on page 28 ▶

Digidesign Session 8 For Macintosh

Digidesign now has a Macintosh version of the Session 8 digital recording and editing system. The card, interface and software program system was first introduced for PC in 1993.

The workstation system is designed for home, project music and broadcast production studios.

For more information, contact Digidesign at 415-688-0600; or circle Reader Service 149.



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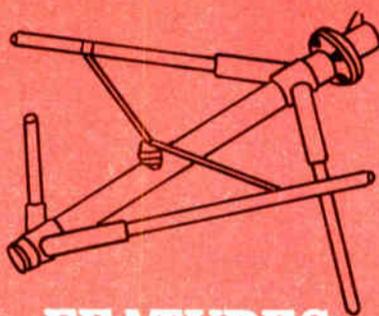
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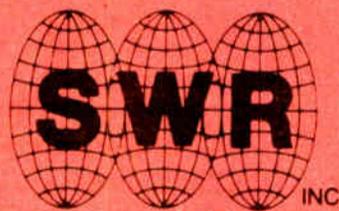
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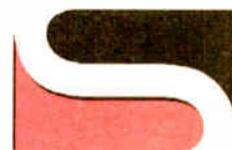


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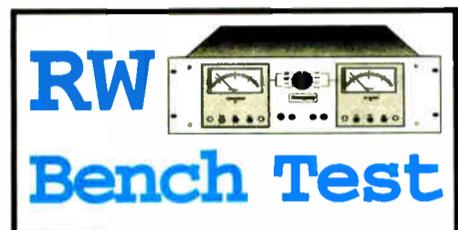
Circle (153) On Reader Service Card

CD Quality from Marantz CDR-610

by Ken C. Pohlmann
Hammer Laboratories

CORAL GABLES, Fla. Without question, the compact disc is the most impressive piece of audio technology since Edison's cylinder. The only problem with the CD, it seemed, was its lack of recordability. Now, that has been remedied.

Following the introduction of early CD recorders which were bulky and expensive, models such as the \$4,000 Marantz CDR-610 have suddenly made CD



recording a temptation for many, many radio stations and studios.

At first glance, the CDR-610 may look like an ordinary CD player and indeed it functions like one—playing playback-only (Red Book) or write-once (Orange Book) CDs with equality. However, a knob marked RECORD LEVEL and a RECORD button arouse suspicion that this is a CD recorder.

Orange Book II

The CDR-610 adheres to the Orange Book II multisession standard that lets you record part of a disc, remove it and add more tracks later, however, the disc is playable only in Orange Book players because of its incomplete Table of Contents. When you're finished recording the disc, the automatic FIX-UP process (it takes about three minutes) writes a final table of contents so the disc can be played on Red Book players—additional recording is not possible.

A professional user must be assured that any device in the audio chain does not

diminish audio fidelity. In this case, according to our measurements, the reviewed CDR-610 was quite strong in this respect.

Performance check

Both playback and record/playback frequency response was flatter than a motel carpet. There was, however, a very slight channel imbalance in the latter test. Phase response was excellent too. Playback residual noise was below 100 dB, but increased slightly to 95 dB in record/playback mode. THD+N measurements showed that distortion was a low -88 dB in playback mode, and was increased only to -85 dB in record/playback. Similarly, SMPTE IM distortion (50 Hz + 7 kHz, 4:1) measured -90 dB at 1 kHz in playback and -88 dB in record/playback.

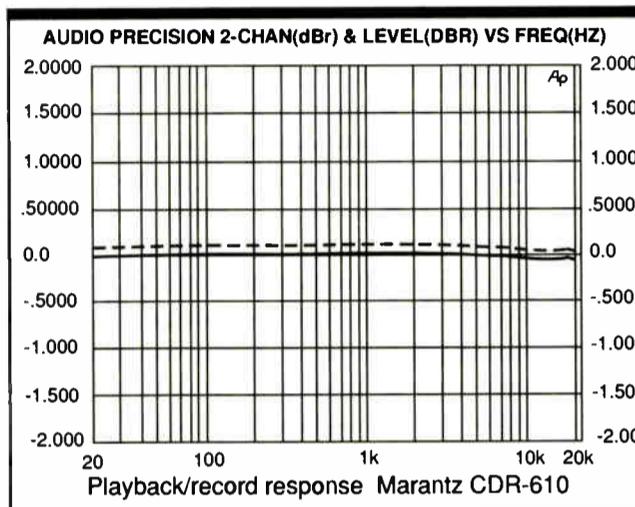
Playback channel separation at 20 kHz measured 100 dB, but decreased to 86 dB at 20 kHz during recording. D/A converter playback linearity erred by -7 dB at -90 dB. This is somewhat high by modern standards and should be better in a professional unit. Interestingly, nonlinearity in the A/D converters was the inverse, resulting in an error of -2 dB at -90 dB when the signal made a complete trip through the recorder.

Denon Test CDs

Throughout these tests, record and playback measurements were made through the balanced analog inputs. Incidentally, the new Denon Professional Test CDs were used in the evaluation. This triple-disc set is the best collection of tones you'll find anywhere; there's

even CD+G subcode with information about track contents.

From a technical standpoint, analog in/out performance of this recorder is similar to that of many consumer CD players—that is to say, it is quite good. Of course, in many applications, you will use the digital input or output, avoiding half of the recorder's analog circuitry. The only measured weakness is the low level linearity error—something that



from a practical standpoint is certainly not a major problem because it would be audible only under extraordinary conditions.

From a functional standpoint, the recorder is easy to use. Entering track number flags is the only thing that requires skill; it would be nice if there were a rehearse mode with a buffer memory and a couple of nudge buttons to help place flags exactly where needed.

In addition, given that this is a professional unit, I think that error correction/concealment indicators would make a nice addition.

Quibbles aside, if you're into sound bites, sound effects, commercial spots, archives, music bumpers, test discs, in-house production or anything else that

could benefit from CD recording, the CDR-610 recording/playback is fully up to the task.

Ken Pohlmann is director of music engineering at the University of Miami in Coral Gables, Fla., and a contributing writer to RW.

CD Recorder Has Place In Studio

continued from page 20
linked to the CDR-610 via a TOSLink Optical input. In this test, we cloned a well worn CD-R disc that was made three years ago for an NPR program. (Users of the CDR-610 may want to consider cloning "work copies" of their important CDs for day-to-day use, and preserving their master CDs).

CD cloning

The CDR-610 immediately locked to the optical output of the Technics SL-P1300. According to the Marantz white paper, there is one small quirk in CD cloning: The CDR-610 must be set to MANUAL TRACK INCREMENT before the clone has begun, then switched to AUTO TRACK INCREMENT during the first track to ensure that the track numbers on the CD-R match the track numbers on the playback CD. Otherwise, the first track increment is transmitted from the CD source and the CDR-610 advances to Track 2, when the CD source is still on Track 1.

The cloning process worked perfectly until the source CD played a scratched

Product Capsule: **Marantz CDR-610**

<p>Thumbs Up</p> <ul style="list-style-type: none"> ✓ affordable CD-R technology ✓ easy to use ✓ excellent sound 	<p>Thumbs Down</p> <ul style="list-style-type: none"> ✓ inconsistent auto track timing ✓ needs remote for external track increment control
--	---

For more information, circle **Reader Service 158**; or call Marantz at 708-820-4800.

track. Although no audio glitches were heard, the data stream was somehow corrupted, dropping the CDR-610 into REC Ready mode. The transfer was successful after careful cloth buffing of the source CD, although the clone now has "unusable" tracks on it.

DAT to CD-R cloning can also be accomplished by linking the DAT's 44.1 kHz output, in this case—a Sony 7010, to the CDR-610's AES/EBU input.

Connecting DATs

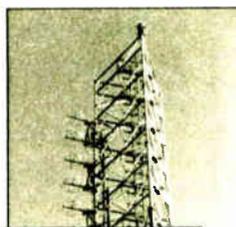
This test involved dubbing over 100 indexed DAT selections into the CDR-610. The selections are music buttons used by an NPR news program—some as short as three seconds and others as long as 29 seconds.

To manually record each selection to the CDR-610 would take hours, so we prepared the DAT master with carefully placed START IDs, typically five frames (1/6 second) ahead of the audio. At this point, we plugged the CDR-610's wired remote control box (model RC610CDR) into the CDR-610. The remote control has a general purpose interface that allows users to connect external contact closures

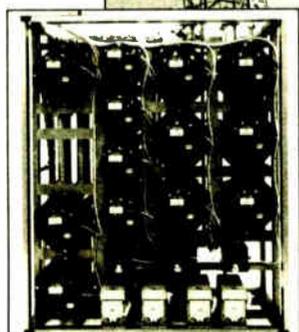
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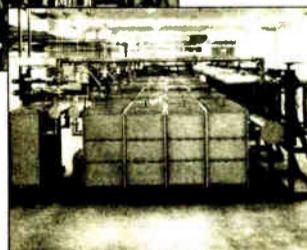
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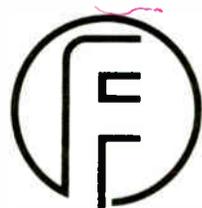


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D.W. Fearn's Tube Mic Preamp Test

► continued from page 20

trally, they were almost entirely second harmonic, which would be audibly masked by the fundamental tone, and therefore, inaudible. The SMPTE IMD was <0.08 percent at +4 dBm out, bridging at 100 k-ohms, 0.14 percent terminated into 600 ohms. Spec was measured at -20 dBm, <0.02 percent. All fine results.

Maximum level is specified as +22 dBm unterminated, bridging (I know, all you letter writers, dBm is a power measurement, where 0 dBm is equal to 1 mW or 0.775V across a 600 ohm termination. Just look at the level, not the power, and put down your pencil), and the VT-1 provided this level, at 1.0 percent THD + Noise.

A minor quibble

However, the maximum level terminated into 600 ohms is specified as +18 dBm, but all I could coax out of this box was about +9 dBm. After swapping some tubes around and checking everything again, I gave Doug Fearn a call.

After debating measurement techniques, and assuring him I was set up properly, we discussed real world usage of the VT-1, and input impedances likely to be encountered. While it may be true that in nearly all cases the VT-1 would be

the guitar, than either of the other two preamps that were used.

The next test involved sticking the preamp on the main control room microphone, also a U89, and, thus, in the station's air chain. Although the change was not dramatic (the existing preamps were good), it was audible, again removing a slight buzz or harshness from the announcer's voice.

Interestingly, the announcer noticed the change immediately, even though he was not aware we had made any equipment changes. His reaction to the VT-1 was very favorable.

One additional note: While listening, at

moderate to high playback levels, with low, or no direct sound into the microphone, I could detect a very slight hiss from the VT-1 that was not evident on either of the solid state units. Let me stress that this noise was completely swamped by tape noise when using the analog recorder and not an issue under normal circumstances.

I did encounter the effects of tube microphonics, in the way of a "ping-g-g" sound, when changing a switch position with the preamp active. Obviously, moving switches, or hitting the unit while in use is to be avoided.

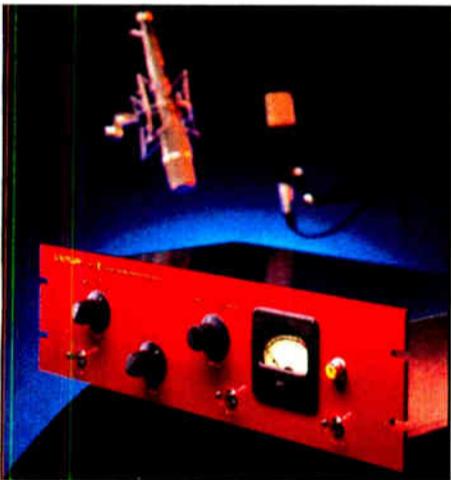
The D. W. Fearn VT-1 vacuum tube

microphone preamp lived up to its reputation as device that re-creates the warm sound of classic tube preamps, and combines that classic sound with state-of-the-art components and topnotch hand construction. These qualities don't come cheap, and the cost of the VT-1 reflects that. The unit lists for \$2,000 and is available directly from D. W. Fearn. Fearn did tell me, however, that a two channel unit, complete with independent power supplies for each channel, will be available soon for \$2,500.

For more information, contact D.W. Fearn at 215-793-2526; or circle Reader Service 116.

□□□

John Diamantis is director of technical operations at WBIG-FM, WGMS-FM and WTEM-AM in Washington, D.C.



Hand-built D.W. Fearn VT-1

connected to a bridging impedance, and operate flawlessly at this level, in my opinion, if a product is specified to drive terminating impedances to 18 dBm, then it should—and at less than 3 percent or higher distortion, tube circuit or not.

Petty complaining out of the way, it was time to start some serious listening sessions with the VT-1. These first tests were performed in a radio production room, with a Neuman U89 condenser microphone, connected to the VT-1 which was patched directly into either an Otari MTR-10 analog reel-to-reel machine or a Panasonic SV-3700 DAT machine. For comparison, the same U89 was plugged into the studio console mike module input, and also a good solid state mike preamp.

Full, clean sound

In listening tests, the male voice sounded much improved through the VT-1 compared to the console preamp, and was fuller and slightly cleaner than the solid state preamp. A slight buzz or edge heard through the solid state preamps was less evident through the VT-1. Sibilant sounds were cleaner as well.

Acoustic guitar sounded bigger through the VT-1; not that it had more bass. It was as though you were hearing less of the strings and more of the wood. If anything, it sounded less like a recording of

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63 Years Ago

Reprinted from Radio World
(June 6, 1931).

Editor's note: The RW of old,
printed for a time in the 1920s
and 1930s and today's RW are
unrelated except in name.

TRADE FLOCKS TO SHOW, FULL OF ENTHUSIASM

Chicago.
From all parts of the United States and
Canada, as well as from across the seas,
radio manufacturers, jobbers, dealers and
others interested in the trade gathered in
this city to attend the fifth annual Radio
Trade Show. More than 150 manufactur-
ers had contracted for booths at the show,
which was held in the Stevens Hotel, under
the auspices of the Radio Manufacturers
Association. More than 20,000 manufactur-
ers, jobbers and dealers were expected to
visit the show.

Much interest was shown in the advance
being made in preparation for the commer-
cial advent of television, particularly as
there were some televisions for exhibi-
tion, and also television tubes, including
photo cells for transmission and neon
lamps for reception, besides other appar-
atus, e. g., scanning discs, screens and
short-wave receivers.

Interest in Tubes

Tubes came in for their just share of
attention, interest focusing on the new
exponential or variable mu tube, the 235,
which, in circuits that vary the grid bias
or the screen voltage, serve to reduce
greatly interference due to crosstalk and
crossmodulation, also hissing sounds and
other extraneous noises. The tube is ex-
clusively a radio frequency amplifier, in
its present use. It is not serviceable as a
detector, and its use as an audio amplifier
has not been encouraged.

Another tube that had the attending
forces talking was the pentode, a power
tube that has higher sensitivity than any
other used in broadcast sets. This tube
provides much more volume for a given
input than does the 245. There are also
a 2 volt pentode for battery sets (233)
and a 6.3 volt one for autos (238).

Optimistic on Business

Midget sets, which comprised about
half the set market for the present season,
appeared with the new tubes in them,
for the coming season, when it is ex-
pected the compact mantel type receiver
and the pier clock or thin upright models
for floor use will absorb 75 per cent. of
the set business.

Members of the trade were optimistic
of business conditions, frankly admitting
they are not good now, but reporting im-
provement, with expectation of gradual
restoration of more auspicious conditions.
The worst was over, was the consensus,
and business will improve until it becomes
actually good, around the holidays.

Lower prices prevail in all lines. Sets
and tubes were outstanding in their lower
prices, compared with last year. Parts
also are at lower list prices. There was
considerable interest in parts, including
assemblies from kits for which parts
manufacturers supplied the components.

Other Bodies Meet

The Institute of Radio Engineers held
a convention at the same time, and the
annual Furniture Mart, due to the close
association of the furniture and the radio
industries, added to the radio trade show
attendance. Radio manufacturers' asso-
ciations held meetings, as did the News-
paper Radio Editors' Associations and
the Radio Press Association.

FIRST IMPRESSION

Multi-Uses for Digital Domain VSP-P

by Rich Rarey

WASHINGTON Digital Domain
President Bob Katz calls his VSP-P
Digital Control Center "a digital swiss
army knife." After using the VSP-P to
route and sample-convert digital audio,
we're inclined to agree. It's an invention
born of need.

Burgeoning digital operations, including
broadcast production suites, typically use a
mixture of professional and consumer digi-
tal gear, sampling frequencies, and optical
and wire transmission paths. Often users
must resort to patch cords of one type or
another to connect inputs to outputs.

A useful tool

Users will find the VSP-P (for profes-
sional) at \$1,995 a useful tool to match a
device's hardware connector and soft-
ware protocol to another. Katz, a record-
ing engineer, invented the box for his
own use.

Its four impedance-matched, trans-
former-isolated inputs and two optical
inputs are easily selected by front panel
buttons to the record bus and/or to the
monitor bus. The record bus then feeds
six digital outputs simultaneously, and the
monitor bus feeds three outputs. The
VSP-P becomes a simple distribution
amplifier, properly matching output
impedance to the device.

The monitor section can be used to feed
external D/A converters so other digital
signals can be monitored while dubbing.
A front panel button FOLLOW
RECORD forces the monitor outputs to
follow the record output instead of the
monitor selector, very handy for compar-
ing any two sources.

Sample rate converter

A process module, containing an exter-
nal digital send and receive for outboard
processing gear, a sample rate converter
and a PRO format converter, is the best
part of the VSP-P. This module can be
switched between the monitor and record
busses as desired via the PROCESS TO
MONITOR button.

This ability makes it possible to distrib-
ute same-frequency signals on one bus,
and frequency-convert and distribute sig-
nals independently on the other. For
example, you can record a 48 kHz clone
from a 48 kHz master on the monitor bus,
and simultaneously record a converted
44.1 kHz clone of the same 48 kHz mas-
ter on the record bus.

Note, however, that a bus without the
process module switched to it is essen-
tially a "straight wire" distributed path,
and does not receive any software con-
version.

The VSP-P's sample rate converter is

engaged by a front panel button and
accepts any incoming frequency rates
between 32 kHz and 56 kHz. According
to the product literature, the VSP-P
accepts "non-standard rates typical of
varispeed sources" and outputs a 44.1
kHz signal.

Passing the test

In our tests, we fed a 48 kHz DAT into
the VSP-P's AES inputs, thru the con-
verter, and into our loaner Marantz
CDR-610 CD recorder's AES input. The
CDR-610 locked immediately to the
VSP-P's output signal and made a flaw-
less conversion all though the CD
recording process. We heard no degrada-
tion of the converted signal in our sub-
jective listening tests. The quality of the

affect short-term clock accuracy in CD
players and DAT transports.

No jitter

Routing signals thru the VSP-P's sam-
ple frequency converter—even material
already at 44.1 kHz—will eliminate this
jitter by relocking the signal to the
VSP's internal crystal controlled clock.

Unfortunately, some digital devices
demand an extremely well-regulated
sample frequency above the AES stan-
dard, and are not immediately usable
with the VSP's converter.

In our initial test, we connected a Sony
7030 DAT recorder's AES output into
the VSP-P and fed the VSP-P's AES out-
put to a Sony 7030 DAT recorder's AES
input. The object was to make a 44.1 kHz



Digital Domain President Bob Katz created the VSP-P out of necessity.

sample rate converter makes the VSP's
\$2,000 list price a bargain.

The product literature for the VSP-P
introduced another use for its sample rate
converter: jitter elimination. As all digi-
tal signals depend on precise clock pul-
ses to manipulate the data in an orderly
fashion, any disturbance of the clock will
adversely affect the audio—typically by
high-frequency distortion and lowering
of the signal-to-noise ratio.

According to designer/engineer Bob Katz,
a digital device's clock instability can be
produced by noise in a digital interface,
ground loops and mismatched impedances
between source and load in a transmission
system, and power supply deficiencies that

clone of a 48 kHz tape. While recordings
were possible with the sample rate con-
verter bypassed, the recording DAT
machine would not lock to the VSP-P's
signal and refused to record at 44.1 kHz.

Katz explained that the problem was
with the narrow frequency tolerance of
the Sony 7000 series, and that an internal
VSP-P trim capacitor adjustment is nec-
essary. Such an adjustment, according to
Katz, can be made in the field with a
suitable frequency counter, or easily
made at the factory.

□ □ □

For more information on the Digital
Domain VSP-P, contact Bob Katz at 212-
369-2932; or circle Reader Service 165.

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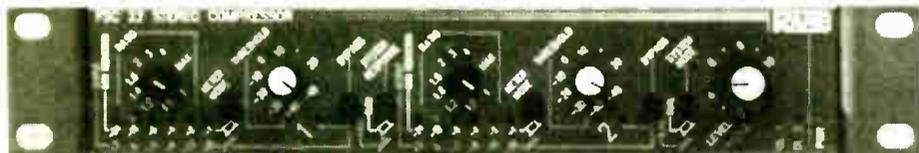
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► continued from page 21



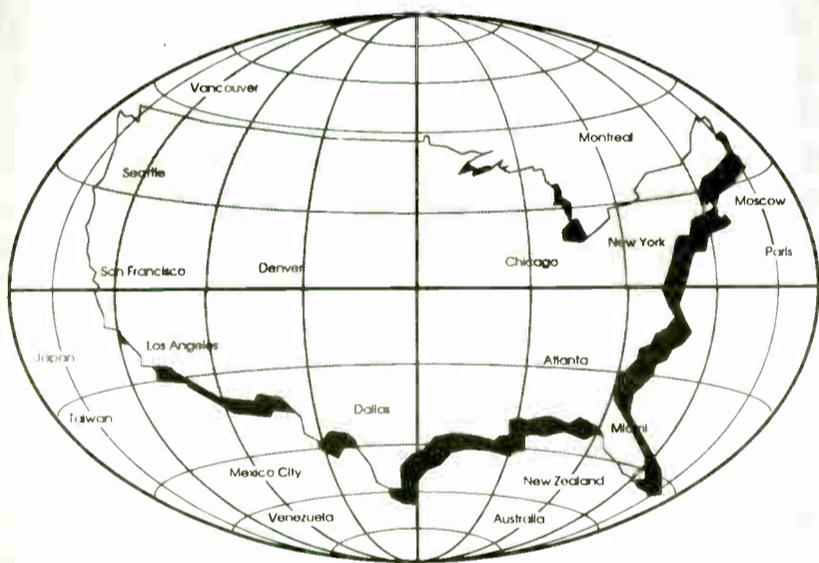
Rane FSC 22 Stereo Compressor

The Rane FSC 22 is housed in the compact HR module for vertical or two-across 19-inch rack mounting. Features include separate threshold and ratio controls for each channel as well as switchable attack/release time and dual function metering. The FSC 22 uses Analog Devices VCAs.

For more information, contact Ellen Allhands at Rane, 206-355-6000; or circle **Reader Service 162**.

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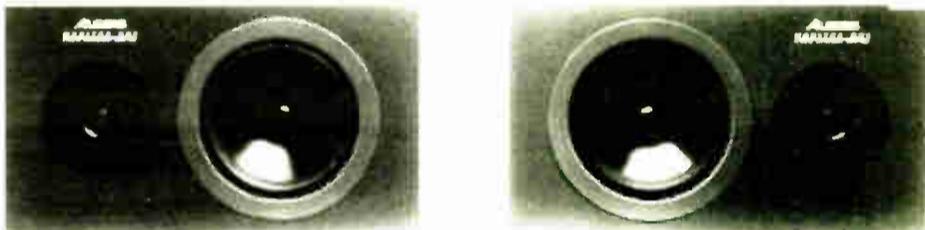
For more information, contact Electro-Voice at 616-695-6831; or circle **Reader Service 88**.



Alesis Monitor One Studio Monitors

The Monitor One features a 6.5-inch woofer and one-inch silk dome tweeter. The speakers is only 8.5 inches tall, but can produce 45 Hz to 18 kHz (within 3 dB). The outside coating is made out of non-slip polymeric rubber. The pairs are sold mirror imaged.

For more information, contact Alesis at 310-558-4530; or circle **Reader Service 94**.



Demeter VTMP-2b Tube Mic Preamp

The Demeter VTMP-2b is said to provide the sound of the classic Neve and API preamps as well as modern 990 op-amp. based mic preamps.

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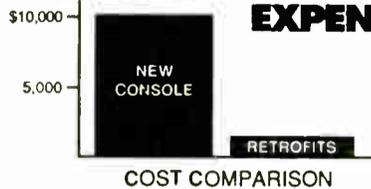
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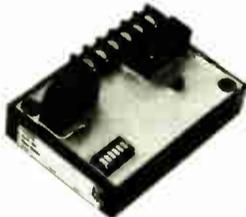
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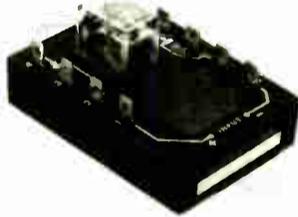
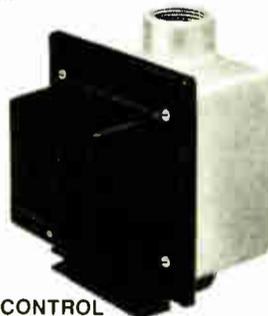


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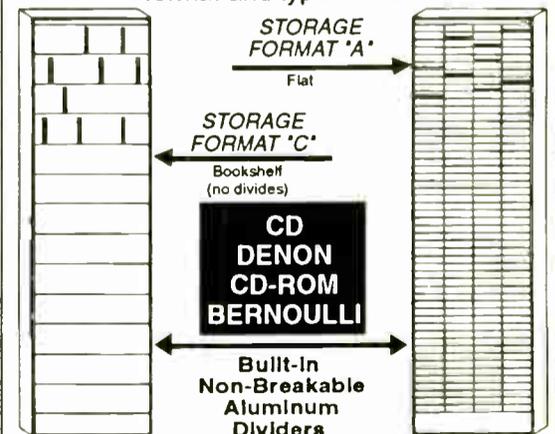
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READER SERVICE NO. 190

Make Your Own CDs with Marantz CDR-610

► continued from page 22

to control such things as REC, START, STOP and TRACK INCREMENT on the CDR-610.

By wiring the TRACK INCREMENT pins to the DAT's START ID SENSE pins on the 7010's rear panel connector, we let the TRACK INCREMENT occur when the DAT read each START ID on the tape. The dub was started and left unattended. After fixup, the CD was played at random cuts, one to 99 (although there were over 99 START IDs on the tape, the CDR-610 will not increment tracks beyond 99).

All tracks played without upcut as expected. The delay between TRACK INCREMENT and audio is lengthened using this method—probably because of processing delays in the CDR-610. The manual method will give better, tighter cueing, but requires more effort. When this many tracks are present, the user should expect noticeable "seek" time when skipping from one track to another.

HHB indexer

We also tried DAT-to-CD-R cloning, using the Sony DAT at 44.1 kHz passed through an HHB CDR Indexer, available from Independent Audio. The HHB Indexer is one of a growing number of add-on devices that help dubbing digital material to CD-R.

While its primary function is to trigger

track increment commands from a DAT source, the HHB indexer also can manipulate AES status flags. In this test, the IEC output from the DAT was fed into the HHB indexer, and the IEC output fed into the CDR-610.

During dubbing, the HHB recognizes DAT START IDs within the IEC code, and translates the start ID data into TRACK INCREMENT data, which the CDR-610 will recognize. In this way, consumer DATs can easily trigger a track increment without having to have an exterior control connector.

More features

An additional feature of the HHB, which may be unacceptable to those needing tightly cued track increments, is a delay of 185 milliseconds in the digital signal passing through it. HHB literature ascribes this delay to the translation of the data stream, and to compensate for users' late ID marks on DAT tapes which have been created by a DAT's AUTO-ID feature. After fixup, there was a short, but noticeable delay between the start of the track and the start of the audio.

The HHB can also interface AES/EBU signals for CD recording, but the DAT must have a START ID SENSE pulse output that needs to be plugged into the HHB. The HHB then sends IEC signals into the CDR-610 as before, translating the DAT's START ID hardware pulse

into a IEC increment command recognized by the CDR-610.

In summary, no matter what method you use to feed audio to the CDR-610, affordable CD-R technology is here for the professional, and it is up to the artisans, production folks and consumers to put it to work.

For more information on the HHB CD-R indexer, contact Independent Audio at 207-773-2424, or circle Reader Service 13.

□□□

Rich Rarey is technical director for National Public Radio's Weekend Edition and a contributing writer to RW.

New Microphone Preamps From Benchmark and dbx

► continued from page 19

used in the 760X. So, if you're planning on recording glockenspiel or the local symphony, the extra engineering is probably worth consideration. I don't have a glock in the studio, so I proceeded with testing the two preamps by plugging their line level directly into my AKG/Orban DSE-7000 workstation (15 kHz bandwidth) and recording voice tracks with a good condenser microphone.

How they sound

Both preamps sounded remarkably similar. If there was any difference in frequency response of the two preamps, it was above the 15 kHz limitation of the workstation or lost in the dithering.

In an effort to eliminate workstation artifacts from obscuring the results, I fed

a nominal amount of tone through both preamps, matched their output levels, and fed them to a balanced set of monitors.

The Benchmark produced slightly less hiss than the dbx with both preamps' inputs unterminated. With the dbx input terminated and the Benchmark unterminated, the hiss levels of both preamps were equal. The Benchmark, when terminated, was noticeably quieter than the unterminated dbx.

Would the difference be noticeable if both preamps had to make their way through your console or if the signal ever hit analog tape? Probably not. Both boxes have their advantages and, as usual, perfection has its price.

□□□

Ty Ford's book, "Advanced Audio Production Techniques," is available by calling 800-366-2665.

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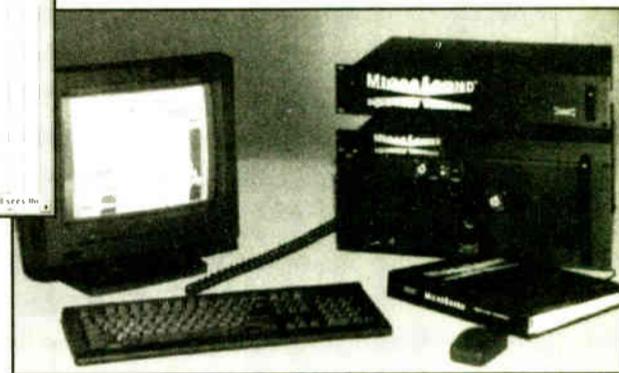
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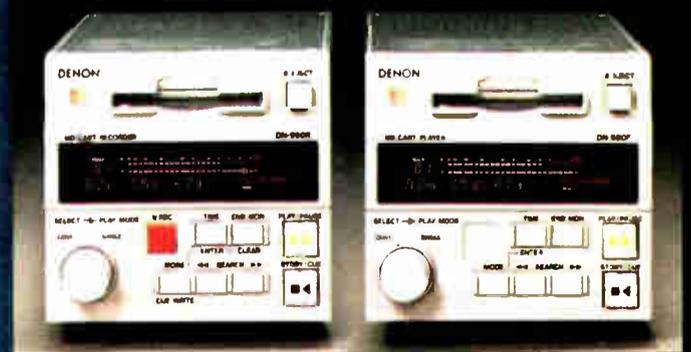
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PREVIEW

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Sunday, March 20 — Thursday, March 24 • Las Vegas Convention Center

INSIDE THIS SECTION:

Product Stories • Interviews • Exhibitor Directory • Previews

NAB Exhibition Is Broadcast Tech Mecca

Digital and Analog Topics Will Dominate The Engineering Conference at NAB

by Andy Butler

LAS VEGAS Radio engineers will find a vast assortment of technology seminars and programs at the National Association of Broadcasters (NAB) convention

Effects. The SMPTE sessions are a full multimedia experience that includes extensive audience participation. Be sure to sign-up early before the limited number of slots are gone.

The cost of the SMPTE workshop is

included in the normal conference registration fee for NAB '94.

Methods and procedures

The Broadcast Engineering Conference opens on Sunday, 20 March at 9 a.m. with remarks by veteran consulting engineer Jules Cohen. In a career spanning more than 40 years, Cohen is instrumental in developing many of the methods and procedures that have defined the broadcast industry. He now plays a crucial role in developing viable RFR exposure measurement procedures for broadcasters. Find out what he sees coming in the future as he reflects on Broadcasting: Past, Present and...?

Digital telephone and satellite services have dramatically increased options for transporting high-quality audio. WMAQ Director of Engineering Margaret Bryant assembled a group of experts to explore alternatives in ISDN and T-1 Transmission, beginning at 9:30 a.m.

Angela DePascale begins with an overview of industry commercial delivery over ISDN. Jim Switzer from RE America

offers practical suggestions for picking the best digital alternative in New Broadcast Decisions: Digital Network Costs Versus Required Bit Rate for Desired Audio

continued on page 35



March 20-24 at the Las Vegas Convention Center.

Beginning with a special series of pre-convention seminars on Saturday, 19 March and continuing with The Broadcast Engineering Conference and NAB MultiMedia World '94 Sunday 20 March through Thursday 24 March, relevant information will abound to help you make the right decisions in 1994.

IEEE tutorial

On Saturday, 19 March at 9 a.m., The Institute of Electrical and Electronic Engineers (IEEE) Broadcast Technology Society will present the Digital Transmission Tutorial. This in-depth seminar is designed to ease the transition from today's broadcast technology to tomorrow's.

Charles Meyers from Boonton Electronics and John Hernandez from Public Broadcasting Service (PBS) expanded the tutorial that played to rave reviews at the Broadcast Technology Society's symposium in Washington last September. It now includes an Introduction to Digital Transmission, Survey of Modulation Techniques, Applications and Examples of Digital Transmission Technology, and Test Methods for Digital Transmission System Performance.

Attendees registered for any conference at NAB '94 can attend the IEEE tutorial without additional charge.

The Society of Motion Picture and Television Engineers also will be active at NAB on Saturday, presenting the SMPTE Post Experience. This day-long seminar takes attendees on a detailed tour of the world of video post production. Radio engineers will be interested in the sections on Digital Sound Editing, Foley Artistry, Automated Dialog Replacement and Audio

Highlights of NAB '94

continued from page 1

help stay ahead of competitors. Legal, programming, financial, personnel, sales and marketing guidance all will be offered. Meetings will be held Sunday through Thursday.

On Tuesday, the Society of Broadcast Engineers will hold a full day of educational sessions for broadcast engineers, including an in-depth program dedicated to technical problem solving.

The Broadcasters' Law and Regulation Conference includes top communications lawyers and FCC officials discussing and analyzing issues and government regulations. Sessions include the latest information on retransmission consent and must-carry, fairness doctrine, duopolies and LMAs, children's television and other emerging issues. Meetings will be held Monday through Wednesday.

Among seminar highlights are engineering sessions on digital audio processing systems, data broadcasting, digital audio workstations, ISDN and T-1 transmission, towers and transmission equipment, and an RFR update.

Two engineering seminars on digital audio broadcasting (DAB) will be held. The first looks at multipath propagation test results and a status report on DAB testing in the U.S. The second seminar includes updates on various DAB system tests, including a report from Paul Ratliff of the British Broadcasting Corp. (BBC) on the recent Eureka-147 trials in London. DAB system updates will also be made by NASA/VOA, AT&T, Amati Communications, USA Digital Radio FM and USA Digital Radio AM.

An engineering session on satellite and auxiliary services also is scheduled. Wegard Holby and Noah Samara of Worldspace will discuss direct broadcast satellite sound and Anthony Campbell of Andrew Corp. will discuss how the new FCC rulings for earth stations will impact broadcasters.

Two seminars will attempt to demystify new technology for broadcasters. In the first, radio managers will discuss what technologies on the exhibit floor are important to radio. In the second, multimedia experts will explain what equipment in the Multimedia World exhibition will affect the future of radio.

Several sessions are dedicated to selling, financing and promoting radio, including a meeting with the Best of the Best Radio Promotions contest winners.

Other seminars, meetings and events include the Broadcast Education Association Convention, HDTV sessions, production and post production sessions, idea swaps, and the NAB and Interactive Multimedia Association's joint NAB MultiMedia World.

Two new Saturday seminars were added to NAB this year. On March 19, the SMPTE Post Experience promises a day-long, detailed tour of the world of post production. Also on the 19th is a new half-day seminar sponsored by the Institute of Electrical and Electronics Engineers (IEEE) broadcast technology society. The IEEE seminar includes a survey of modulation techniques and an introduction to, applications of, test methods for and a demonstration of digital transmission technology. Both seminars require full NAB '94 conference registration.

Question: Ever wonder why transmitter manufacturers operate Altronic dummy loads at NAB and other trade shows?



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World Radio History

SBE, IEEE and SMPTE Take Part in Sessions

► continued from page 33

Bandwidth and Quality.

Steve Church from Telos Systems considers the effects of digital data compression in ISO/MPEG Layer III Audio Coding and ISDN. Lynn Distler of Comrex Corp. will then brief you on Selecting a BRI ISDN Terminal Adaptor. Doug Lane, in charge of technical support for the National Basketball Association and an early user of switched 56 technology, will discuss the latest transmission system changes in the NBA, changing from Switched 56 to ISDN.

John Kelly from Intraplex will conclude the session with a look at The Growing Importance of Digital Transmission for Broadcast Applications.

Information highway

Your station can act now to stake out a position on the "information highway." Find out how when Chairman Jim Ary from Great American Communications presents Data Broadcasting: Radio on Sunday at 9:30 a.m. A series of presenters will discuss the latest developments in data transmission, including David Kelley with Terrapin Corp.'s global positioning system; Gary Gaskil with the Seiko High Speed Subcarrier System; Tetsuro Miyazaki with NHK's Multiplex Data System; and Miller Gardner with Mainstream Data's information service.

Data services can earn substantial revenues today and pave the way for even greater returns in the future.

The emphasis shifts from digital data to digital audio on Sunday afternoon as Fred Morton from KMGZ-FM hosts Digital Audio Workstations and Storage at 1 p.m. Production guru and RW writer Ty Ford opens with, Confessions of a Digital Workstation User.

Laura Tyson of Broadcast Supply Worldwide follows with Saving the Goods: A Survey of Digital Storage Alternatives. Jeff Wilson from Digital Audio Labs has suggestions to help convert a desktop computer into a production powerhouse in Configuring a Digital Audio Workstation for Broadcast. Jim Hauptstueck from Harris Allied follows with a detailed study of Technology that Pays—Evaluating Digital Alternatives.

As industry debate continues over the

audible effects of transcoding errors, Richard Becvar from California Digital Audio Systems presents an interesting alternative in, "A Systems Approach to Non-transcoded Audio Delivery" (see page 68). Willem Bakker from International Tapetronics concludes the session with his profile of A New Device for Digital Audio Storage.

Monday morning, following a convention keynote by new FCC Chairman Reid Hundt, radio engineers will return to the Broadcast Engineering conference at 10:30 a.m. for Digital Audio Processing and Systems, hosted by Carl Davis from Voyager Communications.

Geoffrey Mendenhall of Harris Allied kicks off the morning with suggestions for maintaining a 100 percent digital path from the studio to the "on-air" RF signal. Greg Urbiel from CBS Radio updates participants on international standards activities with State of the Standards: Coding and Connectivity.

Robert Orban shares thoughts on utilizing second-generation transmission processors for audio and Eric Benjamin from Dolby Labs concludes the session with his consideration of the interaction of audio processing and low bit-rate coding for broadcast applications.

The management tasks facing broadcast engineers have changed dramatically in recent years. Keeping up to date on the latest equipment and design techniques just is not enough. Margaret Bryant of WMAQ radio offers an overview of critical non-technical challenges in her session, Managing in Broadcast Engineering at 10:30 a.m.

Gerry Robinson from Hearst Broadcast-ing has a stern wakeup call for his fellow engineers at 1 p.m. during his session on towers and other transmission support equipment. Craig Snyder from Sioux Falls Tower addresses the topic, Understanding and Preventing Guyed Tower Failure due to Anchor Shaft Corrosion.

J. Cabot Goudy from Structural Systems Technology continues with Controlling Corrosion on Broadcast Towers: A Subject you Can't Afford to be Rusty On.

Once you are sure the tower is okay, your next step is inspection, maintenance and troubleshooting of UHF/VHF/FM Antennas by A.J. Skalina of Dielectric Communications. Ronald Tellas from

Andrew Corp. wraps up with a look at a new solution for burning bullets in his survey of the Performance of a Transmission Line Having a Rigid Outer Conductor and a Corrugated Inner Conductor.

Near your tower or on the other side of town, you are responsible for protecting the public from harmful levels of radio frequency exposure under the proposed new RFR guidelines. As debate over the standard rages in the industry, NAB's Kelly Williams gathers a group of experts to share their opinions during the RFR Update beginning at 3:30 p.m. Monday.

The panel, produced in cooperation with the NAB Legal Department, will include Dr. Robert Cleveland from the FCC in Washington, Bill Hammett from Hammett and Edison Consulting Engineers, Jules Cohen of Jules Cohen and Associates, Richard Strickland from Loral Microwave-Narda Corp., Dave Baron from Holaday Instruments and David Hilliard of Wiley, Rein and Fielding in Washington.

This diverse group represents every possible viewpoint on RFR; consulting engineers, federal regulators, communications lawyers and measuring instrument manufacturers. Be sure you know enough to protect yourself as the new standards take shape.

SBE Day

Tuesday, March 22 is SBE Day at NAB '94. All of the day's sessions are organized and supervised by the Society of Broadcast Engineers, a professional society for technical personnel in broadcasting and related industries.

There is a lot of life left in traditional technologies; a session on AM/FM improvement, hosted by independent technical author and consultant Jerry Whitaker, brings you the latest ideas for improving your station's performance. Walter Johnson from Voice of America (VOA) has made an exhaustive study of techniques to extend the service life of high-power vacuum tubes. You will be amazed at the possibilities. No matter how much power you make, it is wasted if your anten-

na system shoots most of it into space. Find out how to improve your antenna's performance when Jim Cutforth, PE, presents Broadband Implementation of a Physically Short, Highly Top-Loaded Anti-Skywave Antenna.

Even the best designed antenna system needs some extra care and attention. Tom Osenkowsky has just the right prescription in his Tuneup Guide for AM Broadcast Antennas. Your antenna is only half of your signal delivery system. Larry Paulausky looks at maximizing the hidden half in Modern Practical Techniques for Installation and Repair of AM Antenna Ground Systems.

Despite advances in transmit antenna system design, FM stations are still haunted by the multipath devil. The answer may lie at the receiving end. Richard Zerod from Ford Motor Co. offers help with FM Diversity Reception Systems. Everybody is talking about DAB but digital starts long before the transmitter. Engineering Consultant Skip Pizzi has tips for the front end in Preparing for Radio Multicasting and the R-LAN Environment.

The tests are over, bushels of reports have been filed and the industry is waiting for a final verdict on EBS. On Tuesday afternoon at 3:30, consulting engineer Dane Erickson from Hammett and Edison brings you the latest on The New EBS System.

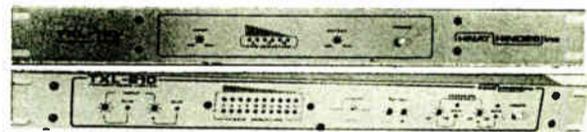
Paul Montoya from Broadcast Services of Colorado opens the session with his report on Testing the New Technologies for Emergency Alerting Systems. The FCC's Richard Smith continues with his observations in This is No Longer a Test. The new EBS includes cable systems. Ken Wright from Jones Intercable considers how that portion of the new system will work in cable TV and the new EBS. Nothing will work if your operators can't understand it.

Richard Rudman from Group W has some practical advice for the industry in User Friendly EBS. Canada also has overhauled its emergency systems. Patricia Lok from Metromedia profiles its progress in All Channel Alert: Canadian Emergency Broadcast System. The session concludes with a final look at the testing process for

continued on page 75 ►

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Morgan Ushering in New Technology

Charles T. Morgan will be the recipient of the NAB Engineering Award for Radio for 1994. Morgan is senior vice president and vice president of engineering for Susquehanna Radio Co., which operates 16 radio stations throughout the U.S.

He has been chairman of the National Radio Systems Committee (NRSC) for the past eight years and has been instrumental in a number of broadcast industry standards, including those affecting AM and the recent RBDS (Radio Broadcast Data Service). He also has authored six books on radio broadcasting.

Morgan's career began in his hometown of Pittston, Pa., in 1953, when he helped build the community's first radio station. The father of three children, Morgan currently resides in Avoca, Pa., with his wife Genevieve.

Recently, News/Studio Sessions Editor John Gatski talked to Morgan about his career, the current state of radio and the NRSC.

RW: How did you decide on a career in radio?

Morgan: I first developed an interest in radio and electronics while in high school. This interest led me to a technical school that offered curriculum on all aspects of radio and TV including the preparation for obtaining an FCC license. I became more interested in the broadcast end of the business, and shortly after receiving my first class ticket, a job became available at a

new station in my hometown. I took the job and have been broadcasting ever since.

RW: What particular aspect of engineering interested you when you first started out?

Morgan: My first job was to help build a new station and, I guess, that has always been the part of broadcasting that I liked best. Since joining Susquehanna 34 years ago, I have been involved in building more studio and transmitter sites than I can remember, and in the early days I spent a lot of time wiring studios and installing transmitters. As Susquehanna grew, so did the caliber of our station engineers, and my part of these projects evolved from the actual construction to overall planning and supervision.

RW: Tell us how you got involved with the NRSC and your eventual leadership of that organization.

Morgan: I was chairman of the NAM AM Improvement Committee, which after a very complete investigation of the problems with AM and its potential future, issued a very comprehensive report. This report, among other things, suggested reconvening the NRSC to look at the entire broadcast system, including the transmitter, allocation system and the receiver to determine what, if anything, could be done to save what appeared to be a dying medium. I guess it seemed reasonable that they ask me to serve as chairman of this committee.

RW: Have the various NRSC standards that you have been involved with improved the quality of radio broadcasts?

Morgan: Yes, I believe AM sounds better today than it did five or 10 years ago. The adherence to the maximum pre-emphasis curve cut down on much of the excessive high frequency boost that many stations unrealistically expected to overcome the deficiencies of many poor-quality receivers. Unfortunately, this approach provided more distortion and splatter without ever getting these high frequencies to the speaker terminals. The "occupied bandwidth" standards that followed will soon become very effective, with the FCC requiring bandwidth measurements in the near future.

Unfortunately, the receiver industry has not moved as fast as we would like in providing new receivers that comply with this standard. It is important to realize that these are voluntary standards, and the best we can hope for is that we will get these receivers whenever these manufacturers provide new designs or the marketplace prompts them to make the changes. New receivers that I have seen do sound better, and this is particularly true in auto radios.

RW: Although there have been a lot of technical improvements in AM broadcasting, and recently the long overdue enactment of an AM stereo standard, AM radio is not considered as good as FM by listeners. What will it take to change that impression? Can it be changed?

Morgan: That's a complex question. Let me first address the AM stereo question. Yes, the AM stereo decision was long overdue, but I have never believed that a stereo standard would have any real effect on (reversing) the decline of AM. The differences that exist between AM and FM are quality, dynamic range and immunity to interference and noise. Stereo is simply a dimensional effect, and without better quality receivers it would simply provide two channels of poor audio. As we improve the quality of receivers, stereo

will follow.

In its early days, good AM on a good receiver sounded great because we generally compared it to a phonograph disc heard on speakers similar in design to that in the radio. Today, AM is compared to CDs, high-quality tape and FM. The best-sounding AM station heard on an average AM receiver will always sound inferior to FM. Bandwidth and noise immunity coupled with our allocation system provide limitation that simply do not exist in FM. As we improve the receiver, we will get quality that is closer to FM. In addition to the NRSC receiver standard, the implementation of automatic bandwidth receivers and noise blanker could help close this quality gap.

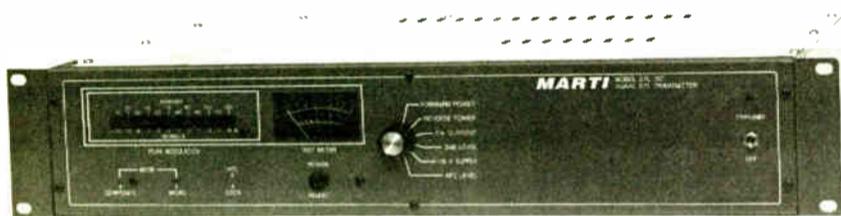
RW: Can you tell us about the progress on some of the new NRSC standards? DAB? RBDS? High-speed data SCAs?

Morgan: First, let's talk about RBDS. That standard was adopted last year. The time lag that occurs between the publication of a standard and getting equipment in the hands of the consumer can be extremely long, but RBDS is a top priority of receiver manufacturers. The design is not new, manufacturers are making similar equipment for Europe, and only minimal software changes are required to meet the U.S. standard. All major manufacturers have these receivers in the pipeline, and receivers will be available in some 1994 automobiles by mid-year.

The standardization of SCAs using high-speed data is the most recent undertaking of the NRSC, and the request for proposals are due shortly. A number of service providers utilize SCAs for the distribution of high-speed data, and generally they use a data stream of their own design for their own specific purpose. The problem with this approach is that they require the SCA full time and can not share it with other users. With a standard, it is our hope that several services can share the same SCA, thus providing greater efficiency, with more providers utilizing SCAs at a lower cost and more income for FM stations. There is a great deal of interest in this standard setting process, but it is too early to determine the outcome.

continued on page 50 ►

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World Radio History

Product Stories: Test & Monitoring • Automation • Mics & Monitors • STL, Remote, Telco & ISDN • Source Equipment • Studio Gear • DAWs • Antennas, Towers & Cable • Audio Processing • RF Equipment • Consoles • Products & Services

TEST & MONITORING

Improved Test Meters and Monitors Designed for Smooth Daily Operation

LAS VEGAS With the day-to-day operation of complex broadcast equipment, good test and monitoring equipment is a necessity.

At NAB 1994, look for several companies to introduce new lines and display their existing products.

Wohler Technologies will show its full line of monitors and meters including the 2 RV 20 channel LED audio metering display.

Inovonics will demonstrate its line of test and monitor gear including the "David" FM processor/Stereocoder, the Sentinel and Model 530 FM modulation monitor.

Besides its RDS encoder and SCA generators, **Modulation Sciences** will show its ModMinder modulation monitor/analyzer.

FM Systems will show its AVM digital Audio Volume Meter, a true-RMS program audio volume meter, and the AMM audio modulation meter.

Asaca/ShibaSoku will showcase its full line of video and audio test equipment including analyzers and routing switchers.

Tektronix will show the much-anticipated AM 700 audio measurement systems, a fully integrated test instrument for professional troubleshooters.

Logitek is introducing the Super-VU bargraph audio meter with simultaneous display of loudness and peak levels. Selectable functions include peak hold, maximum hold, phase, density and sum display.

Audio Services Corp. is introducing the DK Audio MSD-550 master stereo display, which monitors signal level, phase indication and stereo imaging on a backlit LCD screen.

Schmid Telecommunications plans to

display its SIAT (Short Interval Audio Test systems) an automated system designed to tests across transmission paths during program breaks or station IDs without disturbing the audience.

Potomac Instruments will show its AA-SIA, a new improved version of the Automatic Audio Analyzer, and other assorted test and monitor gear.

Holiday Industries will have its established lines of RF and MW instruments plus EMF meters.

Gorman Redlich Mfg. will show its existing line of test gear as will **Faraday Technology**.

Look for the **Dorrrough Electronics** line of audio level meters and stereo signal test set Model 1200, a gain set for stereo line measurements of level, balance, crosstalk, signal-to-noise and phase with a 96 dB range.

Delta Electronics will be promoting its Splatter Monitor, ASM1- AM stereo monitor, AAM-1 analog antenna monitor and PRH-1 high power reflectometer.

Belar will introduce a new digital FM stereo monitor/analyzer. Its well-known Wizard for AM and FM, and FMM-2/FMS-2 FM test set will also be featured.

Avcom of Virginia will debut its BNG-1000A broadband noise generator for use with spectrum analyzers.

Audio Precision will show an improved, reduced-bit-rate/encoder/decoder testing software as well as its popular audio test sets: the Portable One Plus, System One, and Systems One plus DSP.

Ward-Beck Systems will show its established M405P portable extended-range VU meter.

AUTOMATION

Automated Audio Storage and Playback Assumes Important Share of Work Load

LAS VEGAS A constant over the past several years has been advancement in automated audio and storage and playback technology for the radio studio.

More and more can be stored in smaller spaces and accessed more quickly thanks to the sinking costs of computer memory, the development of data compression systems and improved, user-friendly software.

Among the new products for 1994 is a hard disk, live-assist and music automation system from **Register Data Systems (RDS)**. The so-far unnamed system features simultaneous record and playback and audio overlap of music or commercials. Dolby AC-2 compression is optional.

RDS will display new network interfaces for its Phantom automation system, which was introduced at NAB 1993. The Phantom is designed to automate satellite program sources and live assist. It features dynamic spot retiming for quick and easy fits during commercial breaks.

New RDS traffic and billing software is designed to work with Windows 3.1. The company has other software packages for tracking traffic, accounts receivable, accounts payable, payroll and general ledger.

The DAD 486x Digital Audio Delivery System from **Enco Systems** will be on display at the **Harris Allied** booth. The hard disk, off-the-shelf system features unlimited expansion and user-friendly graphic interface.

AEQ will display its MAR System. Introduced at the Fall Radio Show, MAR (Management of Audio Resources) is a combination hard-disk system and digital audio workstation.

The **ITC DigiCenter** digital audio management will be displayed with new, enhanced CD player and jukebox controls and 4 gigabyte and 9 gigabyte hard drives. **DigiCenter-NEWS** is a new networking feature, linking

audio and text workstations in the newsroom. It offers event scheduling and audio/text editing capability.

An Italian company, **AEV Electronic Professional Equipment**, is introducing the Aurad System 2 Evolution, which connects up to 64 digital audio devices storing up to 40 hours of digital audio each.

Broadcast Electronics, will introduce two new digital audio storage systems from the "BE Sports Bar" at its booth: the D.A. Box system and the enhanced AudioVAULT-100 storage system with networking capability. BE's established CORE Program Automation System and Sentry system will also be displayed.

Broadcast Programming, a music programming services company, also offers a line of digital audio storage and automation systems. It will introduce Digitalease, a low-cost package of automation equipment designed to convert radio studios to digital operation in one low-cost step.

Radio Computing Services feature the Master Control digital live-assist and full automation system, introduced at NAB 1993. The RCS spot scheduler and Selector music scheduler are among the established software products to be shown.

Fidelipac Corp. will show its Air Marshal hard-disk system.

Design Financial Reports (DFR) is a new software option for **CBSI/Custom Business Systems Inc.**'s InterAct general ledger/accounts receivable system. It is written to be equally efficient for the accounting needs of small, single-market stations to large station groups.

PowerPlus, a third new CBSI package, offers agency management, advanced sales analysis, scheduling and transmission certificate capabilities. It interacts completely with the CBSI Classic system.

Software products scheduled for NAB display by **Jefferson Pilot Data Services** include: JDS2000/1000 broadcast management software with interfaces to traffic, billing, accounts receivable and sales management systems; SALESLINE, a sales management system with local and national contract routing and approval, account profiles, activity tracking, inventory tracking, inventory tracking, rate card, competitive and historical buy information, and PC SESAMI, a PC-based system for writing proposals and researching accounts, with interface to SALESLINE.

Ednews, a radio news editing software system that lets the news staff share text and audio files, will be introduced by **Dalet Digital Media Systems** of Paris. Dalet will also show two new applications to its Sneak Preview software, including a news editing option and traffic scheduling.

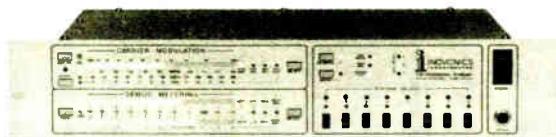
The Dalet Windows Multitasking system allows playback of one audio file while recording another, and offers programming logs, operating with PC Windows.

A-Ware Software will show an updated version of the MusicMaster scheduling system, with improved average turnover control and interfaces to most available automation and traffic systems. Foreign language and government reporting modules are available.

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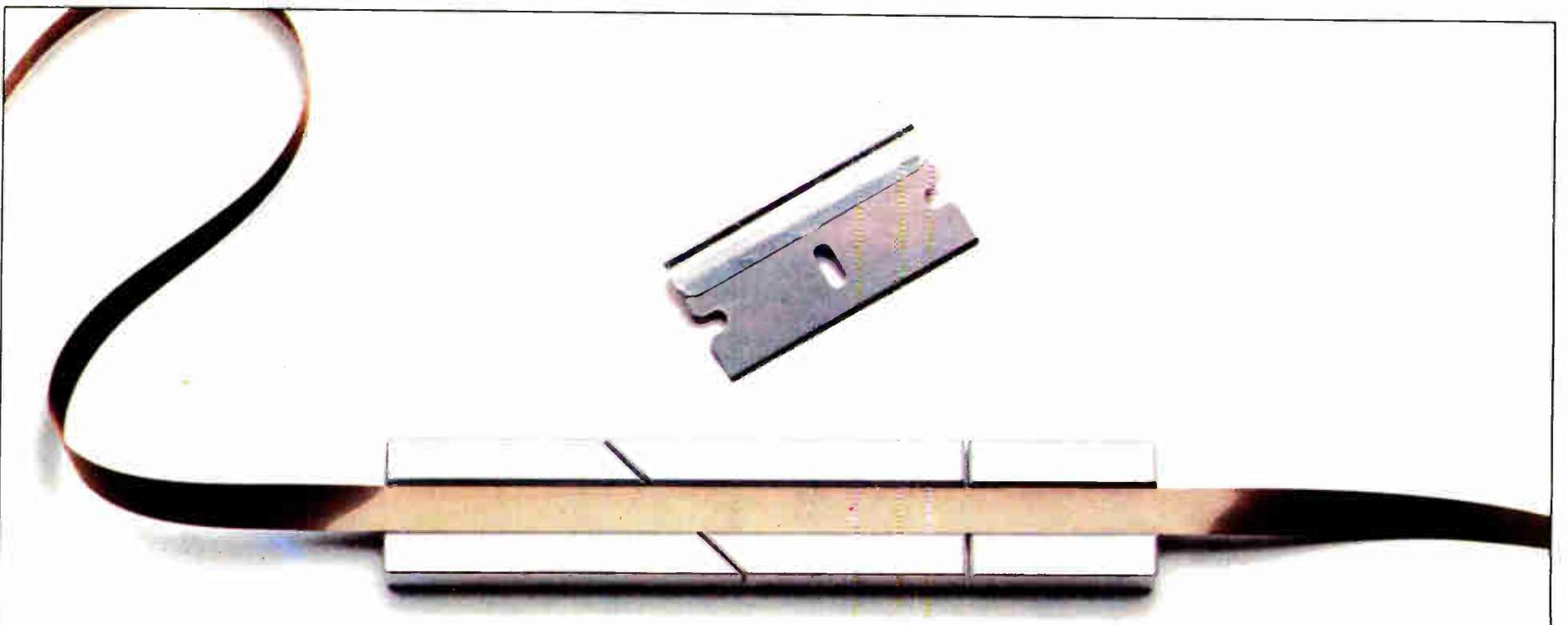
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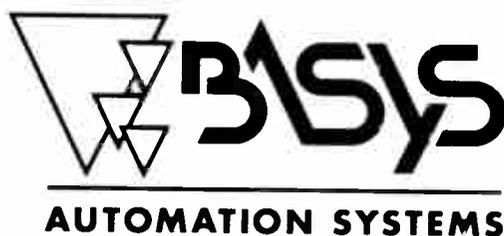
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Wireless ways

In wireless systems, Vega will introduce the VegaNet networkable wireless mic system, incorporating Lone Wolf's MediaLink technology for real-time computer-based control and monitoring on an open architecture network.

The system consists of the new R-662B PRO PLUS UHF receiver and up to eight Model NE-2 interface modules. Because each module can interface two receivers, a

network can have up to 16 receivers per frame.

The new R-662B receiver features LAN interface capability and a control and monitoring access port for the interface units, allowing networked monitoring of key receiver functions and control of numerous receiver parameters, such as frequency.

Nady Systems will introduce the 950GS UHF wireless system available in 10, 40, 100 or 160 channel models. Listing at \$2,749 for 40 channels, the system uses a proprietary UHF RF link featuring patented noise reduction technology that Nady

claims is up to 20 dB quieter than competing systems.

Other features include switchable balanced level out, 115/220V AC power with a 20-25V DC power option, bass boost and front or rear-mounted antennas.

Nady will also showcase its existing UHF and VHF wireless systems.

Telex will demonstrate a number of wireless products, including the FMR-450 UHF receiver, the HT-450 UHF hand-held transmitter and the WT-450 UHF all-metal belt pack. Also from Telex is the HT-200 hand-held transmitter, the BP-1000 single-channel belt pack and the BP-2000 two-channel belt pack.

Shure Brothers will introduce the SC wireless mic system featuring a battery fuel gauge, frequency agility, and tone key squelch.

Audio Services Corp. will have on hand the Lectrosonics line of UHF diversity wireless microphone systems.

New intercoms

Systems Wireless will exhibit the HME System 800 UHF wireless intercom system that interfaces to Clear-Com, RTS and most cabled systems. Featured are tone squelch control, 2000-foot range and the ability to tie-in two-way radios.

Systems Wireless will also bring out Vega's full line of wireless mics and IFB systems, including the new VegaNet, as well as Clear-Com party line and Matrix intercom systems.

Clear-Com will exhibit its line of two-, four-, eight- and 12-channel wired and wireless intercom systems, as well as the Matrix Plus II 100x100 central matrix. The Matrix Plus system features software adjustment level controls "intelligent Linking" between systems and DTMF access from touch-tone phones.

Studio Technologies will showcase its IFB Plus two-channel mobile IFB system.

In microphones, Orban will show the AKG C3000 mic designed for radio announcing. Listing at \$699, the unit has a large diaphragm and an internal wind-screen and is switchable between cardioid and hypercardioid patterns.

Along with its full line of existing microphones, Crown will exhibit the new CM-312 head-worn microphone designed for hands-free operation. The mic has a hypercardioid pattern with superb off-axis rejection and high gain-before-feedback.

Also showing a head-worn mic is Professional Sound Corp., which will display the PSC Headset Microphone. The unit has three-wire positive bias, noise canceling, an electret element and a cardioid pattern. PSC will also show the OmniPlate tabletop microphone that can be plugged into any 9-52-volt PH or 12-volt (AB) or T mic input.

In addition to its wireless systems, Shure will display the VP88 stereo microphone and the Beta 87 condenser mic.

Sanken will introduce the CSS-5 stereo shotgun microphone. The unit can be operated in mono mode for definition below 2 kHz, normal shotgun mode for stereo localization along the hypercardioid pattern, and wide mode for expanding the stereo image to 140 degrees.

Sanken will also display its full line of studio, MS stereo, field production and lavalier microphones, including the dual-capsule CU-41 studio mic and the COS-11 miniature lavalier.

Electro-Voice will highlight its RE27N/D and RE36N/D dynamic cardioid microphones.

Richardson Electronics will have a complete line of Shure and Sennheiser products.

A few monitors

Monitoring systems will see a smattering of product introductions.

Audio Services Corp. will display the new DK Audio MSD-500, a master stereo display for signal level, phase indication and stereo imaging on a back-lit LCD screen.

Studio Technologies will demonstrate its StudioComm series, particularly the Model 50/51 and Model 55/56 central controller and control console combinations for monitoring and communications.

Mark IV will display Electro-Voice concert series speakers.

In addition to its microphones, Electro-Voice will show its S-40 compact monitor system.

More channels. More power. More versatility.

Only Dolby DSTL systems offer you more.



The original Dolby DSTL already handles the most demanding of paths, with better sound quality and more spectrum efficiency and freedom from interference than any other STL, digital or analog. But we heard you wanted more.

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Look no further than our new 4-channel DSTL, ideal for taking advantage of the new LMA/duopoly rules or when you just need additional capacity. It conveys four program channels and two RS-232 data channels in only 400 kHz of bandwidth.

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STL, REMOTE, TELCO & ISDN

STLs, Remote Pickups and ISDN Links Fall Well Within the Digital Domain

LAS VEGAS Perhaps nowhere else in radio facilities have digital audio and data compression technologies caught on quicker than in the area of studio-to-transmitter links (STLs), satellite links, radio data system/radio broadcast data system (RDS/RBDS) generators and other ways to move audio signals.

Digital signals are maintain higher quality than analog after several passes, are often cheaper to work with (especially when using compression) and are becoming increasingly simple to plug into a station operation.

One illustration of this is the StarLink 9000 all-digital modular system for simplex or full duplex transmission, to be introduced by **Moseley Associates Inc.**, at NAB 1994.

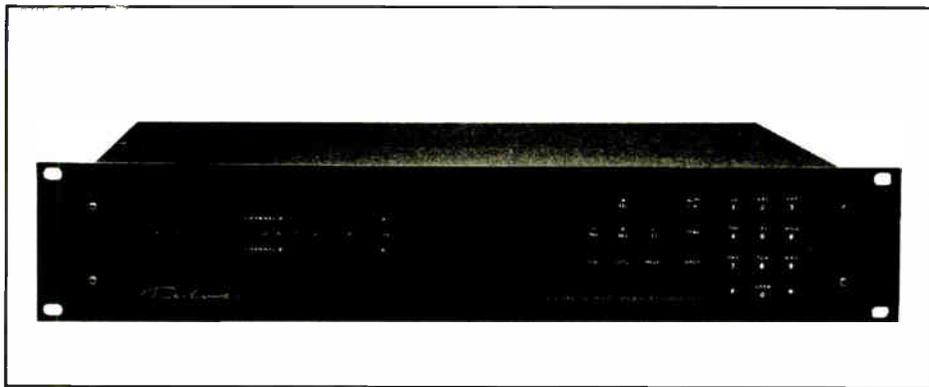
A partial list of the features and functions (what Moseley calls "Personality Modules") that can be computer controlled with StarLink includes: 16-bit linear digital audio; ISO/MPEG and sub-band-ADPCM source compression;

Bradley will also show the Telos ONE-x-Six talk show system, a digital hybrid, six-line phone system for on-air teleconferencing.

The G2500 and G3200 "Superhybrid" telephone systems that **Gentner** introduced at the 1993 Radio Show will be back, along with the new TC-101 telephone interface and the ET-100 Personal Teleconferencer.

Burk Technology will offer expanded software options for its ARC-16 transmitter remote control system, available in single-unit, stand-alone operation or two-unit, studio/transmitter and multi-site systems. ARC-16 can also control studio equipment, including EBS generators, automated playback systems and STLs.

Intraplex is introducing STL+, an uncompressed digital link for T1 lines, with 16-bit discrete stereo capability. It is now available, starting under \$9,000. **Bext Inc.** will show its established line of STLs, from 1.5 watts (\$3,980) to 15 watts (\$48,995).



Telos' Zephyr

1-3 bit-per-second selectable efficiency channel coder; drop/insert and variable-rate multiplexers; digital stereo, SCA and RDS generators, and T1/E1/ISDN/Switched 56 drivers.

Moseley will also offer new ISO/MPEG codec and built-in AES/EBU rate converter options to its established DSP 6000 STL. (The DSP has been available with apt-X compression.) The MRC 2 transmitter control system will be shown with new optional interfaces for satellite controllers and audio video switchers, as well as an optional programmable intelligent co-processor.

Marti Electronics will introduce the STL-15C frequency-agile composite system for export frequencies 150 MHz to 480 MHz. Other Marti systems on hand will be the STL-10 SCPS available in 150 MHz to 960 MHz, and the RPT-30, RPT-15 and RPT-2 remote broadcast systems.

QEI Corp. is introducing real-time, uncompressed digital remote pickup (RPU) and transmitter-to-studio links (TSL).

Dolby Laboratories is now offering its DSTL, introduced at NAB 1992, with two-watt power output to provide improved reliability over difficult terrain. The DSTL features Dolby AC-2 compression.

The **Telos Systems Zephyr** Digital Transceiver for ISDN phone links, featuring ISO/MPEG Layer III compression, will be shown at the **Bradley Broadcast Sales** booth. The Zephyr system can be used for remote broadcasts, satellite links and several other networking applications.

Audio Processing Technology (APT) of Belfast, Northern Ireland, is introducing its DSM100 digital audio transceiver to the U.S. market. The system is already used in Europe to deliver compact-disc quality stereo over ISDN and other low-capacity digital telephone circuits.

APT is also introducing the Pro-link ISDN terminal adapter. It can be combined with the DSM100 for secure, full duplex 24 kHz stereo transmission.

Corporate Computer Systems (CCS) will have the first showing of its CDQ2001 audio codec with MUSICAM compression, an upgrade of the CDQ2000 introduced in 1991. It features an 18-bit analog-to-digital converter, 32 kHz sampling rate for audio response up to 15 kHz, and a new remote control data port allowing for control from a PC modem. (The CDQ2000, which can send 20 kHz stereo with 112 kbps, will also be a featured product.)

CCS's CDQ1000 MUSICAM/G.722 codec, introduced last fall, will also be displayed. It will transmit 10 kHz audio on a single 56 kbps or 64 kbps digital telephone circuit.

Comrex Corp. is offering a number of new stereo and mono digital codecs, including the Model DX-100 with apt-X compression, and the DX-200, DX-210, DX-230 and DX-240 "MusicLine" codecs. Established Comrex products to be displayed include a 7.5 kHz digital audio codec; one-, two- and three-line frequency extenders; telephone couplers, and a wireless cue system.

ComStream will introduce the ABR75B satellite digital audio receiver, designed for business music applications.

It will also introduce the Remote Performance Monitoring (RPM) system, for PC modem control of telephone audio links.

ComStream's established product line includes digital satellite network components, such as the ABR200 and ABR75/75B receivers, currently used in 25 different countries.

RE America, best know for its RDS/RBDS encoders, will introduce a line of MUSICAM and ISDN audio codecs at NAB. They will be on display at the **Harris/Allied** booth.

Along with STL+, Intraplex is showing a new line of codec modules to use with its STLs and broadcast transmission multiplexers. The PT/R 350 transmitter and receiver for 16-bit linear uncompressed audio. It can transmit 7.5 kHz or 15 kHz audio, sampled at 16 or 32 kHz.

Intraplex is also introducing the PT/R 355 system for 15 kHz discrete stereo transmission over T1 circuits. Both PT/R 350 and 355 are now available for under \$2,000.

DB Elettronica Telecomunicazioni of Italy will introduce its TD4/16-RD4/16 16-bit coder and decoder for four channels of 15 kHz audio. They can be used in combination with existing analog

STLs without modification.

TFT Inc. will show the latest models of its EIS 911 and 912 Emergency Information System manager and generator, the key components in TFT's proposed new Emergency Broadcast System technology. The FCC is currently rewriting EBS technical standards using EIS and other company's systems as models.

Wegner Communications Inc. will show its established line of digital audio SCPC transmission systems with addressable network control. **AEV Electronic Professional Equipment** of Italy will show its ERDS 3100 and RDSM 3900 RDS systems.

Hallikainen & Friends is introducing its DRC200 transmitter control software. It provides support for multiple logical channels on packet radio systems and provides an unlimited number of user-defined screens.

IDB Broadcast is offering 15 kHz Switched 56 digital sports interconnect services, and **DDD-2 Direct Digital Audio**, a high-quality audio transmission system designed for recording studios.

Among the satellite services, **PanAmSat** and **NPR Satellite Services** will feature their established lines.

SOURCE EQUIPMENT

Vast Selection of Hard Disk, Mini-Disk And Tape-based Gear Available

LAS VEGAS With the proliferation of new disk- and tape-based source equipment, broadcasters have more products to choose from. Many of those products will be on display at NAB 1994.

Hard disk haven

Akai plans to demo its \$2,500 DR4d four-track digital hard disk recorder and DD1000i recorder/editor that utilizes magneto optical disks.

Harris Allied will show a number of products including the new MiniDisc professional cart machines from **Sony**, **Denon** and **Otari**. Also look for the **ALR** digital cart that uses 128 megabyte magneto-optical disks in the uncompressed format. Other products from Harris Allied will include the **Audio-Metrics** CD-10 CD cart player and the **Tascam** DA-88 multitrack Hi8 audio recorder.

The DigiCart/TC digital audio hard disk recorder is scheduled for introduction by **360 Systems**. It is a random-access recorder with SMPTE timecode synchronization and interfaces with videotape recorders. Other features include: chase/lock, transport control, playlist generation, insert-edits, jog/shuttle control and remote control.

360 systems will also feature the DigiCart/II digital audio recorder, and eight-hour hard disk system with editing functions, at its booth.

HHB will show the PORTADAT line of portable DAT recorders. The four-head, four-motor digital recorder comes in the PDR1000 version and the PDR 1000TC for those who need time code.

ITC plans display of its Delta and Series 99 cart machines as well as the **ESV V** and Series 1 and Series 2. The company also refurbishes older machines for resell.

From **Sony**, expect the new DAE-D5000 digital audio workstation that uses the PCM 9000, the full line of MiniDisc cart recorder/players and players and the PCM-E7700 DATStation, a

dual deck DAT editor. Other existing products include the full line of professional studio DAT recorders and tapes.

Studer will show its full line of recorders, plus will have the NAGRA-D, a four-channel, self-contained professional open reel digital audio recorder.

Fingertip control

New from **Scott Studios**, the CompuCarts, 16-bit digital audio player has computer touchscreen control and a cart recorder for production. Digital audio is stored on hard disk and accessed through on-screen data bases. Other products will include an uncompressed option for CompuCarts featuring the Turtle Beach software, Light Pen CD jukebox controller and CD controller for Pioneer's CAC-V180M.

Otari will show its full line of recorders, including the quarter-inch, two-track analog machines to one-inch, 32-track digital, and professional DATs and ProDisk-464 work station. Also look for the MR-10 MiniDisc cart recorder, (shown in prototype form) at the 1993 AES, and a new high capacity CD changer.

Audio Services Corp., will show the Fostex PD-2 DAT recorder with timecode and Tascam DA-88 eight-track digital recorder.

Garner Industries will display its full line of tape erasers including the CF 750 Type II/IIA extended range degausser.

The **Audiopak** display will include its line of NAB carts—the A-2, AA-3 and AA-4s—as well as lubricated audio tape carts and cassettes, including the formula 605, 613, and 614.

3M will show its complete line of digital audio and analog recording tape, and magneto and CD-R media, including the 3M 908 tape for the Nagra open reel recorder.

Maxell will have an array of media including DAT, three-quarter inch digital, CD-R, MO, analog cassette, reel-to-reel and 8 mm.

STUDIO GEAR

The Little Things Often Count the Most in the Search for the Best Fitting Studio Accessories

LAS VEGAS With all the equipment made for broadcast studios, there are many accessory and associated products that are required to make it work. At NAB 1994, the product category will be full as usual.

Clark Wire and Cable will introduce the Clark 1300 Series audio snakes, Hannay Cable Reels as well as a planned display of established products.

Cole Wire and Cable Co. will have its line of audio and video transmitter cables. **Henry Engineering** plans display of the new StereoSwitch, a three-input line switcher.

New gear

NVision will show its NV 1050 four-channel sample rate converter, NV 1055 four-channel digital audio/mix/minus and routing module, NV 1060 digital delay compensator module and BNC-/I-volt digital I/O interfaces for other NVision products.

Besides its workstations and recorders, **Pacific Recorders** will show its complete line of studio equipment and peripherals including furniture and wiring.

Richardson Electronics is scheduled to show new components including RD Transistors Pallets, Directional Couplers, Amphenol connectors, Unilators and WL Gore cable assemblies.

Sonex will showcase its sound control products including Sonex Fabrex. **SESCOM** will be displaying its assortment of audio accessories. **Sandar Electronics** plans to have an array of products for digital and analog audio including routers, conference equipment, distribution amplifiers and equalizers.

Expect the latest in audio cables from **Nemal Electronics**. **Lemo USA** plans to display connectors for single, coaxial, triaxial, multicontact, high voltage, fiber optics applications.

ESE will demonstrate the new ES-185 GPS master clock, ES-2940 dual audio and video D.A.s and five output black burst generator, ES195 GVG Master 21 interface/master calendar and the new

LUX-line product family.

Connectronics will show its full line of audio cables, patchbays and terminating connectors. **Audio Accessories** will showcase its audio panels, jacks, patchbays, patch cords and Edan connectors.

Acoustic Systems will demonstrate and show its various acoustically

designed broadcast and studio enclosures.

Symetrics Inc., will introduce its 420 stereo amplifier, designed to replace the earlier A-220 model. It offers 20 watts RMS and 40 watts of bridged mono, and fits in one rack space. A front-panel "speaker-mute" button is included for those wanting to alternate between head-

DAWs

Digital Audio Workstations Developed For Cleaner Audio, User Friendliness

LAS VEGAS As is evident in this month's Buyers Guide (see pages 83-103), digital audio workstations (DAWs) combine digital accuracy with ease of use for applications ranging from producing commercials and promos to cleaning up phone calls in the on-air studio.

New DAWs, as well as established products and upgrades, are slated to be seen at the NAB 1994 exhibition.

VTR interface

360 Systems will introduce its DigiCart/TC digital audio hard disk recorder this year. The DigiCart/TC is designed for SMPTE time code synchronization applications between video and audio and it interfaces with VTRs.

360 Systems will also display its DigiCart/II digital audio recorder. The DigiCart/II features a 68-minute removable disk, an internal eight-hour hard disk, workstation editing functions, playlisting functions, visual read-out, instant access to cuts and comprehensive library and utilities management.

Roland Corp. will introduce its Version 2.0 firmware for the DM-80 digital audio workstation. The firmware upgrades the DM-80 with more than 40 new or improved features.

Roland will also introduce its DM-80-S 2.0 Version of Multitrack Manager Macintosh System software for the DM-80. This software will allow a user to lock up to four DM-80 recorders together to provide up to 32 tracks of synchro-

nous digital recording, all under the control of a single computer.

The Australian company **Fairlight** will introduce a third generation of products based on its MFX digital audio workstation. The standard MFX3 can be configured from four to 24 tracks, and includes DSP functions such as real time clip-based EQ. The MFX3 "Mini" can be configured from four to eight tracks. Both units are available in a rack-mount or portable chassis.

ASC Audio Video Corp. will introduce its New Virtual Recorder that features digital random access replacement for VTRs. The New Virtual Recorder will be demonstrated in combination with commercial spot insertion systems and audio workstations.

It records and plays 60 field broadcast video, two-channel audio and SMPTE time code. Recorded material is instantly available for commercial insertion, audio workstations and video-on-demand.

On-air DAW

Audion Labs will introduce its VoxPro workstation, which is designed for on-air use. The VoxPro includes custom "folders" for on-air personnel to store liners, jingles, sound effects, etc., as well as rapid, intuitive editing.

Henry Engineering will introduce its Fast Trac II voice-over audio workstation. While not specifically a DAW, the Fast Trac II is a "studio in a box," well suited for use with digital editing systems. It works just like a console, with

phones and monitors.

Studio Technologies Inc., is introducing Studio Tools, a series of distribution amplifiers. The Model 80 amplifier is for analog stereo operation, with one stereo input and eight outputs. The Model 85 operates in AES/EBU digital audio, and features transformer-coupled inputs and outputs and a front-panel switch to assign its one input and eight outputs.

Ward-Beck Systems will show its established D8212 audio distribution amplifier system. **Fidelipac Corp.** will show its Dynamax SRC digital audio sample rate converter.

five stereo line inputs, plus mic input with automatic ducking.

AKG-Orban will introduce the Orban DSE 7000 workstation, which is designed specifically for radio production.

CCS will display its computerized audio editing system, PACE. PACE is based on the MUSICAM ISO 11172.3 Layer II compression standard, and is designed specifically for newsrooms and radio stations. The human interface of PACE is designed to aid non-technical users in using the system.

Human interface

PACE's operator interface provides users with icons of the equipment they are already familiar with—carts, tapes, recorders, tape racks, mixers and even a television set. Because PACE users understand how to edit audio manually, they can quickly learn how to use PACE.

Also at NAB '94 will be **Pacific Recorders & Engineering**, offering a streamline version of its ADX digital workstation.

ENCO Systems will display its DAD486x digital audio delivery system.

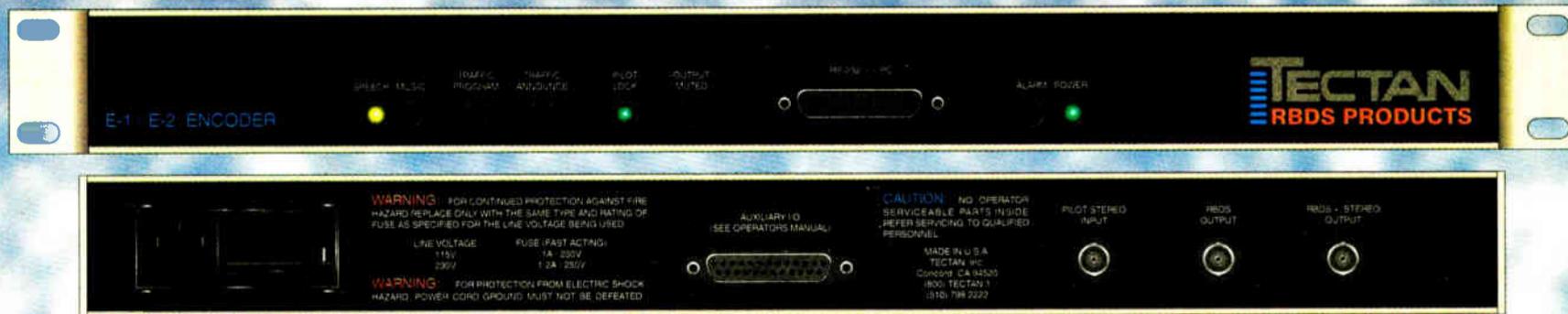
BASYS Automation Systems will display the Australian-designed D-CART digital audio record, edit and playback system, which offers simultaneous multi-user capabilities. BASYS also will show its NetStation for Windows, PC-based newsroom system workstation.

Harris Allied will show the Orban DSE 7000, ENCO DAD486x, **Tascam DA-88** and Roland DM-80 DAWs. And **Broadcast Supply Worldwide (BSW)** will offer the Arrakis Digilink and Track*Star systems and **Korg** and **DigiDesign** DAWs.

First class quality

First class performance

Incredible price! -- \$995*



No-compromise RBDS just became affordable!
Phone 1-800-TECTAN-1 for details.

* Limited time introductory price for E-1 Encoder. Introductory price for the E-2 Encoder is \$1195. Shipping & handling \$25 additional for 2-day air shipment anywhere in the U.S.A.

ANTENNAS, TOWERS & CABLE**New Antennas to Be Unveiled Along with Cables to Help Get Radio Signals on the Stick**

LAS VEGAS No matter how good a station sounds, no matter what digital gear or processing equipment used, without an antenna, a signal cannot reach listeners. NAB 1994 will include new products and exhibitions from many antenna and tower manufacturers.

Jampro Antennas Inc. will introduce the JCPD flat panel circularly polarized antenna and the JADP cavity-backed panel antenna. Both the JCPD and the JADP are broadband antennas.

Jampro will also introduce a new combiner, the JIDC inter-digital combiner and the JIDF inter-digital filter. The Penetrator series of FM antennas will also be shown.

Andrew Corp. will introduce a new VHF panel antenna, MR-050 series

DryLine dehydrators and SD-002 series static desiccators. Also on display will be a variety of coaxial cable products, 3M Cold Shrink weatherproofing kits and ESA Systems antenna control products.

Comtech Antenna Systems will introduce the new EC8 microprocessor control system with optional IBM-compatible software. The EC8 can control the Comtech line of satellite antenna systems by local or remote control.

Comtech also offers a 3.8-meter motorized antenna system of receive applications. It is reportedly in use by hundreds of radio stations for high quality SCPC reception. Comtech also offers the Offsat

antenna for SCPC uplink requirements.

The British company **Advent Communications Ltd.** will introduce New-Swift, a new generation of digital flyaway and vehicle-mount SNG systems. Other Advent products also making debuts are C Band MANTIS, C-band flyaway; NOMAD, cabin-based satellite uplink systems; MIGRA, lightweight trailer-based satellite uplink systems, and the AVR 2950, satellite video receiver.

Advent will also display its VSAT and DAMA systems and LYNX range of fully integrated satellite newsgathering vehicles.

RF Industries will feature its universal flush-mount wall plate system to connect telephone, cable TV or local area networks. **Cole Wire & Cable Co.** will introduce high-voltage transmitter cable.

LDL Communications will show its

Low Windload Spearhead FM CP antennas and FM band pass combiner, both of which are designed for use in multistation operations. Also on display will be LDL's FMAC series FM broadcast circularly polarized antenna.

Electronics Research Inc. (ERI) will display its side mount FM antennas in circular, vertical-only or horizontal-only polarization; master, multi-stations antennas, filters and combiners, and its Lambda antenna mounting systems for increased predictability of antenna pattern gain.

Details were unavailable at press time, but **Kintronic Labs Inc.**, **Will-Burt Co.**, **Utility Tower Co.**, **Shively Labs**, **MYAT Inc.**, **Cortana Corp.** and **Central Tower Inc.** are also scheduled to appear at the 1994 NAB equipment exhibition.

AUDIO PROCESSING**New Processing For Just the Right Sound**

LAS VEGAS This is one of those chicken or egg questions. Which is more important to a radio station—sound or programming? Perhaps one is no more important than the other. Would you venture out on a limb and say they're on equal footing?

But if developing the sound for your station is your job, the exhibit floor is the place to shop for the latest gear and the most recent upgrades for the wide variety of audio processing equipment on the market.

Cutting Edge will introduce the Unity AM processor and demonstrate the Unity 2000i FM processor. Also on display will be the new VIP-1 programmable voice processor. Other products Cutting Edge will show includes the Dividend Composite Filter that provides full spectral protection, including RBDS and other SCA signals.

Inovonics will demonstrate its line of signal processing equipment, including the Model 530 FM Modulation Monitor, the "Sentinel" all-mode diagnostic receiver, and the "David" FM processor/stereocoder.

From **Dolby**, on display will be the Model 740 Spectral Processor for broadcast and post-production audio processing.

UREI will exhibit the LA Series of compressor/limiters and the Platform Modular rack-mount signal processor with a new delay module.

Circuit Research Labs (CRL) will show the Amigo AM audio processing system for C-QUAM AM stereo. CRL said that if you plan to go stereo but need to improve your processing now, the Amigo AM will maintain your station's mono loudness and coverage.

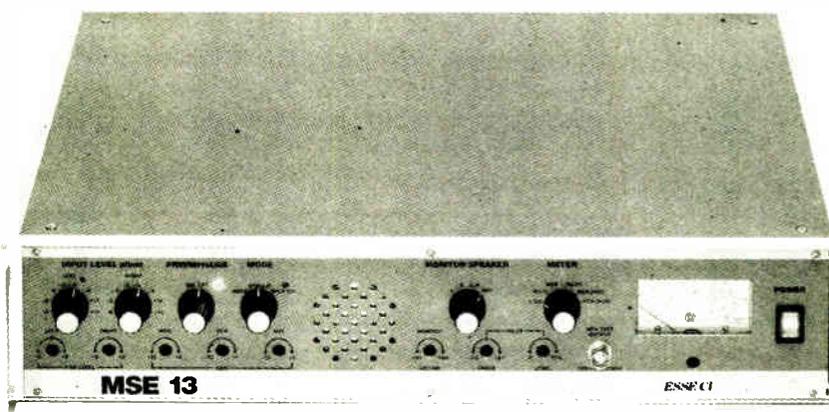
FM Systems will exhibit the ALM771 Audio Level Master. It regulates audio program levels so that the sound volume as perceived by the human ear will be consistent even when the source material differs in amplitude by as much as 25 dB.

Among its line of broadcast equipment, **Sony** will introduce the HR-MP5 multieffects processor.

Products from the **Mark IV Pro Audio Group** include the 500 Series of compressors and gates from Klark Teknik and its programable stereo graphic equalizers.

Symetrix will introduce the 528E Voice Processor to replace the 528. Improvements include improved gain reduction metering, a rugged "E" series chassis, program-adaptive compressor and expander release times, and easy-access rear panel patching.

Simply perfect



STEREO ENCODER MSE13

Professional Stereo Encoder, specially designed to comply with specifications of government broadcasting authorities and able to meet the requirements of professional broadcasting at any level.

It is not a chance that this apparatus shows characteristics which may not likely be found in other apparatus of same price: besides the indispensable RH and LH channel inputs, it features 3 fully independent auxiliary channels, 3 separate multiplex outputs and one pilot frequency synchronization output for a possible RDS generator.

Further technical data: S/N >90dB;

Distorsion <0,01%;

Audio passband 20Hz ÷ 15Hz ± 0,1dB;

Crosstalk between channels >70dB.



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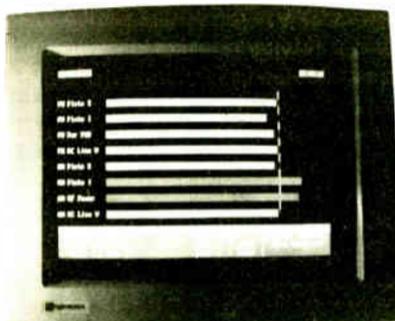
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Who's running the ship?

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.

But wait. There's more!



Introducing AutoPilot™ from Burk Technology.

AutoPilot is break-through computer software that makes automatic operation of your studio/transmitter facility a dream come true.

- Automatic power changes
- Automatic pattern changes
- Automatic site changes
- Automatic power trim
- Automatic fault recovery
- Automatic logging

Now your imagination is the only limit.

The new FCC fine schedule is imposing. Why risk a big penalty when AutoPilot can help you stay within the rules?

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and a FREE DEMO.

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See Us At NAB Booth 4818

RF EQUIPMENT

Solid State FM and Digital Exciters Top Bill In Crowded Hall of Transmitters and RF Gear

LAS VEGAS RF and transmission gear will flood the NAB 1994 equipment show, offering everything from gadgets to the guts of station operation.

Harris Allied's RF offerings will include the new Harris Quest 1 FM transmitter, a compact 1,000 W FM unit featuring all solid state broadband design.

Also on hand will be the Harris Platinum Series PT 10FM transmitter with DIGIT digital FM exciter; the DIGIT itself, which combines digital and solid state technologies; the Harris DX 20 and DX 100 digital solid state AM transmitters; Harris AMS-G1 C-Quam stereo exciter, and Harris HT 10FM and HT 25 FM transmitters.

Broadcast Electronics will feature among new products the FM-3C 3 kW solid state FM transmitter; D.A. Box digital audio storage system, and AV-100 networked digital audio storage system. BE also will display the FM-1C 1 kW solid state FM transmitter; FM-30B 30 kW FM transmitter; AM-5 5 kW AM transmitter, and RBDS equipment.

From **Circuit Research Labs (CRL)**, participants can see the DAA-50 digital audio analyzer, designed at low cost with features to identify digital audio signals, determine their integrity, be easy to use and highly

portable. Also on display will an upgraded version of the Amigo AM audio processing system for C-QUAM AM stereo; the RBDS-SC-100, and CRL's real-time Event Sequencer.

Modulation Sciences will feature the new RDS/RBDS data receiver and a software upgrade for the Model RDS-1 RDS/RBDS encoder. Also on display will be the FM ModMinder, StereoMaxx spatial image enlarger and the CP-803 composite processor.

Cutting Edge Technologies will demonstrate the new Unity Remote software, which enables transmitter processing control from anywhere by modem. The company also will introduce the Unity AM processor and demonstrate the Unity 2000i FM processor. Also new is the VIP-1 programmable voice processor.

Bext will show the new SF Series solid state MOSFET FM amplifiers, from 100 to 1,000 nominal output, and the LEX 25 programmable FM exciter with continuously variable output power of 0-25 W.

Continental Electronics promises new products at NAB, along with its line of AM and FM transmitter, FM antennas and associated RF equipment.

CCA Electronics will demonstrate AM,

FM and shortwave broadcast transmitters, and display its high-performance 60 W FM exciter.

Altronic Research will show the Model 67150 150 kW megawatt air-cooled dummy load for the first time at NAB, as well as a processor-based calorimetry system for air or water systems, and an assortment of Altronic 6700 Series of air-cooled loads and 9700 water-cooled loads.

DB Elettronica will show a new version of the TD4/16 16-bit digital coder for 4x15 kHz; and the RD4/16 16-bit digital decoder for 4x15 kHz. Also on display will be the Vivaldi digital stereo coder; PE 21 0-22 W out FM exciter, and the PM 100/PM 250 100 W/250 W out FM exciter.

Inovonics will demonstrate its entire line of audio recording, signal processing and instrumentation equipment for broadcast. Featured will be the Model 530 FM modulation monitor, Sentinel all-mode diagnostic receiver and David FM processor/stereo coder. An operational RBDS display also is planned.

J.N.S. Electronics will display its D-Mux 500 Series stereo or mono audio multiplexing systems using full 16-bit technology for multiple 15 kHz, 7.5 kHz or 3 kHz audio feeds, and RFL-700 Series 1.5 to 2.3 GHz digital microwave link for the D-Mux. Also at the show will be the 8000 Series Frame modules for audio and video amplification and distribution, audio monitoring, audio switching, audio test, RF demodulation, off-air reception and program changeover functions.

QEI Corp. will introduce the Model 675-B FM exciter. Also on display will be the Automod closed loop Automatic Gain Control for FM, and solid state and single tube FM transmitters at power levels from 10 W to 30 kW.

Richardson Electronics Ltd. will offer RF transistor pallets, directional couplers, unilator capacitors, along with numerous transistors and a variety of miscellaneous RF products.

Telos Systems will display the Zephyr digital audio network transceiver. Zephyr is capable of transmitting bidirectional 15 kHz stereo audio over a single ISDN line. It also is appropriate for Switched 56 and other digital audio links. The Telos range for the broadcast-to-telephone interface also will be demonstrated, including the Telos 100 Delta, the Link, the One plus One and Call Screen Manager software.

RE America will display the RE 532 RDS/RBDS encoder, a full-featured unit in a stand-alone 1U rack-mountable chassis.

The new **Nautel NE50** digital FM exciter will further enhance the performance of solid state Nautel FM exciters. The exciter uses direct digital synthesis to generate the modulated FM carrier. The company also will exhibit a full range of Ampfet Series AM and FM solid state transmitters featuring high-efficiency modular redundancy and on-air serviceability.

Energy-Onix will display the SSA/SST Series of low-power solid state FM trans-

continued on page 50 ▶



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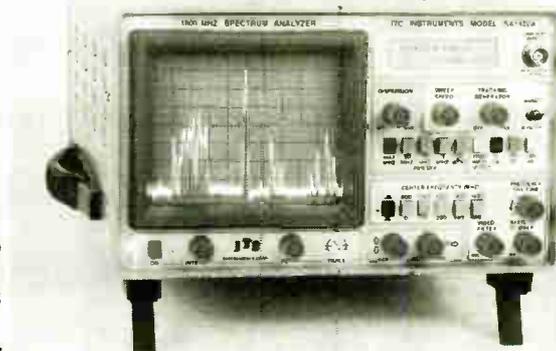
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READER SERVICE NO. 93

CONSOLES

Custom Configuration, Hard Disk System Interfaces Among Top Console Features

LAS VEGAS As you roam the NAB exhibit floor in search of new consoles next month, take note. There are a number of introductions you won't want to pass by.

Be sure to stop by the Sony booth for a look at the new MXP-700 audio production console. It's available in three frame sizes—the MXP-716, with 16 positions in which modules can be installed; the MXP-728, with a 28-position frame, and the MXP-744, with a 44-position frame. Surface mount component technology allows for a very compact console.

Users may custom-configure the MXP

console by selecting from 20 available soup-to-nuts options, including a dynamics module to provide assignable dynamics processing (such as a limiter/compressor); multiple "clean feed" outputs; an automatic power supply switch-over unit; a VU meter, and a console stand. Completely configured, an MXP-716 will sell for about \$28,000, and an MXP-744 will sell for about \$60,000, according to Product Manager Karl Kussmaul.

Digital control

Another console Sony plans to show is the DMX-E2000, with digital audio

sound quality and 10 stereo inputs. The unit carries a price of about \$17,000.

Sony will have the DAE-D5000 digital audio workstation, using the PCM 9000 for storage. Although it is a high-end editing system aimed at pre-mastering and mastering houses, the technology is certainly worth a look.

Auditronics promises its new Destiny 2000 Program On-Air Management console and computer, designed to be used in conjunction with hard disk storage systems such as Computer Concepts' DCS system and multi-player jukebox technology. It offers complete control of both music and traffic log systems, combining them into one on-air management system in a "live-assist" situation. The console can also operate in auto mode, operating from satellite sources or in "auto."

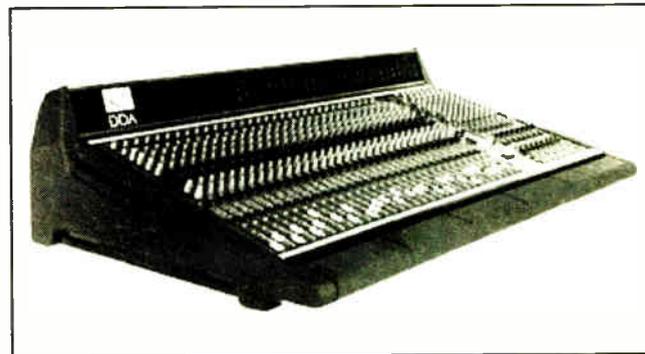
The company will also bring along its established product line, including the AirMaster 90 on-air console, the 210, 800 and 850 Series on-air consoles, and the 1900 Series IFB/mix-minus system.

Ward-Beck will be on the floor with its new Renaissance Radio Console Series. The Renaissance is automation-ready for live assist broadcasting. Features include illuminated electronic switching throughout; digital shaft encoder controlling monitor VCAs;

modular design, and three standard frame sizes (for eight, 16 and 24 modules). Those placing orders by March 31 will receive an M405P portable extended range VU meter.

Wheatstone will display what it calls its finest radio console, the A-6000. Users can customize the console with a family of more than 125 input module combinations. Features can include a built-in routing switcher with individual alpha channel displays; Wheatstone's own "Bus-Minus" system; four mix-minus busses; logic-controlled program and mix-minus busses; stereo and mono send controls, and an equalizer option.

One of the A-6000's best options is



DDA Q11 Console

that it has no options: all module slots are configured exactly the same, so any module can be plugged into any slot.

Mixing

Logitek Electronic Systems will show a host of new products, including its continued on page 48 ▶

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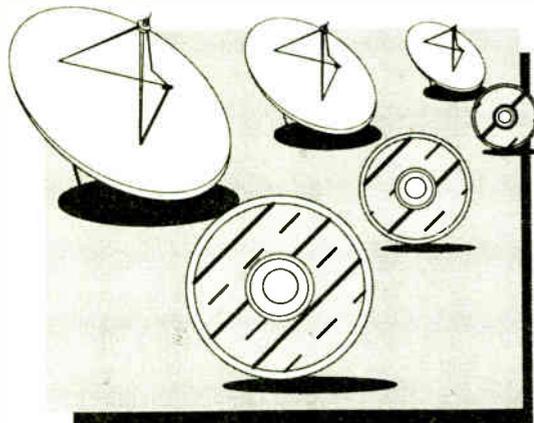
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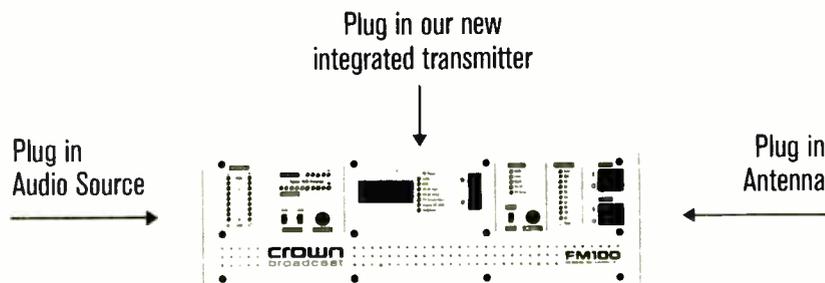


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World Radio History

CONSOLES

Consoles with New Functions Set for NAB Debut

► continued from page 46

four-channel automated mixer, the Crossfire II, that provides local or remote control of levels and crossfades. Its RS-232/422 port accepts ESAM-2 commands. The established Mariner on-air modular console will also be displayed.

Among the new products from the Mark IV Pro Audio Group will be the DDA QII console, a true LCR (left, center, right) console with choice of eight mono groups, eight stereo groups or four true LCR outputs.

Soundcraft plans on several product introductions, including the Series IOS

live-on-air mixer, Series 30 live-on-air/production mixer and Spirit Studio LC console. (Details were not available as of press time.)

The MXE Series console will be featured at Fidelipac's booth. It provides up to 18 channels.

Neotek Corp. will display its Esprit Series console system, offering eight auxiliary busses and a mix-minus from every input module. Features include live mic sensing, fader switch logic and a talkback/return talkback system.

Pacific Recorders & Engineering Corp. will bring its full line of consoles

and other products.

Bradley Broadcast Sales announced it will be the exclusive exhibitor of the Audioarts line of broadcast mixing consoles for on-air and production studios, including the A-50 air board, the low-cost R-10 and the MR-40 production/air mixer.

Graham-Patten Systems will show an enhanced version of its D/ESAM 800 digital edit suite audio mixer, with an improved processor board allowing for 18-bit analog and 20-bit digital signal paths; an improved audio delay function for delay up to 16 frames per channel, and processing loop module for four

AES/EBU digital outputs and four digital inputs.

Audio Technologies Inc. will show its established Vanguard Series on-air, mixer/dual stereo consoles, available with six, eight and 12 outputs.

New products scheduled for display by Audio Developments Ltd. of England include: ADO66-12 line level MS/AB converter, a portable monitor and insert system; ADO66-13 Flex EQ four-band parametric equalizer; AD146, a portable pro mixer, available in six-12 inputs and four outputs, and AD261 MS-compatible, four-input mixer.

Audio Developments established products for display include its complete line of Port A Flex limiters and stereo mic pre amps, as well as: ADO62 and AD145 edit mixers; ADO81 Flexilink mixer, and AD150 studio racks.

Another British company, Penny & Giles Studio Equipment, is introducing the VCA16 audio control module, the second in the company's new venture into digital gear. The VCA16 offers 16 channels of VCA audio with full MIDI capabilities.

PRODUCTS & SERVICES

New Formats and New Digital Sound Packages Will Fill the Halls

LAS VEGAS In an effort to keep up with the growing demands of radio and production, a number of companies will have programming and automated services on hand at this year's NAB.

OMNIMUSIC will feature the OMNIMUSIC Sound Effects Library offering 12 digitally-recorded compact discs, a complete cross-referenced index, a computer search program, and a library organized by location or application (such as "Around the House" or "On the Road"). In addition, each disc contains "environments" or ambient atmospheres pertaining to the title.

Broadcast Programming will hit the ground running with a number of new offers. Digital AC Christian is an up-tempo Adult Contemporary Christian format available on CD; Chartbreakers is a monthly compact disc with Adult Contemporary hits, and DigitalLease is a package of digital automation equipment.

Valentino Production Music and Sound Effects Library will show its Sound Production Libraries, including the Music Library with over 75 CDs and the Sound Effects Library with over 50 CDs. New this year are collections in the CD-ROM Multimedia format for IBM, Windows and Mac formats. The company will offer its collection on computer for audition purposes at the booth.

TM Century will unveil its TM Mix and TM Country GoldDisc libraries; its Ultimate Digital Studio II with full audio control (set for delivery this spring); the Slam Dunk production library; jingles, including "We Play the Hits" and "Ridin' with KSCS;" TM Century Television customized spots; PowerPlay music scheduling software, and TM Comedy Network.

Sound Ideas will show its Ambience II Series 7000, containing 325 contemporary atmospheres on 14 CDs; the Mix Broadcast Music Library; the Warner Bros. Sound Effects Library, and the Hanna-Barbera Sound Effects Library.

Two items slated to be hot at the Radio Express booth are HitDisc E, a weekly compilation of breaking European hits and

continued on page 50 ►

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We'd like to introduce you to Mackie... even if we do probably seem like a wet-behind-the-ears newcomer compared to some manufacturers. We've been around six years now. During that time we've gained a serious reputation for building high-value, trouble-free mic/line mixers.

Mixers with legendary headroom, ultra-low noise and unique features that make using them easier.

Mixers so good that they're regularly used to create major label compact discs, feature movie soundtracks, and more commercial production work than you can shake an RE20 at. For example, our CR-1604 16-channel mic/line mixers are used nightly on the Tonight Show, Arsenio Hall, Conan O'Brian and David Letterman Shows¹.

Our mixers have also covered hundreds of thousands of miles with acts like Peter Gabriel, Madonna, Whitney Houston, Paula Abdul, Bruce Springsteen, Reba McIntyre, Alabama and Michael Jackson¹. Compared to the relative security of a station production room, a six-month world tour is about the most brutal test that any electronic component can go through. Our mixers have a reputation for being bullet-proof on the road — even when loading dock mishaps and power surges have taken out everything else in the same rack.

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

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

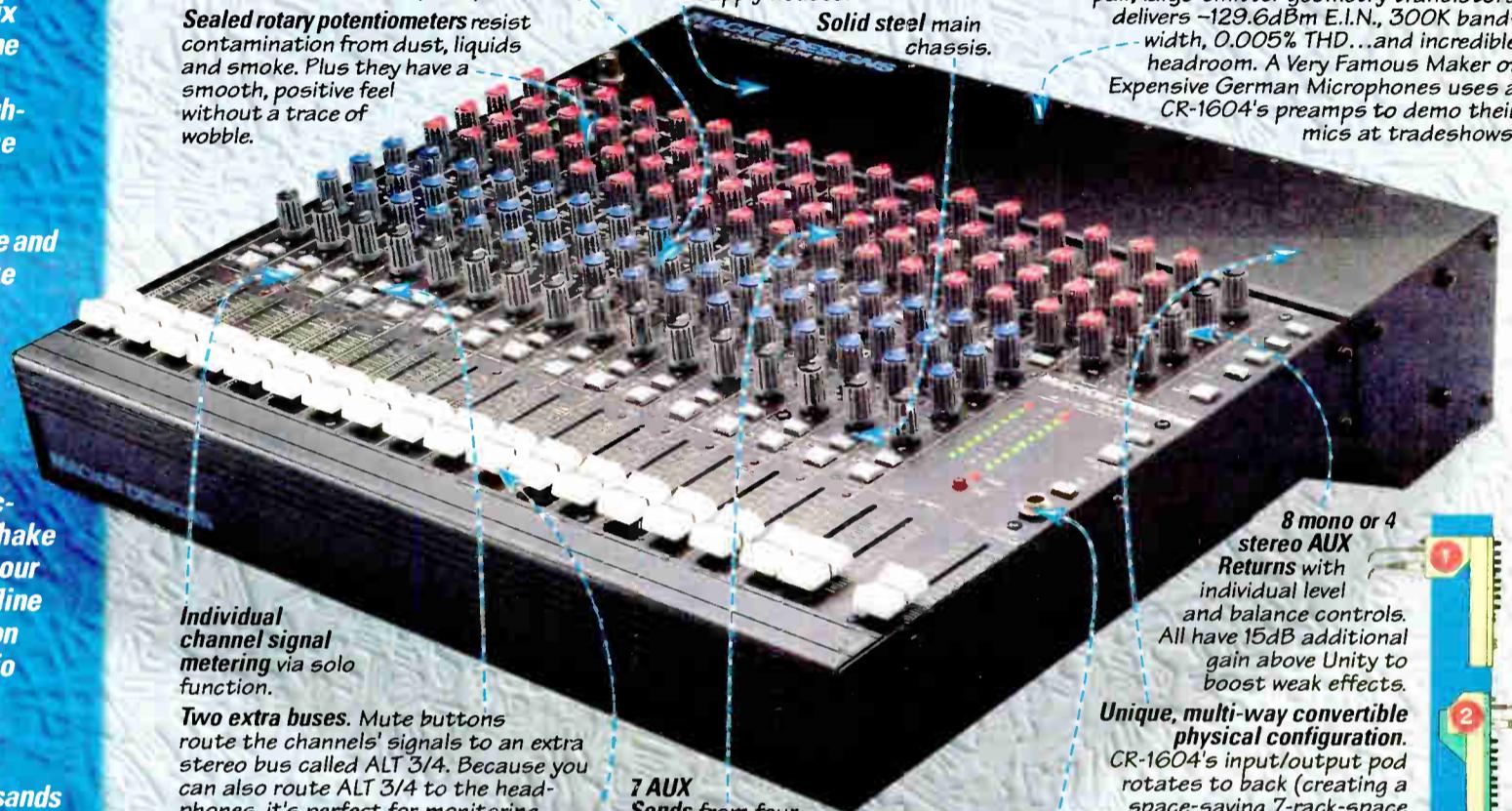
If you are conservative, keep an eye on us, anyway. We want your business even if we have to wait five years.

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

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

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UnityPlus gain structure gives high headroom and low noise at the same time. Set the fader to center-detent Unity Gain, press channel solo to monitor the channel via the CR-1604's LED meters, adjust the input trim ONCE, and you're ready. Because there's 20dB MORE gain available on the fader, you

won't need to constantly re-adjust the trim.

Maximum RF protection. Most compact mixers use plastic jacks that transmit RF to the main circuit board where it's re-radiated and picked up by anything that rectifies (A). The CR-1604 uses metal jacks and washers plus a shunting



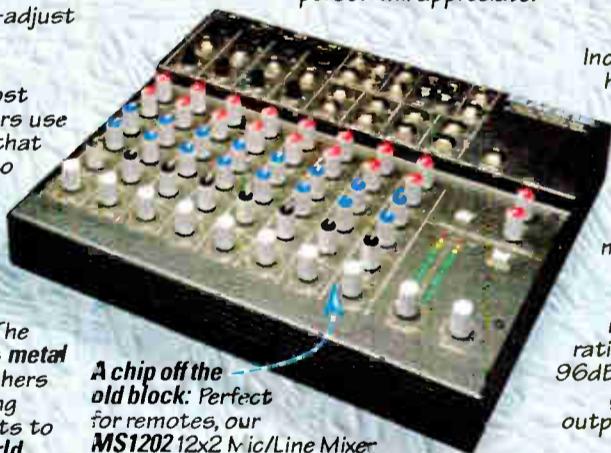
capacitor to de-rail RF before it gets to any circuit traces (B). A *Radio World* reviewer tested a CR-1604 on a transmitter hill with 3 VHF TV and 1 FM sticks plus several microwave repeaters and shortwave transmitters. When he plugged in a notoriously RF-prone microphone, he detected NO RF.

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

Solid steel main chassis.

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

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



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

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

Unique, multi-way convertible physical configuration.

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

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

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



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² Price is slightly higher in Canada.

RF EQUIPMENT

Where to Discover the Finest in New RF Gear

► continued from page 44

mitters from 100 to 500 W; the Legend Series of medium-power solid state FM transmitters from 1 kW to 5 kW, and the MK Series of grounded grid triode tube FM transmitters in powers from 1.5 kW to 50 kW.

Dataworld will offer its full line of services, including AM, FM and wireless cable databases, customized maps, directories, allocation and interference studies, population counting, FCC Flag service, terrain elevation retrieval, FM and TV area-to-locate studies, AM daytime and nighttime channel studies and unused call sign listings.

Varian Associates will promote its power grid tubes for AM, FM and shortwave radio and will offer a new service—remanufacturing of power grid tubes for radio transmission.

Larcant-TTC will show the FMS4000 4 kW solid state FM transmitter and FMS100 100 W solid state FM transmitter, among other products.

Econco will feature its high-quality rebuilt power tubes and klystrons for radio and TV transmitters.

Superior Electric will feature the WHR Series Stabiline Automatic Voltage Regulators, high-power units that correct wide fluctuations in input voltage that can cause damage to components. The company also will have its full line of power pro-

tection products, including uninterruptable power supplies, power conditioners, transient voltage suppressor/RFI filters and automatic voltage regulators.

Itelco will offer its new FM exciter-transceiver with output power from 100 W to 250 W. Features include a MOSFET amplifier; ultra-broadband working for OIRT and CCIR standards in the range of 50+120

MHz, and Automatic Power Control.

Elenos will show the SF Series of amplifiers, based on MOSFET solid-state technology. It features compact design, ease of maintenance, high output power, stability, output protection and the company's "Smart protection system." Also on hand will be exciters, radio links, filters, combiners, aerials and RF diagnostic gear.

PRODUCTS & SERVICES

Program Services Give Stations More Choices

► continued from page 48

alternative rock, and Weekly Programming, featuring American Top 40, Hot Mix, American Gold and American Country Countdown.

Manhattan Production Music will introduce new releases from Chesky Records Classical Series and MPM 49 High Energy Rock III.

New in 1994 for **Halland Broadcast Services** is the "Halland Country Hits" CD music library, a 461-song compilation of the best contemporary country hits from the 1980s and 1990s. Also new is "The Nineties" AC/CHR library update featuring more than 75 songs of 1993. A number of the established libraries will also be on display.

Energetic Music Inc. will introduce its EZ-1 Easy Listening #1 Light middle-of-the-road background music, Jewish Party Volume I, Jewish Party Volume II and 427 Sound Effects.

Capitol/OGM Production Music will display its production music for contemporary markets in broadcast, film, cable, home video, satellite programming, CD-ROM and electronic publishing.

FRESH/The Music Library will show its line of music libraries, and **Focal Press** will have its broadcast- and communications-related publications at the show.

Finally, **International E-Z Up Inc.** will display its instant shelters, which can be set up in less than 60 seconds.

Morgan's Contributions

► continued from page 36

From the broadcaster's standpoint the most important issue before the NRSC is DAB. A very exhaustive system of tests is presently under way at the NASA Lewis Research Center in Cleveland. Seven systems will undergo identical laboratory and subjective listening tests conducted jointly for the NRSC and EIA subcommittees. Once testing is completed, the NRSC will analyze and evaluate the data for all in-band/on-channel systems and, if appropriate, recommend a standard for the United States. Only the NRSC will evaluate the three FM systems and the single AM system that are considered in-band/on-channel. The three remaining systems that use satellite, new band and adjacent FM channel delivery systems will be evaluated in a similar manner by a separate committee of the EIA. If all goes well and there are no roadblocks or unanticipated delays, we could

have recommended standards by early 1995.

RW: Are there other new technologies on the horizon that can enhance radio's technical quality?

Morgan: I guess. I consider DAB to be still on the horizon because it is not here yet. I don't question the technical feasibility of any of the various systems proposed. The real question is: Are they practical, economically feasible and how do they fit in the overall spectrum plans of our government? For the FM broadcast, in-band/on-channel is the perfect answer to providing enhanced quality for existing facilities without requiring new spectrum. For the AM broadcaster, DAB offers the most dramatic improvement, which, if successful, will truly be the rebirth of AM.

It is hard to imagine enhancements beyond DAB for radio, but as long as there are people with ideas, there will be new technologies on the horizon.

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Exhibitor Directory

The 1994 Exhibitor Directory is a listing of information provided by exhibitors who responded to an RW NAB questionnaire. Past and potential NAB exhibitors were asked about new and established products scheduled to be shown at NAB this year. Questionnaires returned by the deadline are included here. TBD for booth number means a booth assignment had not yet been made.

COMPANY BOOTH #

360 Systems 5420

Introducing: The DigiCart/TC, a random access digital audio hard disk recorder designed for SMPTE time code synch applications between video and audio.

Also: The DigiCart II digital audio recorder and the A16/B audio routing switcher.

Contact: Doug Leighton, Marketing Manager
18740 Oxnard Street
Tarzana, Calif. 91356
818-342-3127

3M 16605

On display: The 908 analog recording master tape for Nagra recorders, featuring 75 dB signal-to-noise ratio, and line of recording media.



A-Ware Software 5120

On display: MusicMaster music and scheduling maintenance system, which interfaces with almost any automation and traffic system. Also Closeline, a school and business closing management system.

Contact: Scott Wirt
A-Ware Software, Inc.
22600 Arcadian Avenue
Waukesha, WI 53188
414-521-2890

Acoustic Systems 12807

On display: Modular broadcast/recording enclosures including the BB/Econoline and BB/Proline series of voice-over booths.

AEQ 2300

On display: The Management of Audio Systems (MAR) digital audio workstation and storage device. Company line of studio gear, including power amplifiers, audio monitors, consoles, portable mixers and telephone hybrids.

Contact: Gerard Vargas
AEQ
2211 South 48th Street, Suite H
Tempe, AZ 85282-1008
602-431-0334

Akai 4602

On display: The DR4d self-contained four-track hard disk recorder and DD1000i re-writeable magneto optical recorder, both now utilized in broadcast and radio production environments. Other products will include the S-Series of digital samplers.

AKG/Orban/dbx 2806

Introducing: The Orban DSE 7000 digital audio workstation and the Optimod-FM 8200 digital processor. AKG's new C3000 microphone, designed for radio announcers, also will be in the booth.

Contact: Amy Herndon
1525 Alvarado St.
San Leandro, CA 94577
510-351-3500

Altronic Research 2700

Introducing: The model 67150 150 kW medium wave, air-cooled dummy load, processor-based calorimetry system for air or water systems, and the Model 6700 and 0700 series of dummy loads.

Contact: Doug Starkey
P.O. Box 249
Yellville, AR 72687
501-449-4093

Andrew Corp. 15674

On display: The MR-050 Series DryLine Dehydrators, SD-002 Series Static Dessicators, IEC connectors for HELIAX, VALUFLEX HELIAX jumper cable assemblies, and 3M Cold Shrink weatherproofing kits.

Contact: Bobbi Rick
10500 W. 153rd St.
Orlando Park, IL 60462
800-255-1479

Aphex Systems 3924

Introducing: Expander Gate Model 622, featuring Logic-Assisted Gate circuitry. Four-channel Logic-Assisted Gate Model 105, featuring VCA 1001 for pristine audio quality and high-speed performance. Easyrider four-channel compressor Model 106.

Also: Audiophile AirChain, including the Compellor Model 320, aural exciter type C2 with Big Bottom Model 104, Dominator II Model 720 and Digidocder. Full line of professional audio processing equipment.

Contact: Chrissy McDaniels, Sales Coord.
11068 Randall St.
Sun Valley, CA 91352
818-767-2929

Arrakis Systems 2412

Introducing: MixStar consoles, including the 22,000 20- and 30-input modular consoles; the 1,200-5S compact, five-input console; 1,200-10-S 10-input console; and the 1,200-TRT four-channel turret for news/talk operation. Deskstar furniture line.

Also: DigiLink digital audio system. TrakStar digital audio editor. 12,000 Series consoles.
Contact: David Burns
214 South 19th St.
Richmond, IN 47374
317-935-7087

ASACA 16619

On display: Audio analyzers, switchers, magneto optical recorder and other audio equipment.

ATI 13603-13604

Introducing: The Nanoamp Series of low-cost utility amplifiers, which includes expandable mixers, microphone, and line amps. Also: The MicroAmp and Encore Series of amplifiers.

Contact: Ed Mullin
328 W. Maple Avenue
Horsham, PA 19044
215-443-0330

ASC Audio Video Corp. 19753

Introducing: The Virtual Recorder, a digital random access replacement for VTRs, in combination with commercial spot insertion systems and audio workstations.

Audi-Cord Corp. 3926

On display: Full line of DL Series NAB cartridge machines, available in either mono or stereo configurations. Dual recorder reproducer for simultaneous recording or cartridge copying.

Contact: Andy Rector
1845 W. Hovey Ave.
Normal, IL 61761
309-452-9461

Audio Accessories 13041-13042

The company will show its audio panels, jacks, patch panels and cords.

Audio Developments 16125/16225

Introducing: The ADO62 and AD145 location and edit mixers, AD081 Flexi Link Systems and ADO150 Series 19-inch 1U studio rack equipment.

Audio Precision 3402

Introducing: An improved bit-rate digital encoder/decoder testing software.

Also: The Systems One, System One Plus DSP, and Portable One Plus.

Contact: Tom Minter
P.O. Box 2209
Beaverton, OR 97075-3070
800-231-7350

Audio Services 4506

Introducing: The DK Audio MSD-550 Master Stereo Display.

Also: The Fostex PD-2 portable DAT, and TASCAM DA-88.

I COULD HAVE BOUGHT A DIGILINK!

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

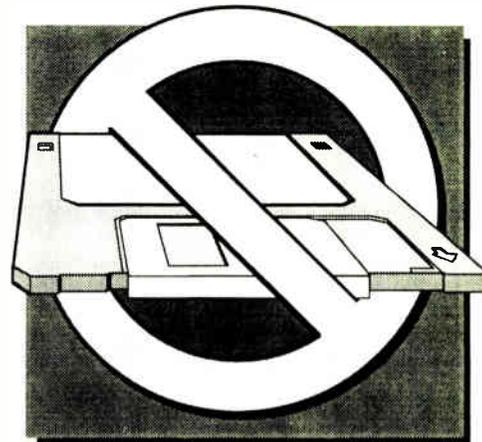
A DigiLink workstation stores audio on an internal hard disk and comes out of the box with a capacity of 547 one minute, stereo carts for only \$7,995. Even better, the DigiLink hard disk has an average 15 year life. Imagine how many floppies you will break, wear out, lose, and replace over 15 years.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

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

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

(303) 224-2248

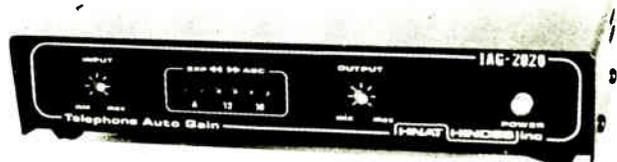
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APT 4306
Introducing: The Pro-link, which combines an ISDN terminal adapter with six channel I-MUX. Also: The DSM100 digital audio transceiver, ACE 100 Series of PC and Macintosh expansion cards, and X-console.
Contact: Steve Cheung
Edgewater Road
Belfast BT3 9JQ
Northern Ireland
0232-371110

Audiopak Inc. 4018
On display: NAB standard continuous-loop audio carts, including A-2, AA-3 and AA-4 for the recording and broadcast of spots, jingles, announcements and music. Lubricated audio tape for use in all types of endless loop cartridges and cassettes, including Formulas 605, 613 and 614.
Contact: Gordon Stafford
P.O. Box 3100
Winchester, VA 22604
703-667-8125



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Auditronics 2302
Introducing: The Destiny 2000 on-air management console for use with hard disk storage. Also: The Airmaster 90 on-air console, 210 Series, and 800 series.
Contact: Murray Shields
3750 Old Getwell Rd.
Memphis, TN 38118
901-362-1350

Autogram Corp. 4520-2
On display: MM-8A and MM-12A low-cost 8 slide pot audio console. PM 1032, part of the Pacemaker Series of 6, 8, 10 and 16 slide pot consoles. R/TV-20 top-of-the-line slide pot audio console.
Contact: Ernest T. Ankele Jr.
1500 Capital Ave.
Plano, TX 75074
800-327-6901

AVCOM 11607
Introducing: The BNG-1000A broadband noise generator that can be used with spectrum analyzers. Also: The GAE-1575 GPS antenna extension.
Contact: Charles Odom
500 Southlake Blvd.
Richmond, VA 23236
804-794-2500

b

BASYS Automation Systems 19247
Introducing: The NetStation for Windows, a PC-based newsroom system workstation. Also: The D-Cart digital audio record, edit and playback system.
Contact: Kristin Schleiter
5 Odell Plaza
Yonkers, NY 10701
914-376-4800

Belar 2508
Introducing: A new digital FM stereo monitor analyzer. Also: The Wizard modulation monitor and company's established line of products.
Contact: David Hirsch
119 Lancaster Avenue, P.O. Box 76
Devon, PA 19333-0076
610-687-5550

Benchmark Media Systems 11059
On display: The Jr. Audio Director Plus, an eight-input, two-output monitoring device; RGM-10 remote gain and metering control, AudioWorld Interface, MDA-101PA microphone preamp, DA-102M and DA-111 and DA-112 stereo distribution amplifiers.
Contact: Rory Rall
5925 Court Street Road
Syracuse, N.Y. 13206-1707
315-437-6300

BEXT 2414
Introducing: The SF Series of solid state MOS-FET FM amplifiers from 100 to 1000 watts, and the LEX 25 programmable FM exciter. Also: The line of FM amplifiers and STLs.
Contact: Dennis Pieri
739 Fifth Avenue
San Diego, CA 92101
619-239-8462

beyerdynamic Inc. 11315
Introducing: DT 190 sportscaster headset/microphone combo. DT 150 monitoring headphone. MC 834 large diaphragm condenser microphone for on-air voice work. MEM 86 set shotgun microphone system. MCE 50 Series miniature clip-on microphones. M424 control room talkback microphone. VHF and UHF wireless microphone systems. NE 700 TE2 two-channel diversity receiver.
Also: RR 7000 TG 12 12-channel UHF diversity receiver. NEM 191 and 192 neck-worn mics. Complete range of professional microphones and headphones.



Benchmark's Jr. Audio Director

Bradley Broadcast 4002
On display: The Telos Zephyr digital transceiver that uses ISDN lines, and the Telos One-x-Six Talk Show System, a digital hybrid six-line phone/console system. Other products will include Digidesign's Session 8 digital studio and the Audioarts line of broadcast mixing consoles.

Broadcast Electronics 3424
Introducing: The FM-3C 3 kW solid state FM transmitter, the D.A. Box digital audio storage system and the AV-100 networked digital audio storage system.
Also: The FM-1C 1 kW solid state FM transmitter; FM-30B 30 kW FM transmitter; AM-5 5 kW AM transmitter; RBDS; MT-90 12-channel console; AT-90 12-channel console; AV-100 digital audio storage system; CORE automation system; Sentry automation system and VMC-16 voice remote control system.
Contact: Kim Winking
4100 N. 24th St.
Quincy, IL 62301
217-224-9600

Broadcast International 17582, 17682, 17782
No information available at press time.

Broadcast Marketing International 19328-19329
New products to be displayed are: Kobold ENG 200 compact lighting system and Noriyuki time code equipment.

Broadcast Supply Worldwide 4820
On display: The Arrakis DigiLink and TrakStar systems as well as the KORGE and DigiDesign digital workstations.
Contact: Tim Schwiager
7012 27th Street West
Tacoma, WA 98466
800-426-8434

Burk Technology 4818
Introducing: Software options for the ARC 16 transmitter remote control system.
Also: The LX-1 six-input stereo selector.
Contact: Phil Halter
7 Lomar Drive
Pepperell, MA 01463
508-433-8877

e

Cablewave Systems Inc. 15753
Introducing: Cablewave broadcast antenna pattern computer software for pattern viewing with database of product information. N and 7/16 DIN series cable connectors with improved water blocking design.

Also: Flexwell air and foam coaxial cables. Cablewave BU series of side-mount and top-mount broadcast antennas. Rigid line coaxial cables. CP-1000 and HP-1000 FM antennas.

California Amplifier 15383-5
Contact: Tom Ellsworth
460 Calle San Pablo
Camarillo, CA 93012
805-987-9000

Capitol/OGM Production Music 12905
On display: A full line of production music for contemporary markets including the new Archives line.

CBSI 1624
Introducing: Broadcast accounting and traffic department software including Design Financial reports, Custom Reports and PowerPlus. Also: The Classic and Elite Traffic and Billing systems, as well as the InterAcct. software.

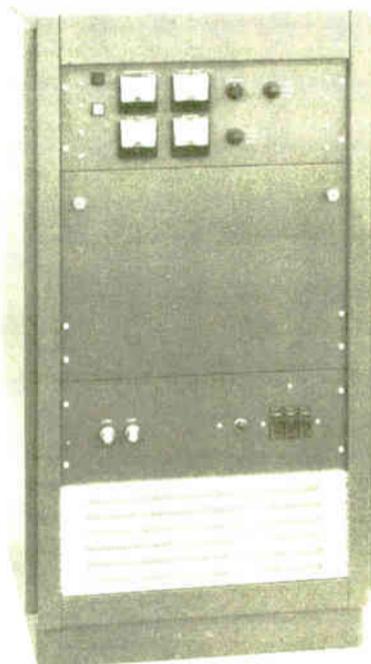
CCA 4220
On display: The full line of AM, FM and short-wave broadcast transmitters as well as company's 60 watt FM exciter.
Contact: Steve McElroy
360 Bohannon Road
P.O. Box 426
Fairburn, GA 30213
404-964-3530

Central Tower 1906
On display: Antenna support towers, guyed towers and welded sections.

Clark Wire & Cable 19537-8
Introducing: Clark 1300 Series audio snakes. Hannay cable reels.
Also: Bulk audio and video cable and connectors. Remote composite cables, patchbays and terminated reels. OEM custom terminated cable assemblies and harnesses.
Contact: Julie Clark
151 S. Pfingsten Rd., #B
Deerfield, IL 60062
708-272-9889

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World Radio History

Clear-Com Intercom Systems 18015
On display: AMS-1022 stereo audio monitor. Wired and wireless two, four, eight and 12 channel partyline intercom systems. Pro-40 lightweight headset product line. Matrix Plus II digital 100x100 central matrix intercom system.

CRL 3015
On display: The DAA-50 digital audio analyzer, a digital audio interface tool for analysis and decoding of AES/EBU and consumer digital audio signals. Other products include RBDS-SC-100 generator and the Real Time Event Sequencer.

Coaxial Dynamics Inc. 5116
Contact: John R. Ittel
15210 Industrial Pkwy.
Cleveland, OH 44135
216-267-2233

Cole Wire and Cable 10759 & 10859
On display: Cable and wire for audio and video. High voltage transmitter cable.

Comark 16113
On display: IOX TV transmitter lines, IOT and the S Series transmitters.

Communications Data Services 4019
On display: Data and computer applications for radio and GIS industries.

Comrex 12206
Introducing: 20 kHz mono/stereo digital audio codecs, DX-100 apt-X, Model DX-200, DX-210, DX-230, and DX-240.
Also: Established lines including 7.5 kHz digital audio codecs.
Contact: Lynn Distler
65 Nonset Path
Acton, MA 01720

Comstream 4000
Introducing: A desktop version of its ABR75B satellite digital audio receiver that is suited for business music applications. Also: The ABR 200 and ABR75/75B integrated receivers.

Comtech 13402-13403
Introducing: The EC8 microprocessor control system with optional IBM compatible software for control of the company's line of satellite antenna systems.

Continental 3418
On display: Full line of broadcast transmitters and other RF equipment. New product information was not available at presstime.
Contact: Steve Claterbaugh
P.O. Box 270879
Dallas, TX 75227
214-381-4949

Corporate Computer Systems (CCS) 4826
Introducing: The CDQ2001 MUSICAM codec, an enhanced version of the CDQ2000, with 18 bit A/D converter.
Also: The CDQ1000, CDQ2000 and the PACE MUSICAM digital audio editor.
Contact: Doreen Avleth
33 West Main St.
Holmdel, N.J. 07733
908-946-7167

Connectronics 13628
On display: Line of audio and video cables including JB9600 Easy-Wired TT Patchbays and XB range of modular patchbays.

Cortana 3704
On display: Stati-Cat lightning prevention system.
Contact: David Stockmar
P.O. Box 2548
Farmington, NM 87499
505-325-5336

Crown International Inc. 4400-3
Introducing: CM-312 head-worn microphone.
Also: Line of Crown microphones and amplifiers for broadcast purposes.
Contact: Bob Herrold
1718 W. Mishawaka Rd.
Elkhart, IN 46517
219-294-8000

CTE International Srl
Contact: Enrico Antoniazzi, Comm. Dept. Mgr.
Via R. Sevardi, 7
42010 Mancasale
Reggio Emilia, Italy
39-522-516660

Cutting Edge Technologies 5200
Introducing: New Unity Remote Software, Unity AM processor and will demonstrate the Unity 2000i FM processor. The new VIP-voice processor also will be shown as will the Dividend Composite Filter.
Contact: Danielle Cline
2101 Superior Avenue
Cleveland, OH 44114
216-241-3343



Dalet 3803
Introducing: Ednews news editing software. Traffic scheduling system.
Also: Cart replacement, satellite automation, non-destructive audio editing and walk-away music automation digital audio systems.

Dataworld Inc. 1918
Introducing: Customized maps, including international.
Also: AM, FM, TV, LPTV and wireless cable databases. Customized maps, directories, allocation and interference studies. Population counting. FCC Flag service. Terrain elevation retrieval. FM and TV area-to-locate studies. AM daytime and nighttime channel studies. Unused call-sign listings.
Contact: Jack Neff
4827 Rugby Ave., Ste. 200
Bethesda, MD 20814
301-652-8822

Dawn Satellite Inc. 17779
Contact: Rose Prete
1190 S. Lapeer Rd., Ste. 100
Oxford, MI 48371
313-969-0010

DB Elettronica TBD
On display: TD4/16 and RD4/16 16-bit digital decoders. Vivaldi digital stereo coder. PE 21 FM

exciter for new analog and digital audio processors. PM 100/PM 250 FM exciter. KN 500/KN 1000 FM solid state amplifier. DCV Series STL translator.

Delta Electronics TBD
On display: The Delta Splatter Monitor, as well as the ASE-2 AM stereo exciter, ASM-1 AM stereo monitor, OIB-1, OIB-3, and CPB-1,1A impedance bridges, RG-4 receiver/generator, TCA RF ammeters, 6730E, 6740B transfer switches, AAM-1 analog antenna monitor and PRH-1 high power pulse reflectometer.
Contact: Joseph S. Novak
Delta Electronics
5730 General Washington Dr.
Alexandria, VA 22312
703-354-3350

Denon America 4303-4
Contact: Michael Stelts
222 New Rd.
Parsippany, NJ 07054
201-882-7460

DIC Digital 19183
Introducing: Beta Cam SP metal particle tapes.
Also: HQ DAT cassette for multipurpose applications and live recording. Digital MQ Series studio two-pack for safe DAT cassette storage and transportation. CD-R recordable CD, available in 18-, 63- and 74-minute recording times. CR-4000 4mm/DAT and CR-8000 8mm dry, non-abrasive cleaning system. Complete line of DAT tape. Professional MQ Series and HQ Series
Contact: Rich Mancuso
500 Frank W. Burr Blvd.
Teaneck, NJ 07666
201-692-7700

Dielectric Communications 15719
Introducing: digitLine-broadband rigid transmission line designed to transmit any VHF, FM or UHF frequency with extremely low VSWR. Improved DCR-M quadropole antenna-broadband FM antenna with low VSWR bandwidth in excess of 10 MHz.
Also: TDM, TCL and TUP television broadcast antennas. DCR-C.C.P. FM antenna. Model 200B automatic dehydrator for pressurization of broadcast feedlines. 50000 Series RF switches. 5000 Series oil load and 4000 Series dry load. 7000 series calorimeter.
Contact: Jay S. Martin
P.O. Box 949
Raymond, ME 04071
207-655-4555

Dolby Laboratories Inc. 1620
Introducing: Four-channel DSTL® digital aural STL system. AC-3 digital audio coding. DP521 codec for AC-3 coding. DP501 codec for AC-2 coding.
Also: Model 740 Spectral Processor. Dolby SR professional noise reduction. Dolby Surround. Dolby film sound products.
Contact: Kevin Tam
100 Potrero Ave.
San Francisco, CA 94103
415-558-0200

Dorrough Electronics 18815
On display: Audio Level Meters. Stereo Signal Test Set Model 1200.

Econco 2210
On display: Rebuilt power tubes and klystrons for radio and TV transmitters.
Contact: Debbie Baker
1318 Commerce Ave.
Woodland, CA 95776
800-532-6626

Electronics Research Inc. 3212
On display: Side mount FM antennas. Master, multi-station antennas, filters and combiners in medium and high power configurations. Master antenna remote monitoring and reporting equipment. Lambda™ antenna mounting systems. Antenna support towers and structural engineering services. Turn-key construction and emergency repair services.
Contact: David Davies
108 Market Street
Newburgh, IN 47630
812-853-3318

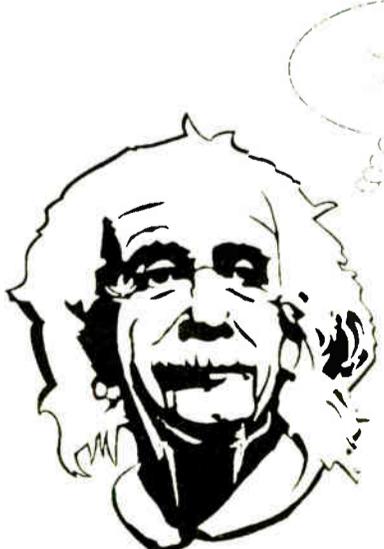
Electro-Voice 15716
On display: RE27N/D microphone, a professional quality dynamic cardioid mic. RE36N/D microphone for broadcast applications. S-40 compact monitor system.

Elenos SRL 1024
On display: SF series amplifiers based on MOSFET solid state technology. Range of radio broadcasting products including FM power amplifiers, exciters, radio links, filters combiners, aeriels, remote control RF diagnostics.

ENCO Systems Inc. 5121-5122
On display: DAD486x digital audio delivery system.
Contact: Larry Lamoray
1866 Craigshire Dr.
St. Louis, MO 63146
314-453-0060

Energetic Music Inc. 3921
Introducing: EZ-1 Easy Listening #1, light "middle of the road" background music. Jewish Party Music volumes I & II, music for Bar and Bat Mitzvahs, weddings, anniversaries, Horas and folk dancing. 427 Sound Effects library.
Also: Energetic Music Buy-Out Library.
Contact: Monty Smith
P.O. Box 84583
Seattle, WA 98124
800-323-2972

Energy-Onix 5408-5410
Introducing: New line of transmitters.
Also: SSA/SST Series of low power solid state FM transmitters. Legend Series of medium power solid state FM transmitters. MK Series of grounded grid triode tube FM transmitters. AM and short-wave transmitters.
Contact: Ernie Belanger
752 Warren St.
Hudson, NY 12534
518-828-1690



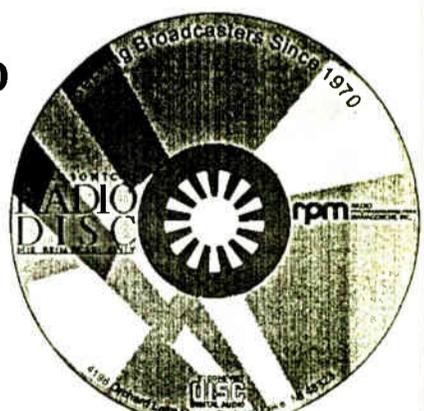
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8-Track Digital Audio Editing Station For Under \$10,000



See the Session 8 on display at BSW NAB booth 4820

The Digidesign Session 8™

Digidesign's award winning Session 8 brings together virtually every leading edge recording technology available today such as: direct-to-disk digital multi-track recording, digital mixing and track bouncing, random access "cut and paste" style editing, and digital signal processing.

One of the first things you'll notice about Session 8 is how good it sounds. It supports 16-bit audio for 20 Hz to 20 kHz frequency response. It also has the simplest user interface available in a computer based editing system. If you know how to use a recorder and mixer, Session 8 will be a snap!

Session 8 includes it's own on-screen mixer, digital equalization, insert points and patch bay so it can be used as a stand alone studio or in conjunction with your existing mixer and effects. The optional RI controller offers remote control with real analog style faders.

Now Session 8 operates on either PC or MAC platforms, and even with a computer, is still under \$10,000.

Best of all it's available from Digidesign, the manufacturer with more workstations in broadcast production than any other, and BSW, the industry leader in service and selection, with over 20 years experience in serving broadcasters.

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Digital Specialist Nearest You**

East of the Mississippi, Contact:

Laura Tyson

Voice: 800 • 762 • 5566

Fax: 908 • 459 • 5540

West of the Mississippi, Contact:

Rick Kemp

Voice: 800 • 426 • 8434

Fax: 800 • 231 • 7055

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Circle (64) On Reader Service Card

World Radio History

ESE 12808-12809
 Introducing: ES-185 GPS master clock/time code generator. ES-2940 dual 1x4 and video distribution amplifiers and a five output black burst generator. ES-195 VVG master 21 interface/master calendar. New LUX-Line product family.
 Also: master clock systems, clocks and timers. Time code products. Audio and video distribution amplifiers. Audio level indicators and interfaces.
 Contact: Brian Way
 142 Sierra St.
 El Segundo, CA 90245
 310-322-2136

Eventide Inc. 4809-10
 Introducing: H3000-D/SX Studio Dynamic Ultra-Harmonizer. H3000-D/SE Studio Enhanced Dynamic Ultra-Harmonizer with new 3D speaker-based spatial imaging effects.
 Also: DSP4000 Ultra-Harmonizer. VR240 digital broadcast logger. BD980 broadcast delay.
 Contact: Gil Griffith
 One Asian Way
 Little Ferry, NJ 07643
 201-641-1200

f,g

Faraday Technology Ltd. 19123-19124
 On display: Video filters. Video delay lines. Cable Clone for testing integrity of serial digital signals.

Fidelipac Corp. 1920
 On display: Air Marshal digital hard disk system. MX E Series console. Dynamax SRC digital audio sample rate converter.
 Contact: Bob McNeill
 97 Foster Rd.
 Moorestown, NJ 08057
 609-235-3900

FM Systems 19528
 Introducing: ALM 771 audio level master.
 Also: AVM audio volume meter. AMM audio modulation meter.

Focal Press 13404-13405
 On display: Books about broadcasting.

Fostex 19185
 Contact: David Oren
 15431 Blackburn Ave.
 Norwalk, CA 90650
 310-921-1112

FRESH/The Music Library 2000
 On display: TBA

Garner Industries 13622-13623
 Introducing: Model CF 750 Type II/III extended range degausser.
 Also: Line of tape erasers for all formats.

Gentner Communications Corp. 2612
 Introducing: G2500 and G3200 telephone Superhybrids. TC-101 telephone interface. ET-100 Personal Teleconferencer.
 Also: Line of telephone interface products including couplers, hybrids, call directors and audio bandwidth extenders. VRC-2000 remote control system. Audio routing and distribution products. On-air audio processing equipment. Teleconferencing products and services. Assistive Listening System for ADA compliance in public buildings.
 Contact: Elaine Jones
 1825 Research Way
 Salt Lake City, UT 84119
 801-975-7200

Gorman Redlich Mfg. Co. 4812
 On display: Off-site EBS monitor. Models CM and CMR digital antenna monitor. Model CEB EBS encoder-decoder.
 Contact: James T. Gorman
 257 W. Union St.
 Athens, OH 45701
 614-593-3150

Graham-Patten Systems Inc. 11551
 On display: D/ESAM® 800 and D/ESAM 400 digital edit suite audio mixers.

Halland Broadcast Services Inc. 3700
 Introducing: Halland's Country Hits CD music library. The Nineties AC/CHR library update.
 Also: The Seventies AC/Gold CD library. Rock 'n' Roll Graffiti Oldies library. The Eighties Plus AC/CHR library.
 Contact: Steve Steinberg
 1289 East Alosta Ave.
 Glendora, CA 91740
 818-963-6300

Hallikainen & Friends 1712
 Introducing: DRC200 transmitter control system software update. Election Central software.
 Also: DRC190 transmitter control system. TEL 171 digital telemetry adaptor. ITO178 board and software for controlling a Moseley TRC-15A with a TEL 171. TVA series of audio mixers.
 Contact: Harold Hallikainen
 141 Suburban Road, Building E4
 San Luis Obispo, CA 93401-7590

Harris Allied
 Introducing: Harris Quest 1 FM transmitter. AIRcart digital cart machine. Audisk. Cylink. Band spread spectrum modems. ENCO DAD486x digital audio delivery system. Gentner telephone hybrids. Mini Disc recorders/players. nVision digital interface products. Orban DSE-7000. RE America digital audio codecs.
 Also: Harris Platinum Series® PT 10FM transmitter. Digit™ digital FM exciter. Harris DX 10 and DX 100 digital solid state MW transmitters. Harris AMS-G1 C-QUAM® stereo exciter. Harris HT 10FM and HT 35FM FM transmitters. Audio-Metrics CD-10 CD cart player. Tascam DA-88. Roland DM-80. Auditronics consoles. RE America RDS/RBDS equipment. Harris Allied radio studio systems.
 Contact: Martha Rapp
 3200 Wismann Lane
 P.O. Box 4290
 Quincy, IL 62305-4290
 217-222-8200

continued on page 59 ▶

ACCESS THE MAX! RDS Global Messaging



Join the telecommunications revolution!
 Enter the lucrative paging and personal communications market with
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 The most technologically advanced alphanumeric message transfer system (in any language) available today. Use your existing FM radio station for effortless paging, message and information transfer.

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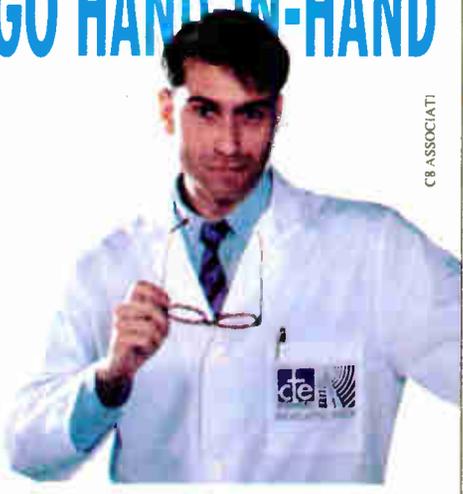
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With C.T.E. equipment, there is an effectiveness you cannot ignore. In fact, C.T.E.'s manufacturing process includes quality control checks that make all products masterpieces of reliability. At the same time, CCIR, FCC and OIRT requirements are fully complied with and prices are kept reasonable. Our team of professional engineers is always on hand to provide any assistance you may require. C.T.E.'s impressive number of installations and next-door service demonstrate our achievements. At C.T.E., we believe that technical innovation and its continued implementation are the most important ingredients for success. And when you buy a C.T.E. product, you share in this success.



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ITALIAN TECHNOLOGY FOR WORLDWIDE MARKETS

Ultimate Digital Studio

MUSIC IS FROM COMPACT DISC (TM CENTURY GoldDisc® MUSIC LIBRARIES ARE AVAILABLE IN ALL POPULAR FORMATS)

COMMERCIALS, JINGLES AND LINERS ARE FROM HARD DISK.

THE SOURCE IS CLEARLY DISPLAYED AT ALL TIMES

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

- Header:** TMC I 2:22 PM ULTIMATE DIGITAL STUDIO Tuesday 01/04/94
- ON THE AIR 1:04:**
 - DECEMBER, 1963
 - FOUR SEASONS
 - Time: 2:13 ◀ Intro:13 End:F
 - PIONEER #16
 - Slot:13 Cut:12
 - Music:433
 - Sked at:02:25P
 - Sked on:01/04
- READY TO AIR:**
 - IT HIT ME LIKE A HAMMER
 - LEWIS, HUEY & THE NEWS
 - Time: 3:53
 - CD JUKEBOX #2
 - Slot:41 Cut:09
 - CD ID:9108
 - Sked at:02:28P
- NEXT T:**
 - SET THE NIGHT
 - FLACK, ROBERTA WITH
 - Time: 4:33
- VIEW EVENTS ESC to Exit:**

2:19 PM	4	Hormel #1	DIGITAL AUDIO
2:20 PM	D	Pizza Hut #1	DIGITAL AUDIO
2:20 PM	D	Mix 105 #3	DIGITAL AUDIO
ON AIR		DECEMBER, 1963	FOUR SEASONS
02:28 PM	:15	IT HIT ME LIKE A HAMMER	LEWIS, HUEY & THE NE
02:32 PM	:01	SET THE NIGHT TO MUSIC	FLACK, ROBERTA WITH
- System:** AUTO/SEGUE, LOADING, LOGGING:ON, TIME UPDATE
- Help:** F1
- Footer:** Copyright 1990 - 1994 TM Century, Inc. Dallas, Texas

UDS clearly shows you WHAT'S ON THE AIR, WHAT EVENT IS READY TO AIR NEXT, AND WHAT IS NEXT TO FOLLOW

USER FRIENDLY WINDOWS POP UP WITH ONE KEY STROKE

View what has played and what is coming up without access to schedule

TM CENTURY HAS DELIVERED OVER 400 Ultimate Digital Studio systems worldwide. The software and hardware components that comprise the UDS are highly reliable and proven.

Call your sales representative for information about the many other features that are incorporated into the Ultimate Digital Studio.

(800) TM CENTURY

TM CENTURY[®] Inc.

TM CENTURY would like YOU TO SEE THE SCREENS YOU LIVE AND WORK WITH BEFORE you've made your choice for AUTOMATION OR LIVE ASSIST...

ENDINGS ARE CLEARLY SHOWN AS Cold (C) OR FADE (F)

LARGE COUNTDOWN CLOCK SHOWS THE EXACT TIME BEFORE THE VOCAL BEGINS! IT CAN'T BE WRONG!

GET HELP AT ANY TIME WITHOUT INTERRUPTING ANY PART OF THE PROGRAM

SWITCH TO MANUAL play if you NEED OR CHOOSE TO STOP THE PROGRAM

EDIT EVENTS ALLOWS ACCESS (CAN BE PASSWORD PROTECTED) TO SCHEDULE TO FIND SONGS BY TITLE, ARTIST, OR LENGTH ON THE FLY IN REAL TIME WITHOUT INTERRUPTING play.

TOTAL TIME, INTRO LENGTH, ELAPSED TIME, AND ALL IMPORTANT INFORMATION IS ALWAYS CLEARLY SHOWN.

TMCI 2:46 PM ULTIMATE DIGITAL STUDIO Tuesday 01/04/94

ON THE AIR 0:04
I WONDER WHY
STIGERS, CURTIS
Time: 4:06 Intro:28 End:F

System
AUTO | SEGUE
LOADING: 1
LOGGING: ON
TIME UPDATE

READY TO AIR
Raid Max
DIGITAL AUDIO
Time: 0:29 Intro:00 End:C
DCS
Mode: STEREO
Spot: 7021
Sked at: 02:51P
Sked on: 01/04

NEXT TO FOLLOW
CERTS
DIGITAL AUDIO
Time: 0:30 Intro:00 End:C
DCS
Spot: 7036
Sked at: 02:51P
Sked on: 01/04

F1 Help
F2 Manual
F3 View Events
F4 Edit Events

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WE DON'T LOCK YOU INTO ONE TYPE OF MUSIC SCHEDULING SOFTWARE, TRAFFIC AND BILLING SOFTWARE, CD JUKEBOX OR HARD DRIVE. INTERFACES FOR MANY COMBINATIONS ARE AVAILABLE. YOU DECIDE WHAT COMBINATION YOU LIKE BEST.

FOR YOUR PERSONAL SALES REPRESENTATIVE CALL:

invented the DigiCart® recorder to bring CD quality audio to broadcasting. Our on-going technical efforts provide customers with the service, upgrades and confidence expected in the broadcast community.

360



DIGICART/II

DIGICART/II

THE PROVEN UPGRADE FROM ANALOG CARTS

STANDARD FEATURES

- Instant access to any of 10,000 cuts
- 2-hour internal hard disk
- 68-minute Bernoulli cartridge drive²
- 16-bit linear recording for true CD quality
- Selectable Dolby AC-2 Data Reduction¹
- Normal operation provides 20 kHz stereo audio
- Digital Editing
- DSP generated fades & levels changes
- Bright 40-character display shows cut name, ID#, running time, and helpful user prompts
- Pre-program breaks and spot rotation
- Automatic record-on-audio
- Five year hard drive warranty
- Five year Bernoulli disk life
- Worldwide sales and service

BREAKTHROUGH PRICING

- Only \$4,995 record/play stereo, including a 2-hour hard disk. Other models from \$4,250 less hard disk. DigiCart/II is by far the lowest priced digital cart recorder on the market.
- Low-cost media—Only \$1.42 per minute²

OPTIONAL FEATURES

- Mini keyboard for titling and remote control
- Two new remote controls include LCD display
- "Hot Keys" give instant access to 16 spots
- Larger hard disks store 4 or 8 hours of stereo
- External hard disk arrays store up to 48 hours
- AES/EBU and SPDIF digital I/O³
- Toolkit for developing custom serial port programs

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360 Systems

PROFESSIONAL DIGITAL AUDIO

360 SYSTEMS 18740 OXNARD STREET, TARZANA, CALIFORNIA 91356 818.342.3127 FAX 818.342.4372

DigiCart/II

¹User-selectable. ²150 MB Bernoulli Disk. ³SMPT/EBU Time Code board and Digital I/O available 1994. Stated specifications are with Dolby AC-2 operation.

DIGICART IS A REGISTERED TRADEMARK OF 360 SYSTEMS. DOLBY IS A TRADEMARK OF DOLBY LABORATORIES, INC. ©1993 360 SYSTEMS

Circle (164) On Reader Service Card

Henry Engineering 3700
 Introducing: Fast Trac II voice-over audio workstation. Stereoswitch three-input stereo line switcher.
 Also: Matchbox. Telephone Information System. USDA. Twinmatch. Micromixer. Logicconverter. MixMinus-Plus. Superelay.
 Contact: Hank Landsberg
 503 Key Vista Drive
 Sierra Madre, CA 91024
 818-355-3656

HHB Communications 1403
 Introducing: New recording media product and an addition to the company's CEDAR range of audio restoration products, among other new products.
 Also: The PORTADAT range of portable DAT recorders, featuring 4-head, 4-motor transports derived from DDS technology. The advanced media products range of HHB DAT tape, and the CEDAR DC-1 de-clicker, the CR-1 de-crackler, featuring buzz removal and distortion reduction as well as the CEDAR II production system. The HHB CDR Indexer, and the ATC range of studio control monitors and the Coles line of mics.

Holiday Industries Inc. 3920
 On display: RF and MW instrumentation and EMF meters.
 Contact: Michael Leighton
 14825 Martin Dr.
 Eden Prairie, MN 55344
 612-934-4920

IDB Broadcast 5226 & 5227
 On display: Information on company's 15 kHz Switched 56 Digital Sports Interconnect Transmission services. Also 3D2 - direct digital audio, high quality audio transmissions for recording studios.

Inovonics 2306 - 2308
 Introducing: Operational RBDS display.
 Also: Line of audio recording, signal processing and instrumentation equipment for broadcast, including the Model 530 FM modulation monitor, "Sentinel" all-mode diagnostic receiver, and "David" FM processor/stereo coder.
 Contact: Jim Wood
 1305 Fair Ave.
 Santa Cruz, CA 95060
 408-458-0552

Intraplex Inc. 5118
 Introducing: The PT 350 and PR 350 are program audio transmitter and receiver modules that transmit in 16-bit linear uncompressed format. The Intralink STL+ is a fully integrated STL package for transmitting high quality, uncompressed linear stereo audio over T1 lines.
 Also: Line of high speed digital communications equipment.

International E-Z Up 5212-5213
 On display: World's Fastest Shelter free-standing canopy. Instant Shelter canopy.

International Tapetronics Corp. 1218
 Introducing: A series of enhancements to company's DigiCenter digital audio management system, including DigiCenter-EDITOR, an integrated multitrack waveform production editor operating on a workstation; DigiCenter-NEWS, a networked array of workstations offering collection, editing and management of both audio and text information for news applications; DigiCenter-PLUS, expanded networking capabilities for background file transfers, backups and maintenance, and the DigiCenter-LITE, a low-cost entry level system in a computer tower hardware platform.
 Also: The DigiCenter audio management system; digital program repeater, a solid state, full bandwidth mono recorder and reproducer; audio routing switcher with adjustable input levels, mono/stereo switching, various remote controls and RS 232/422 control; ITC Cart II cartridge machine, as well as the Delta and Series 99 cart machines and the ESL V, and Series 1 and 2 cart machines. ITC will offer remanufactured versions of all varieties of its cart machine line.
 Contact: Charlie Bates
 2425 South Main St.
 Bloomington, IL 61704
 309-828-1381

ITELCO S.p.A. 19414
 Introducing: New FM exciter-transceiver with output power from 100 W to 250 W, MOSFET amplifier, automatic power control built-in switched power supply and plug-in construction.

J.N.S. Electronics Inc. 2306 - 2308
 On display: Digital audio program transmission equipment, including the D-Mux 500 series, a stereo or mono audio multiplexing systems using 16-bit technology for multiple 15 kHz, 7.5 kHz, or 3 kHz audio feeds, and the RFL-700 Series 1.5 to 2.3 GHz digital microwave link for D-Mux. Modular rack frames, including the 8000 Series "the Frame" modules for audio and video amplification and distribution, monitoring, switching, audio test, RF demodulation, off-air reception and program changeover functions. Audio routing systems, including the 8300 Series stereo to 100 X 1 and the 9000 Series, mono/stereo to over 100 X 100.
 Contact: John Leonard
 P.O. Box 325000
 San Jose, CA 95125
 408-729-3838

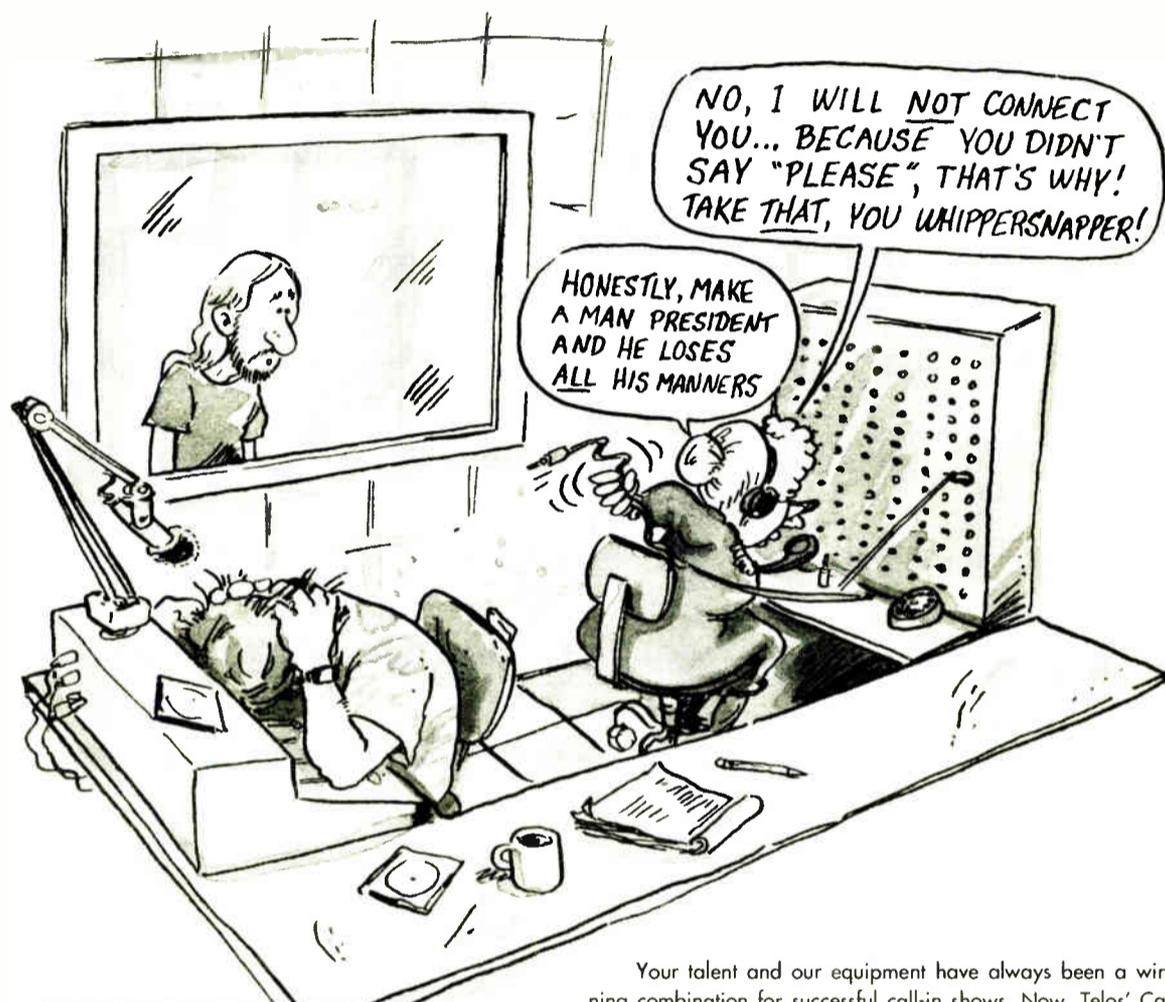
JBL Professional 15713
 Introducing: MPA series amplifiers. SR6670A power amplifiers.
 Also: 4400A series studio monitors. Models 4206 and 4208 studio monitors.

Jampro Antennas Inc. 1915
 Introducing: JCPD flat panel circularly polarized antenna. JADP cavity backed panel antenna. JIDC inter-digital combiner. JIDF inter-digital filter.
 Also: Penetrator series of FM antennas.
 Contact: Marlene D. Young
 6340 Sky Creek Dr.
 Sacramento, CA 95828
 916-383-1177

Jefferson Pilot Data Services Inc. 13811
 On display: JDS 2000/1000 broadcast management system that interfaces with traffic, billing, accounts and sales; BIAS, on-line integrated traffic sales, management and general accounting system; SALESLINE, sales management linking sales to traffic and accounting, and PC SESAMI, a PC-based avail system that provides proposals and research information.

Kintron Laboratories, Inc.
 On display: AM/MW antenna matching. HF open wire transmission line switch. HF open wire feedline. HF feedthrough panel. AM/MW multiplexed antenna systems and tuning units. Air-cooled dummy loads. AM/MW directional antenna phasing system. Open frame and vacuum RF contractors. Rigid transmission line. RF patch panels. Equipment racks. Isocouplers. Fixed and variable inductors. Meter jacks and plugs. Coaxial cable clamps. Static drain chokes. Lighting chokes.
 Contact: Tom King
 P.O. Box 845
 Bristol, TN 37621-0845
 615-878-3141

Klark Teknik 2412
 Introducing: DN3600 programmable graphic equalizer, a digitally controlled analog unit includes two special function keys that allow user to alternate between an EQ curve, relative fader position for channel A or B, or a combination.



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Your talent and our equipment have always been a winning combination for successful call-in shows. Now, Telos' Call Screen Manager software compliments our advanced multiline talk show systems by helping your screener/director provide your talent with information on each caller.

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Two versions of Call Screen Manager are available. Host Software provides for a director position and any number of talent positions using a single PC. Remote Software allows communications between the studio and talent located at a remote site via modem.

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 216.241.7225 • FAX: 216.241.4103

Lakeside Associates 1159
On display: Designers/builders of broadcast, recording and production facilities.

LDL Communications 15758
On display: Low windload spearhead FM CP antennas designed for multiplex operation of several FM stations. FM band pass combiner for use in multi-station operations. FMAC series of FM broadcast circularly polarized antenna, designed to be side mounted to an existing or new tower.

Logitek Electronic Systems Inc. 3215
Introducing: Super-VU precision bargraph audio meter with simultaneous display of loudness and peak levels with selectable functions including peak and maximum hold phase density and sum display; Crossfire II four-channel automated mixer, local or remote control levels and cross-fades as well as RS 232/422 computer port; Serial Scund SS-SRC sample rate converter that accepts AES/EBU or S/PDIF data at ±50 percent of output sample rate.
Also: On-air modular console with frame sizes that hold 6, 12 or 22 mixers. Mixer modules feature DCA faders. Optional RS-232 control.
Contact: Tag Borland
3320 Bering Dr.
Houston, TX 77057
800-231-5870

Maxell Corp. of America 1661
On display: Professional audio and video products, including audio cassettes, R-DAT cassettes and reel-to-reel products. Product line includes 3/4-inch digital audio tape, optical disks and CD and CD-R.

McCurdy Radio Industries Ltd. 13111
On display: DCS 3000 DSP serial digital intercom system, using advanced technology to meet demanding local and network broadcast requirements. MICRO-COMPACT digital intercom system for small mobile units and studios. M/2000 automation system. McCard digital audio storage and multi-channel playback system. UMD-32 tri-color 32-character under monitor display units. ATS-100 stereo audio test set. ATS 2656 stereo audio monitor with integral 6x1 switcher. UIO-80 universal interface unit for serial/parallel machine control interface. 9000 Series audio and video distribution amplifiers and accessories.
Contact: Dan Kupiec
108 Carnforth Rd.
Toronto, Ontario M4A 2L4
800-267-8800

Media Touch Systems Inc. 1006
Introducing: Media Touch digital audio editing program. Pick 'N Play studio control software package. "Auto-Record" workstation.
Also: OpLOG live assist/automation control system. MediaDISK digital audio system.
Contact: Jim Waterman
50 Northwestern Dr., Unit 11
Salem, NH 03079
603-893-5104

Modulation Sciences Inc. 11102-11104
Introducing: Software upgrade for Model RDS-1 RDS/RBDS encoder; RDS/RBDS data receiver.
Also: RDS/RBDS coder, FM ModMinder, Modulation Monitor/analyzer, StereoMaxx spatial image enlarger, CP-803 composite processor, Sidekick audio and data subcarrier generators. DSCA-1 data SCA receiver, composite D/A, wired STL.
Contact: Arthur Constantine
12A World's Fair Drive
Somerset, NJ 08873
908-302-3090

Moseley Associates Inc. 2824
Introducing: The StarLink 9000, all-digital modular system for simplex/full duplex transmissions, including 13 Personality Modules. Two new options for the DSP 6000: ISO/MPEG source codec and built-in AES/EBU rate converter. Optional programmable intelligent coprocessor module and interfaces for VM 700A video analyser, satellite controllers and video/audio switchers for the MRC 2.
Also: The MRC 2 transmitter control system, the MRC 1620 transmitter control system, the RPL 4000 remote pickup link system, the DSP 6000 digital audio codec for RF and T1 applications.
Contact: Jamal Hamdani
111 Castilian Dr.
Santa Barbara, CA 93117
805-968-9621

MYAT Inc. 4619-21
On display: Adjustable quarter wave stub second harmonic filter and line of rigid coaxial transmission line products and components.
Contact: Robert Hilsdorf
P.O. Box 425
380 Chestnut St.
Norwood, NJ 07648
201-767-5380

Nady Systems Inc. 11327
Introducing: 950 GS UHF wireless microphone system, a wireless receiver, rack-mount true diversity frequency synthesis unit with selectable channels arranged in groups for easy access.
Also: Line of established company wireless microphone systems.

NAGRA Lysis 1213
Introducing: Integrated Information System to provide a user-friendly environment with plug-in modules for sound editing, scheduling, broadcasting, administrative tasks and news editing. It is an open system based on distributed computing, client-server architecture, high speed networks, high capacity storage and multitask and multi-user needs.
Contact: Tom Jenny
1865 Air Lane Dr.
Nashville, TN 37210
615-391-3399

Nautel Maine Inc. 1912
Introducing: NE50 Digital FM Exciter uses direct digital synthesis (DDS) to generate the modulated FM carrier. NE50 accepts composite, mono and SCA inputs using a/d technique designed for ultra low-noise and distortion.
Also: Company's full range of AMPFET Series AM and FM solid state transmitters.
Contact: Jorgen Jensen
201 Target Industrial Cir.
Bangor, ME 04401
902-823-2233

Nemal Electronics Inc. 13619
On display: Composite audio/video cables. Audio snake cables. Custom audio/video interface panels. Audio/video cable and patch cords. RF connectors and adaptors.

Neotek Corp. 2226-2227
On display: Esprit Series console system for broadcast production, offering eight aux busses and mix-minus from every input module. Mono/stereo configuration. Information will be available on company's line of consoles for multitrack recording, broadcast production and editing.

NPR Satellite Services 4807-8
On display: Audio interconnection services, including fixed and transportable uplinking, digital audio transmission, digital fiber links and service to Galaxy and Satcom.

Neumann/Sennheiser 12136
Contact: Albert C. Zang, Jr.
6 Vista Dr.
Old Lyme, CT 06371
203-424-9190

Neutrik USA 3906
Intro: NanoCon three-pole sub-miniature connector. Models NC3FX and NC3MXY solderless/screwless insulation displacement connectors. Model NJ*FD-V vertical 1/4" jack.
Contact: James E. Cowan
195 Lehigh Ave.
Lakewood, NJ 08701
908-901-9488

NVISION Inc. 20081
Introducing: NV1050 Four-channel Sample Rate Converter, accepts AES/EBU signal, sample rates 32-50 kHz. NV1055 Four-channel Digital Audio Mix/Minus and Routing Module. NV1060 Digital Audio Delay Compensator Module, provides up to 20 video fields (330 mS) of delay. Optional BNC/1-volt Digital I/O interfaces for NV1000, NV3064 and NV3512.
Also: NV1000 modular terminal hardware. NV2000 digital audio transmission systems. NV3512 expandable digital routing switchers. NV3064 compact digital routing switchers. NV4448 sample rate converter. NV 5500 5200/5100 sync generators.



Omnimusic 19201-2
On display: Omni-FX sound effects library on 12 CDs, organized by application.
Contact: Jerry Burnham
6255 Sunset Blvd., Ste. 803
Hollywood, CA 90028
800-828-6664

Omnitronix 4806
Introducing: 2,800 W panel for Omni-50 50 kW AM broadcast transmitter.
Also: Omni-5000 5000 W AM broadcast transmitter.
Contact: John Solt
113 Dickerson Rd.
North Wales, PA 19454
215-699-2400

Otari Corp. 1209
Introducing: MR-10 MiniDisk recorder. A high-capacity CD changer. A new broadcast console and a line of lower-priced consoles with Concept I-type features.
Also: Line of professional audio recorders from 1/4-inch two-track analog to 1-inch 32-channel digital. R-DAT recorders. ProDisk 464 digital audio workstation. Automatic and semi-automatic audio and video cassette loaders. Pancake and in-cassette audio duplication systems. T-700II TMD high-speed video duplicator.
Contact: Deborah Bryce
378 Vintage Park Dr.
Foster City, CA 94404
415-341-5900

Pacific Recorders & Engineering 13047-9
Introducing: ADX Basic, streamlined version of company's ADX workstation.
On Display: ADX Digital Workstation. Turnkey broadcast systems. Studio furniture. Consoles. Peripherals.
Contact: Jim Miller
2070 Las Palmas Dr.
Carlsbad, CA 92009
619-348-3911

PanAmSat 15171
On display: Satellite transmission services.

Penny & Giles 4527
Introducing: MM16 MIDI Management System, real-time control for production/post-production applications. VCA16 Audio Control Module.
Also: PGF 8000 and 3000 Series linear faders. Analog and digital T bars. E-belt digital controllers.

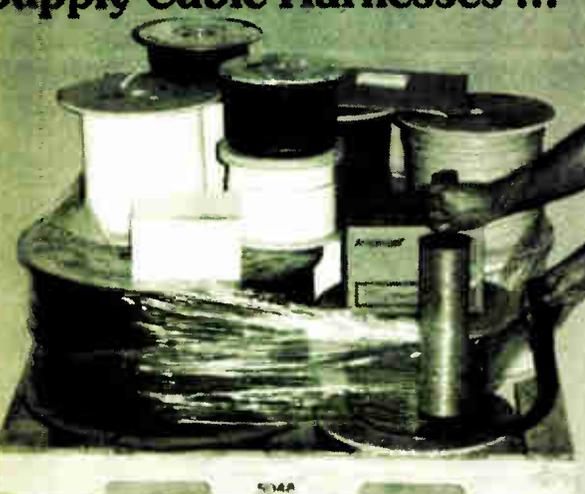


Manhattan Production Music 13635
On display: Company's line of Audiophile Sound Effects Series. Chesky Records Classical Series, and 42 CDs of production music.

Mark IV Pro Audio Group 1000
Introducing: Klark Teknik DN3600 stereo programmable graphic equalizer; DDA QII console, a true LCR (left, center, right) unit with choice of eight mono, stereo or four true LCR outputs.
Also: Klark Teknik's 300 Series graphic and parametric equalizers, 400 Series parametric equalizers, 500 Series compressors and gates, 700 Series digital delays, 800 Series crossovers, DDA's QMR, PROFILE and INTERFACE consoles. MIDAS' XL3-16 broadcast remote console.

Marti Electronics 3918-3919
Introducing: STL-15C frequency agile composite STL link, now available in export frequencies from 150 MHz to 480 MHz.
Also: STL-10 SCPS STL systems available from 150 MHz to 960 MHz. Systems for remote broadcast, the RPT-30, RPT-15 and RPT-2.
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1501 N. Main St., P.O. Box 661
Cleburne, TX 76033
817-645-9163

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 Contact: David G. Harry
 932 Philadelphia Ave.
 Silver Spring, MD 20910
 301-589-2662

Professional Sound Corp. 5124-5
 Introducing: PSC IntelliSlate SMPTE time code slate devices. able to read and generate time code on 24, 25, 29.97 and 30 frame rates, and 29.97 and 30 drop frame. Headset microphone. PSC OmniPlate microphone. PSC Universal Shock Mount System. Solar panel/rechargeable power supply.

Promusic Inc. 13148-9
 On display: Promusic production music library of over 1,000 CDs, with an average of 15 new releases per month. The Match production music library. Digiffects and Sound Ideas SFX library. The Big Whoosh, containing over 250 production elements.

Prophet Systems Inc. 5222
 Introducing: CD and hard drive automation module & copy editing module for Wizard for Windows.
 Also: Wizard for Windows digital editing/automation system, utilizing Windows 3.1 and Novell 3.12 technology.
 Contact: Kevin Lockhart
 111 W. Third St.
 Ogallala, NE 69153
 800-658-4403

Pristine Systems Inc. 3800
 On display: Pristine digital control system for digital radio programming; uses Pioneer 6- and 18-slot CD players and Tascam DAT machines for music and Dolby AC-2 digital hard disk audio for commercials, promos, voicetracks, liners, etc. Music Plus music scheduling software.
 Contact: Boyce Williams
 8489 W. Third St., Ste. 1017
 Los Angeles, CA 90048
 310-670-7500

QEI Corp. 4218
 Introducing: Digital remote pickup system. Digital transmitter-to-studio link. 675-B FM exciter.
 Also: CAT-LINK digital STL/TSL featuring Q-MAX 16-bit digital discrete audio card and digital composite system cards. AUTOMOD closed-loop automatic gain control for FM. Solid state and single-tube FM transmitters at 10 W-30 kW.
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 800-334-9154

Radio Design Labs 5406-7
 Introducing: Additions to the "Stick-On" line of products, including ST-OSC2A and ST-OSC2B audio oscillators, ST-SX4 audio switcher and ST-RG-1 ramp generator with remote control.
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 Carpinteria, CA 93014
 805-684-5415

Radio Express TBD
 Introducing: TM Century's HitDisc E, weekly compilation of new breakers in European hits and alternative music.
 Also: Weekly syndicated programs: American Top 40; Hot Mix, including top 40, modern, techno, and retro versions; American Gold; American Country Countdown.

Radio Systems Inc. 3012
 Introducing: DDS digital audio delivery system for on-air delivery, built on a multi-user operating sys. Also: RS Series consoles. RS-1000 professional DAT machine. TI-101 telephone interface. Super Clock analog and digital master clock/timer systems. Mono and stereo distribution amplifiers.
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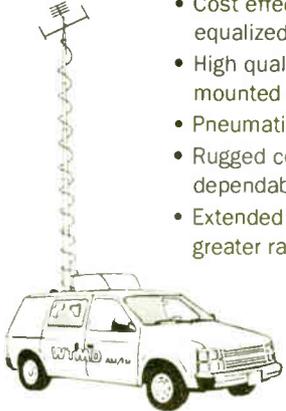
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RE America 3801-2
Introducing: RE 4500 ETSI digital video codec. RE 660 MUSICAM encoder. RE 661 MUSICAM decoder. RE 532 RDS/RBDS encoder.
Also: RE 533 slim-profile RDS/RBDS encoder. RE 8720 tie line encoder. RE 8739 tie line decoder.
Contact: Andrew Bosworth
31029 Center Ridge Road
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216-871-7617

Register Data Systems 4508
Introducing: Windows-based traffic and billing system. Hard disk-based live-assist and music automation. Also: Phantom digital audio automation system. PC-based traffic and billing software packages.
Contact: Brad Harrison
P.O. Box 980
Perry, GA 31069
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Richardson Electronics Ltd. 12901
Introducing: Sennheiser and Shure audio products. RF transistor pallets. Directional couplers. Amphenol connectors. Unilator capacitors. WL Gore assemblies.
Also: EIMAC power grid tubes and accessories. Amperex and National power grid tubes. Motorola, SGS-Thomson, M/A Com and Philips RF transistors.

Roland Corp. US, Pro Audio Division 3406
Introducing: Version 2.0 firmware for DM-80 digital audio workstation. DM-80-S version 2.0 Multitrack Manager Macintosh System software for DM-80 workstation.
Contact: Laurel Cash
7200 Dominion Cir.
Los Angeles, CA 90040-3696
213-685-5141, ext. 338

RF Industries 19481
On display: Universal flush-mount wall plate system for telephone/CATV cable connection. SMA cable connectors. RFA-4084 "Gripper Nipper" wire cutter.

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S.W.R. Inc. 16043
Contact: David K. Edmiston
Rd. #3, Box 182
Industrial Park Rd.
Ebensburg, PA 15931
814-472-5436

Sandar Electronics A/S 3703
Introducing: 16x16 video/stereo audio router.
Also: Audio/video program routers and conference equipment. Distribution amplifiers and equalizers. Routers and distribution amplifiers for 34-140 megabits per second.

Sanken Microphones 2002
Introducing: The CSS-5 stereo shotgun microphone featuring three modes of operation. mono, normal and wide.
Also: Full line of studio. MS stereo, field production and lavalier mics.

Schmid Telecommunications America Inc. 1606-8
On display: SIAT (short interval audio test) System. SIAT-MAX hand-held automatic audio test generator. RESCO Windows-based remote monitoring and control system for broadcast and data transmission.

Scott Studios 4020
Introducing: CompuCarts. 16 digital audio players on a computer touchscreen and cart recorder in production. Uncompressed mode for CompuCarts or Production Bank digital audio. Light Pen version of Scott CD juke box controller. CD Player controller for Pioneer CD players.

Selco Products Co. 4618
No display information available at presstime.
Contact: Celeste Favata
7580 Stage Rd.
Buena Park, CA 90638
714-521-8673

Sescom Inc. 13601-2
On display: Audio accessories for broadcasting, recording and live sound reinforcement.
Contact: Franklin J. Miller
2100 Ward Dr.
Henderson, NV 89015-4249
702-565-3400

SG Communications Services Inc. 16627
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Contact: Dan Ferguson
1100 Northmeadow Pkwy., Ste. 112
Roswell, GA 30076
404-475-0212

Shively Labs 4224
On display: Side-mount and panel FM broadcast antennas. Multi-station combiners. Rigid transmission line. Pressurization equipment. Pattern work.
Contact: Jonathan R. Clark
19 Harrison Rd.
Bridgton, ME 04009
207-647-3327

Shure Brothers Inc. 11901
Introducing: FP32A portable stereo mixer for EFP, ENG, film production and audio recording. FP22 headphone amplifier. SC Wireless Series of wireless microphone systems.
Also: FP410 portable automatic mixer. EC Series and L Series wireless microphone systems. VP88 stereo microphone. Beta 87 condenser microphone.
Contact: Davida Rochman
222 Hartrey Ave.
Evanston, IL 60202
708-866-2200

Siel Sistemi Elettronici S.R.L. 6206-7
Contact: Antonio Orizzonte
Via Bari, 26
20143 Milano, ITALY
39-2-89150150

Sigma Electronics Inc. 16260
On display: The Series 1000 for RGB.

SONEX Acoustical Products Div. 2103
Introducing: Fabrix acoustical material, with fiber-free, semi-rigid melamine, and an asst. of deco fabric covers.
Also: Full line of acoustical products.

SMARTS Broadcast Systems 5224-5
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Also: Line of SMARTCASTER automation and SMARTS office equipment.
Contact: John Schad
2102 Main
Emmetsburg, IA 50536
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Introducing: HMPX Hi8 metal particle tape. HME8 Hi8 metal evaporated tape. DAE-D5000 digital audio workstation that uses PCM 9000 for storage. MXP-700 audio mixing console. HR-MP5 multieffects processor.
Also: BCT-D Series Digital Betacam cassettes. UVWT-MA Series Betacam SP cassettes. ProDAT Plus Series Digital Audio Tape cassettes. MD gear. Digital studio line. DATStation editor.

Sound Ideas 11703-4
Introducing: Ambience II Series 7000 sound library. The Mix broadcast music library.
Also: Warner Bros animation sound effects library. the Hanna-Barbera SoundFX Library.

Soundcraft 15713
Introducing: Series 10S live-on-air mixer. Series 30 live-on-air/production mixer. Spirit studio LC console.
Also: LM-1 portable location mixer. BVE100 audio for video mixer. B100 bdct console. Vienna II production console.

Studer Editech Corp. 1213
On display: Nagra-D four-channel self-contained professional digital audio recorder.
Contact: Tom Jenny
1865 Air Lane Dr., Ste. 12
Nashville, TN 37210
615-391-3399

Studio Technologies Inc. 13618
Introducing: Studio Tools family of distribution amplifiers. Also: StudioComm series for digital audio workstations. IFB Plus System. AN-2 and Generation II stereo simulators. Mic-PreEminence microphone preamplifier.

Superior Electric 4914-5
Introducing: Catalog WHR692 describing WHR Series and Catalog WHR692-S, which describes the series in Spanish.
Also: WHR Series STABILINE automatic voltage regulators. STABILINE rack mount voltage regulator. UPSY Series STABILINE power supplies.
Contact: Ted Gladis
383 Middle St.
Bristol, CT 06010
203-585-4500

Svetlana Electron Devices 10262, 10362
Introducing: The 3CX3000A7 zero bias triode.
Contact: George M. W. Badger
3000 Alpine Rd.
Portola Valley, CA 94028
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Symetrix Inc. 4622
Introducing: Symetrix 420 stereo amplifier.
Also: SX201 parametric EQ/preamp. SX202 mic preamp. SX204 headphone amp. SX208 stereo comp/limiter. 402 dual output delay. 421 AGC/leveler. 425 dual compressor/limiter/expander. 501 peak-RMS compressor/limiter. 571 and 572 SPL computers. 601 digital voice processor.
Contact: Sherri Swingle
4211 24th Ave. W
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Systems Wireless Ltd. 13636
Introducing: Vega-Net, a network-based wireless control and monitoring system. Demo of the Lectrosonics DC1B computerized microphone level controller.
Also: HME System 800 UHF wireless intercom system that interfaces to Clear-Com, RTS and other cabled systems. Vega's full line of wireless microphones and wireless IFB systems. Full line of Clear-Com party line and Matrix intercom systems.

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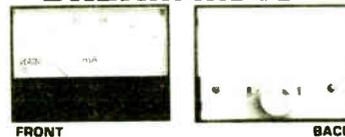
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Introducing: The FMR-450 UHF wireless receiver, the HT-450 UHF handheld mic transmitter, the WT-450 UHF all metal belt pack, the HT-200 handheld mic transmitter, the BP-1000 single channel beltpack and the BP-2000 two-channel beltpack.
Also: Full line of headsets, headphones, wired and wireless mics, intercom systems and high speed audio tape duplicators. The RTS intercom line, including two-wire as well as digitally controlled four-wire matrix intercom systems.

Telos Systems 5200
On display: Zephyr digital audio network transceiver. Telos 100 Delta digital hybrid. The Link. The ONE plus ONE dual hybrid. Call Screen Manager software for talk show production. ONE-x-Six talk show system.
Contact: Danielle Cline
2101 Superior Ave.
Cleveland, OH 44114
216-241-7225

TFT Inc. 1908
Introducing: DSS92, a digital subcarrier system for television. EIS911 and 912 emergency information system manager and generator.
Also: DMM92 digital modem and multiplexer for digital STL transmission. Modulation monitors/analyzers. Analog STLs. Remote pickup transmitters and receivers. Emergency Broadcast equipment.
Contact: Darryl E. Parker
3090 Oakmead Village Dr.
Santa Clara, CA 95051
408-727-7272

Television Technology Corp. 15708
On display: FMS4000 4kW solid state FM transmitter. FMS100 100W solid state FM transmitter.

TM Century TBD
Introducing: TM Mix and TM Country GoldDisc libraries. Slam Dunk production library.
Also: GoldDisc CD library. HitDisc weekly compilation CDs. Ultimate Digital Studio II. Production libraries. Jingles on CD. TM Century television. PowerPlay music scheduling software. TM Comedy Network weekly CDs.
Contact: Stuart McRae
2002 Academy
Dallas, TX 75234-9220
800-299-2121 or 214-247-8850

Tripp Communications Sales 15380-1
Contact: Ted Tripp
P.O. Box 5267
Walnut Creek, CA 94596
510-256-6006

Utility Tower Co. 2326-7
On display: Samples of tower sections for AM, FM, TV, CATV, LPTV and microwave communications.

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Introducing: Production music and sound effects libraries in CD-ROM multimedia format for IBM Windows and Mac formats.
Also: Production music library. Sound effects library.
Contact: Thomas Valentino
500 Executive Blvd.
Elmsford, NY 10523
914-347-7878

Varian Associates 16101
Introducing: New service of remanufacturing power grid tubes for radio transmission.
Also: Power grid tubes for AM, FM and shortwave radio.

Vega Wireless 15716
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Ward-Beck Systems 12501
Introducing: Renaissance radio control series.
Also: M405P portable extended range VU meter. D8212 audio distribution amplifier system.
Contact: Eugene L. Johnson
841 Progress Ave.
Scarborough, Ontario
Canada M1H 2X4
416-438-6550

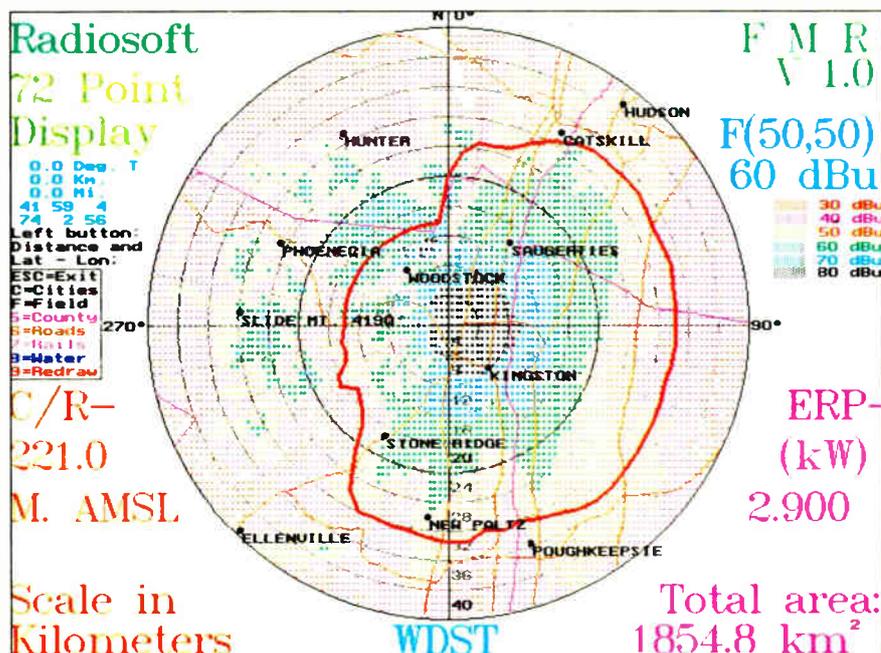
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On display: NightScan remote control elevated lighting system. Pneumatic telescoping masts.
Contact: Steve Pinkley
P.O. Box 900
Orville, OH 44667
216-682-7015

Wegener Communications Inc. 5414
On display: Digital audio SCPC transmission provided with Addressable Network Control System (ANCS).

Wohler Technologies 19539
Introducing: Surround Sound monitor. Digital VTR (AES/EBU) audio monitor.
Also: Line of 1RU visual level and phase displays. ARS Series of audio routing switchers.

Wheatstone 5108
On display: The Wheatstone A-6000 audio console.
Contact: Ramon Esparolini
6720 V.I.P. Parkway
Syracuse, NY 13211
315-455-7740

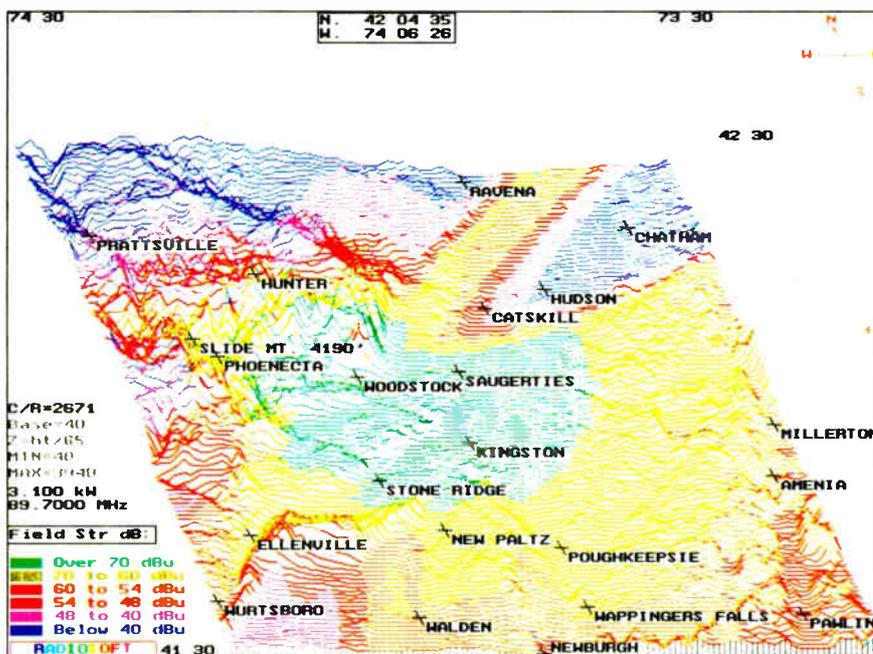
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Compression Menu of Hard Choices

► continued from page 1

But most of the manufacturers, vendors and compression system developers contacted by **RW** say Squire was on to something. There is no dueling-algorithm emergency today, they say, but there could be one someday if broadcasters and compression developers ignore the problem.

Crowded field

It is difficult to say exactly how many data compression schemes have been invented and marketed worldwide. Systems have been developed to compress several forms of data besides audio, such as video, text from computer files

and telephone voice communications.

So far only a handful of systems have had a serious effect on U.S. radio broadcasters. The most famous of them is the International Standards Organization/Moving Picture Expert Group (ISO/MPEG) Layer II standard, better known as MUSICAM-Surround, a versatile, European-developed technology that has already been applied to a wide number of studio and RF applications, as well as audio for video and integrated service data networks (ISDN).

The ISO/MPEG Layer I standard, used primarily today in Philips' Digital Compact Cassette (DCC) digital audio

tape format, is a simplified version of MUSICAM.

MUSICAM is related, but not entirely compatible with the recently completed Layer III. The question of whether Layer II or III fits best for most applications is currently a source of high controversy in Europe. (See story, page 72.)

Dolby Laboratories, San Francisco, has also developed a series of compression, or audio coding (AC), systems for a wide variety of applications. AC-2 is the most commonly used Dolby system in the radio industry, where manufacturers have been licensed to include the algorithm in audio storage and automation

systems, as well as studio-to-transmitter links (STLs) and other RF uses.

The apt-X system, developed by Audio Processing Technology (APT), Belfast, Northern Ireland, is found in a similarly wide number of radio broadcast applications, but is considered especially useful in RF links because of its comparatively short coding delay.

Other compression systems are used in a few, specialized applications. Sony Corp.'s Adaptive Transform Acoustic Coding (ATRAC) system was developed for its consumer MiniDisc (MD) magnetooptical system. Professional MD players and recorders have just been made available for the radio industry in the last year.

Another specialized system, Scientific Atlanta's Spectrum Efficient Digital Audio Technology (SEDAT), may be present in more radio stations than any of the other forms of compression because it is used to feed audio to hundreds of ABC Radio, CBS Radio and other network affiliates.

Weighing the merits

Stations benefit from compression systems in many ways. "I'll say our coder is very good, but I never like to use the word 'transparent.' It's like car salesmen saying a car is 'perfect,'" said Louis Fielder, manager of Dolby's digital audio coding group. But compression saves money in almost every case, while maintaining analog quality or better, he said.

"There are a number of applications-specific issues that people must bear in mind, but no matter what algorithm you select, in the end there are strong, tangible benefits that outweigh any perceived damages," said Jamal Hamdani, executive vice president, Moseley Associates, Santa Barbara, Calif., which offers the DSP 6000 STL with apt-X compression.

"Generally, the thing you really save is antenna costs" when buying a digital STL, Hamdani said. Digital antennas are smaller and less expensive than equivalent analog equipment.

lent analog equipment.

STLs, TSLs and electronic newsgathering equipment transmitting compressed digital signals operate at lower power than their analog counterparts, saving electricity and reducing the chance of interference with other microwave signals.

The digitally compressed bandwidth of satellite signals take up less transponder space than analog uplinks, which saves money and greatly increases satellite capacity.

Some say that the future cost of computer memory will be low enough for all stations to economically store and play back uncompressed music and other audio material in the studio. But it is currently less expensive to store compressed audio on computer hard disk systems.

"There is a hidden benefit in the number of channels we can play from a single box, the start and stop reaction time and the editability. Slowing the data rate

continued on page 66 ►

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Squire Tests Still Are Controversial

A rising concern among broadcasters, following the audio degradation associated with D/A-A/D conversion and the general loss associated with any compression algorithm, is the possibility that additional artifacts are created by using different, incompatible compression algorithms in the same broadcast chain, as WQEW(AM)-WQXR-FM's Squire suggested last year (RW, May 26, 1993).

The Squire tests ran signals through equipment employing different com-

pression algorithms beginning with two passes and going up to as many as 20 passes.



Squire's equipment for the tests included: a ComStream Corp. Ku-band VSAT downlink (apt-X); a SEDAT link from ABC Radio; a Corporate Computer Systems CDQ 2000 digital codec (MUSICAM); a Moseley DSP 6000 STL (apt-X), and Sony MD and Philips DCC player/recorders.

According to a written description of

the tests released during Squire's follow-up dueling algorithm presentation at NAB's 1993 Radio Show, D/A and A/D conversions were made during each compression pass.

"There were no digital-to-digital connections because in an actual broadcast all outside world connections to mixers, consoles, etc., would still be analog," Squire said.

Audio after 20 passes was severely impaired by veiling, chirping, clicking and other annoying artifacts. Two- or three-pass signals sounded acceptable, except for random,

continued on page 68 ▶

Compression Plusses and Drawbacks

▶ continued from page 64

down provides practical systems that the broadcaster needs," said Greg Dean, founder of Computer Concepts Corp., Lenexa, Kan., which is licensed to provide apt-X compression in its Digital Commercial System (DCS).

Whatever digital audio broadcasting system is selected in the U.S., in-band or out-of-band, it will depend on compression technology to fit into narrow RF channels and avoid interference with other stations or other analog services.

Weighing the demerits

The list of compression drawbacks is somewhat shorter, but noteworthy.

The increased use of digital equipment has increased the number of digital-to-analog and analog-to-digital conversions in the broadcast chain, which tends to significantly damage audio with each pass.

If all or some of the D/A-A/D passes are done with compressed digital, the problem is compounded. Compression systems squeeze audio into narrower bandwidths by eliminating bits of original digital information, most of which are not recovered in the decoding process.

Algorithm developers, with the benefit of detailed psychoacoustic research, have determined that the missing information is imperceptible to the human ear. But artifacts do become noticeable after multiple passes of compression, during which bits of information are repeatedly removed from the signal.

(The very title of this report, "In Depth: Audio Compression," will likely be controversial to some RW readers who insist that the term should be "digital audio data reduction." Some compression system manufacturers and vendors prefer the safer, but vague term "coding." However, most manufacturers and their clients in the audio, video and broadcast industries, continue to use the word "compression" without confusion.)

The element of loss after every compression pass leads many equipment suppliers to advise using compression only when it is necessary. "Use compression only when bandwidth is expensive," said Steve Church, president, Telos Systems, Cleveland, manufacturer of the Zephyr ISDN transceiver, the first U.S. product licensed to provide ISO/MPEG Layer III compression.

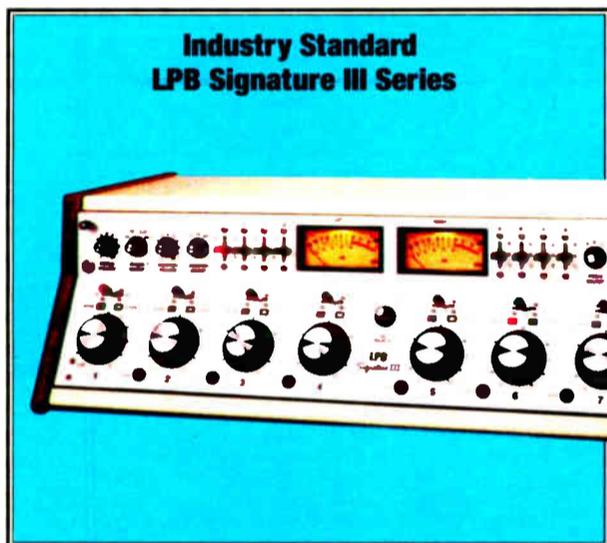
"We compress things as little as possible," said Dave Anderson, vice president, operations and engineering for IDB Communications, Culver City, Calif., which offers its DDD-2 apt-X-compressed links. "If we have a feed that has two or three different stops, we move the maximum amount of compression to the final step at the back of the link whenever we possibly can."

But sometimes it is not possible to limit compression. "It is totally driven by what the customer wants to do. We have problems, for instance, when doing sports backhauls because the requirement there is typically to keep the operating costs as low as possible," Anderson said.

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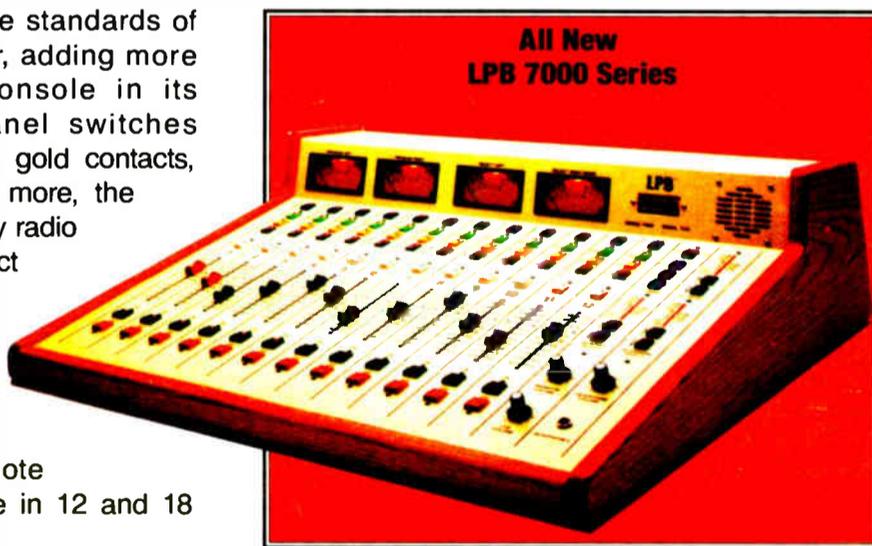
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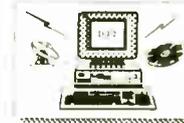
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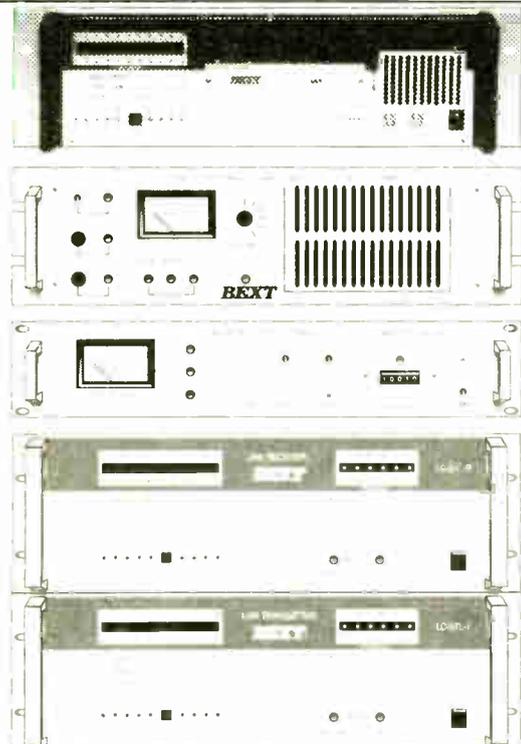
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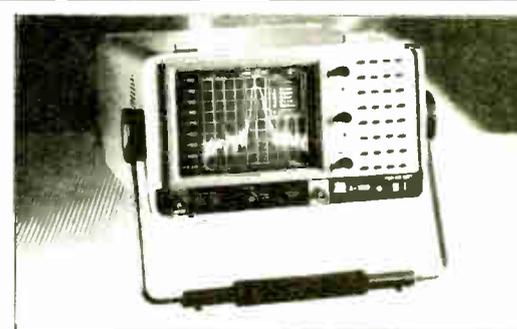
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A Way to Let Ds be Ds

A technology recently developed by a small company, California Digital Audio Systems Inc. (CDAS), Moorpark, Calif., may soon make it practical for a station to operate with one pass of compression. Test versions of CDAS' "digital audio Xpress" (daX) system are in a handful of test sites.

The system is designed to replace many of the functions of various pieces of audio and video studio equipment to reduce the number of different compression algorithms and D/A-A/D conversions necessary. The system is currently developed to the point that all but one D/A-A/D conversion has been eliminated before transmission.

The one remaining conversion to analog is for mixing applications, such as voiceovers. "But we've got people working on that," said CDAS Vice President Richard J. Becvar.

The diagram at right illustrates what CDAS estimates would be the worst-case scenario for a daX system operating with MUSICAM at 256 kilobits per second (kbps). Audio quality is initially impaired by a D/A and A/D conversion at the remote site, but is maintained at the same level through the rest of the chain.

Once digital audio radio service to the public begins, CDAS estimates signals routed through the daX system under this worst-case scenario, would deliver 18 percent of original compact disc source

material to the listener.

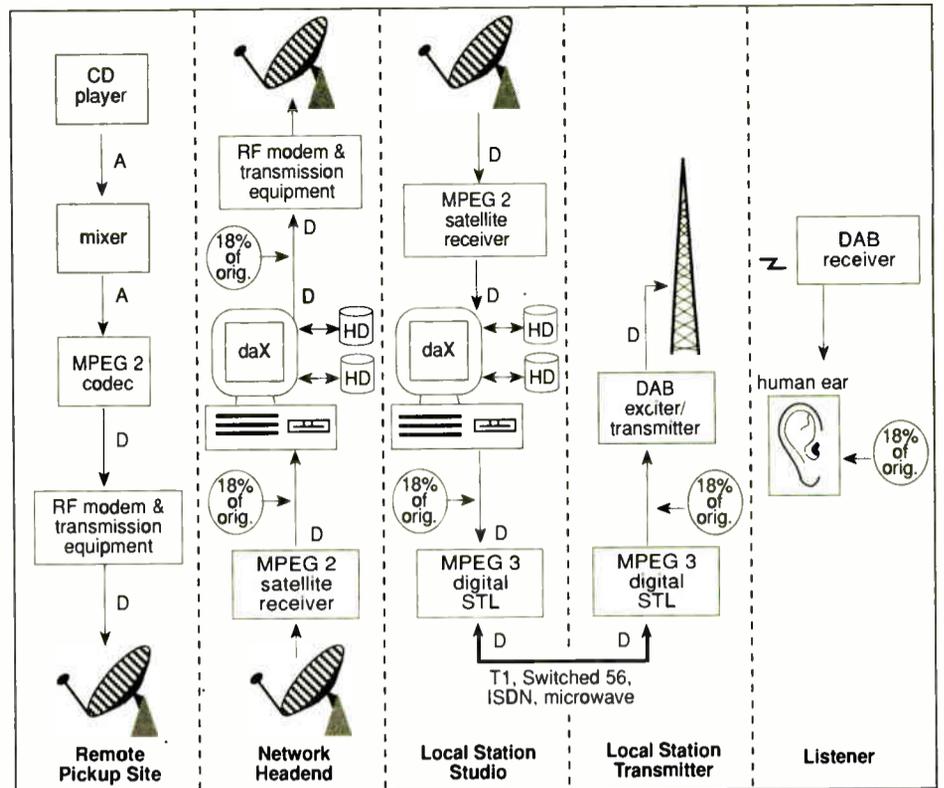
CDAS calculates the worst-case non-daX, multiple-transcoded DAR signal would whittle the original source down to about 0.003 percent by the time it reached the listener.

CDAS has worked closely with Gannett Broadcasting in the development of daX and other projects, such as the application of digital compression technology to VSAT transmission (RW, Sept. 22, 1993). In fact, Paul Donahue, vice president, engineering, Gannett Radio, is a technical consultant to and investor in CDAS.

It is, therefore, not surprising that daX has been developed with MUSICAM as a model. Gannett is a chief partner in the U.S.A. Digital consortium, developing in-band, on-channel DAR transmission systems that operate with the MUSICAM algorithm. The daX approach is not system-specific—any compression system could be applied, Becvar said.

Becvar will provide more information on the system during a technical paper session at the National Association of Broadcasters Convention in Las Vegas, scheduled for Sunday afternoon, March 20.

At press time, Becvar could not say whether CDAS would have a hardware demonstration of the system at NAB, but he said a public demonstration should be ready before the end of 1994.



Tests, Press Draw Fire

► continued from page 66

unpredictable glitches.

Squire's test procedures and results have drawn fire from several critics. "Who knows what Herb was doing, but it was not real-world testing," said Don Bird, general manager, 360 Systems, Tarzana, Calif., which offers the DigiCart/II playback system with optional AC-2.

Test critics

"The coders that he cascaded were not upper-end quality. Some of them were very low-quality at 64 kilobits per second (kbps)," said Louis Fielder of Dolby Labs. Overall, it was a worst-case scenario that does not match what most stations are using, he said.

The most common complaint was over Squire's decision to demonstrate degradation of compression after 20 passes,

which happens very rarely, perhaps never, in today's radio industry.

"The local broadcaster interfacing with networks and having an STL is looking at the problems associated with third generation," Greg Dean of Computer Concepts Corp. said.

Transcoding artifacts are not rare sounds in audio development labs, where researchers purposely try to find the breaking points of compression systems. But most compression developers and compression system manufacturers say they have never heard a transcoding artifact from an over-the-air signal.

Considering other possible impairments created in the broadcast chain or in the transmission path, transcoding algorithms might be hard to distinguish from other noise, especially on FM car radios that have frequency responses of 15 kHz or less.

Others complained about the lack of control samples to make an adequate judgment of how severely compression systems affect signals. Tapes of 20-generation compressed digital audio should have been compared to 20 generations of analog audio on the low end and 20 generations of uncompressed digital audio on the high end, they say.

The results might have shown severely damaged compressed audio, but better quality than might have been produced at an all-analog station.

Twenty D/A-A/D conversions producing artifacts should surprise no one, some Squire critics say. Even if the same compression system were used throughout a 20-pass test, the degradation would be easily audible. In fact, there is no way to distinguish the multi-generational artifacts from the transcoding artifacts, they say.

Protest

"The methodology (Squire) used was quite slack," said Michael Smyth from APT's Los Angeles office, whose brother, Stephen, developed apt-X. The few transcoding artifacts that do reach the airwaves do not sound as bad as the artifacts recorded in Squire's tests, he said. "I believe the artifacts he was listening to

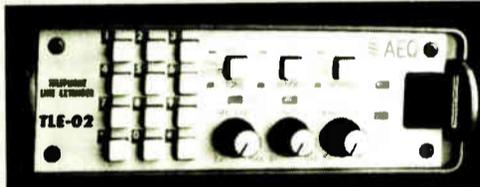
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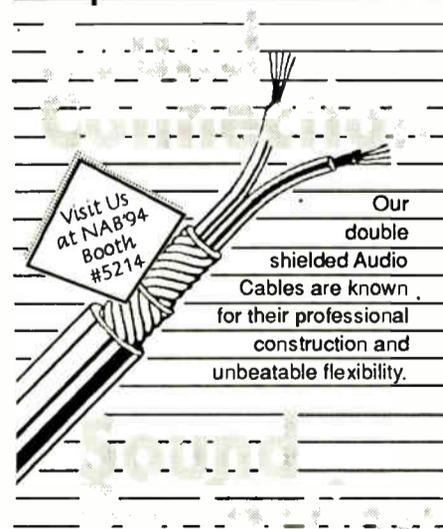


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Algorithms Are Still Dueling a Year Later

► continued from previous page

are not the ones that are actually out there in the field at this stage."

Squire has nearly as many defenders in the radio industry as he has critics.

"I think it is a real problem. Herb didn't manufacture it...I think Herb's results represent a real-world picture of what can happen," said Bob Donnelly, general manager of ABC Radio's network satellite operations, in response to those who say Squire's tests lacked controls.

"Herb issued a cry for reasonableness, and sometimes to make people think in reasonable ways, you have to create some kind of dramatic episode," Donnelly said.

"There was a lot of discussion around about what would happen if you cascaded compression algorithms, but he actually sat down and did the testing rather than just theorize," said Bill Harland, director, domestic sales, Broadcast Electronics, Quincy, Ill., which sells the AudioVAULT 100 MUSICAM audio storage and playback system.

The trade press has attracted some of the same criticism that has been directed at Squire. News stories on compression and incompatible algorithms have dwelt on "a non-issue" and overplayed the seriousness of the situation, said 360 Systems' Bird.

Overblown

"My view is that Squire has overblown it and (the press) has reported it, perhaps giving it more publicity than it is due."

said Jack Fenster, director, broadcast radio product management, Scientific Atlanta's (SA), Melbourne, Fla., facility.

"Customers are as confused as ever. The media could do a lot to alleviate the confusion," Bird said.

Powerless pen?

Trade press reports on the disadvantages of compression may have been harsh, but they did not hurt sales. But many customers have been asking more questions about compression systems before buying and tend to be more aware of how to properly apply the systems to their radio operations, vendors say.

"Frankly, (the dueling algorithm debate) has legitimized compression. Now, instead of asking, 'Is it compressed?,' customers have been asking, 'How is it compressed?'" said Adrian Charlton of The Management, Fort Worth, which manufactures and markets the Digital DJ audio automation system with apt-X compression.

The trade press "is just the messenger telling people about things that need to be dealt with," said Scott Slocum, a salesman for Computer Concepts.

"I would not want a doctor who would not want to tell you have cancer," said Ben Umberger of BLU Electronics, Clearwater, Fla., which sells the DigiStation digital automation system with AC-2.

One of Bird's most specific criticisms of the press is its failure to clearly explain

that both compressed and uncompressed audio equipment is available.

Digital audio technology and compression have merged to represent the same technology in some customers minds,

Quest Begins for 'Lossless' System, Other Noise Cures

Whatever compression-related audio impairment broadcasters may have to face, manufacturers have suggested remedies. Some developers are working on long-term cures.

One of the most popular suggestions for the near-term is a new, more formal round of dueling algorithm tests.

Many say that the Herb Squire tests were good, as far as they went, but that follow-up testing is now needed with a goal in mind. Instead of simply illustrating the problem, the data could be used to develop solutions.

A similar round of tests might be helpful if they yielded a blueprint of how each compression algorithm transcodes to others in particular applications. "It is a system-design kind of research," said Ron Renschel, marketing manager, Sony Pro Audio, Park Ridge, N.J.

Only a few organizations have the facilities where transcoding tests could go through enough passes of compression to

prompting them to avoid all digital audio equipment purchases, Bird said.

Broadcasters are reminded that many digital studio systems are sold with no compression capability at all. Many units are switchable, such as 360 Systems' DigiCart, which gives the broadcaster the option of working in AC-2 or full-bandwidth digital audio.

get valid results—the commercial networks.

ABC's Bob Donnelly agreed that such testing is needed, but said it should be done on an informal basis, rather than ISO-style testing with an eye toward developing a standard. The most effective approach would be to form groups of users "who come together and share experience. Broadcasters talk to each other when they have common war stories," he said.

The alternative would have to be formal testing on an on-going basis. New compression algorithms, along with improved and refined versions of old systems, are introduced every year. Test data on dueling algorithms could be obsolete very quickly.

An alternative many vendors suggest is case-by-case testing. Before signing the contract for a new hard-disk storage system or DSTL, a station manager or engineer is often given a chance to test the model with the station's existing facilities.

continued on page 71 ►

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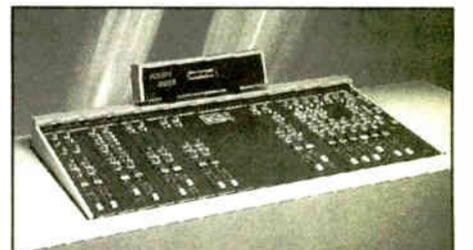


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World Radio History

Ask for a Test Drive

► continued from page 69

This approach carries the same problem of rapid obsolescence of test data, and sometimes stations do not have access to all the sample models of digital equipment they may need. But where possible, case-by-case testing can be effective.

If a new piece of compression equipment produces artifacts, a station may opt to send it back or find some way to adjust it to the existing studio or transmission gear.

Compression equipment often features data-rate control of the level of compression. If the bandwidth of a compressed signal must be widened to avoid audio impairments, reprogramming is a simple matter.

"From our perspective, you must get as much headroom as possible," said Steve Church of Telos Systems.

"If (Squire) had used high-data-rate MUSICAM systems, I think he would have had very different results," Dolby's Louis Fielder said. "The degradation would have been small and manageable."

Flexibility is even easier to achieve if compression equipment is open-architecture. Manufacturers could leave it up to individual broadcasters to buy and install the desired digital compression computer card.

"To us, as component suppliers, (the form of compression used) doesn't make a lot of difference. We predicted that this (dueling algorithm debate) would happen to some degree. Most of the cards we are shipping today have a choice of five or six algorithms on them," said James Antrim of Antex Electronics, Gardena, Calif. Antex builds compression components in Dolby AC-2, the MPEG standards and others.

"If (customers) wish to have something different than what we provide them, they should have that choice. That, in my opinion, is the more responsible way," said Moseley's Jamal Hamdani. Moseley already offers open-architecture DSTLs, he said.

Open-architecture equipment would make it easier for stations to design their digital facilities for single-compression-system operation.

The CDAS daX system could also go a long way toward making it practical to use just one compression system from origination to transmission by keeping signals in the same compressed digital state throughout the chain. Other developers, such as Scientific Atlanta, are likely to eventually introduce similar systems and begin working for a D/A-A/D conversion standard.

"We haven't really done much with it except come up with a concept. We haven't spent any time with the standards organizations because we haven't had the technical people available to develop the product," Scientific Atlanta's Jack Fenster said.

Some are looking to the day when a technical solution erases all transcoding issues. "At some point somebody's going to figure out how to do a lossless compression algorithm," said Bill Harland of Broadcast Electronics.

No one can say when, but the ever-improving art of squeezing audio signals into narrow channels may be advanced to the point that no 1s or 0s need ever be removed.

"Algorithms developed in the future will be 20:1 compression and lossless. Not only will the customer want it, but I'll put it on

my board as soon as I can get one," Antex's Antrim said.

Others are more skeptical about losslessness. If an algorithm developer chooses to leave audio data intact, other forms of data must be sacrificed. One possibility is greater time delay beyond the milliseconds of delay with current systems. Unless that problem is resolved, lossless systems would be impractical in real-time broadcast applications.

"I've trapped myself in years past by saying, 'Oh, I don't think anybody can do that.' I'm not going to say that, but boy, I'd be impressed," said Computer Concepts Corp.'s Greg Dean.

If equipment manufacturers and vendors agree on anything, it is that a single, standard compression algorithm for all applications will never exist in the U.S. Standards are just not Americans' style.

"Dolby, being a typical American company, has a little different philosophy than some of the European organizations, although we have been active in the (European) standards activity," Fielder said. But regardless of the system Europeans standardize, stations will determine their best options on their own, he said.

In a sense, however, compression systems have already begun to be standardized. Dolby's AC-3, a 5.1-channel, surround-sound upgrade of AC-2, has been chosen by the FCC's Advisory Committee on Advanced Television

Service to be the audio component of the high definition television transmission standard, which the commission is expected to approve in 1995. That standard could have an indirect effect on compression in the radio industry.

The FCC's eventual selection of a DAR standard could have even greater influence. MUSICAM and AT&T's PAC (Perceptual Audio Coder) are the only compression systems involved in the current Electronic Industries Association/National Radio Systems Committee tests of DAR transmission systems. (See story, page 7.)

One possible eventuality may be elimination of some compression systems in the marketplace as equipment manufacturers seek commonality with the most

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Why didn't I think of that?

Europeans Differ on MPEG Options

by Alan Carter

ERLANGEN, Germany To call ongoing discussions surrounding the use of Layer II and Layer III algorithms for digital audio transmission at low bit rates a debate is an understatement.

Developers behind the two schemes have their respective arguments. But there is more at stake than meets the eye.

For broadcasters the issue focuses on three main factors: sound quality at different bit rates and modes; audio degradation with multiple coding and decoding, and problems encountered with delay.

Both Layer II and Layer III support: four

modes (single-channel, dual-channel stereo and joint stereo), three sampling frequencies (32, 44.1 and 48 kHz) and bit rates in a range of 32 to 384 kilobits per second (kbps) for Layer II and 32 to 320 kbps for Layer III.

At the Fraunhofer-Institut für Integrierte Schaltungen, located north of Nuremberg in Erlangen, proponents who completed much of the work on Layer III argue that the algorithm is the strongest of the MPEG audio codecs.

Layer III is especially useful to achieve the best compromise between audio sound quality and bit rate at low data rates near or less than 64 kbps per audio channel,

according to the Fraunhofer.

The Fraunhofer also interprets international tests and draft recommendations within the International Telecommunication Union (ITU) Radiocommunication Study Group—formerly the CCIR before an ITU reorganization—as making Layer III “the clear leader in audio coding technology.”

But a two-hour drive south to the Institut für Rundfunktechnik (IRT) in Munich where development of Layer II is centered, engineers claim that the same tests prove their system “is and in the future will continue to be the best choice in the world of audio coding technology.”

Who's right? Who's wrong?

“I think we are seeing a domino effect,” said Karlheinz Brandenburg, head of the audio/multimedia department for the Fraunhofer. “We see at the low-bit rate, more and more people are interested in Layer III.”

Harald Popp, senior engineer at the Fraunhofer, admitted that complaints by Layer II proponents about the complexity of Layer III and delay are a drawback.

However, he said, some decoders will have all three layers on one chip and the next generation of encoders “may be” less complicated.

“I think delay is a weak argument,” he also said. “Yes, it is true. But how much effect or influence does feedback have?”

Gerhard Stoll, head of the psychoacoustic section at the IRT and a chief developer involved in Layer II, said the recommendation from the task group of

continued on next page ▶

Hard Disk Recording Doesn't Have To Be Hard On Your Wallet.

“...in a price/performance comparison, the DR4d would be hard to beat. Thumbs up on this one.”
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“...great sound, useful features, and friendly operation... sure to set a new standard in affordable recording”
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If you're involved in production for radio, then you're aware of the increasing demand for digital audio quality. So your next multitrack recorder should be digital, but which format: tape or hard disk? You've heard about the great editing tricks offered by disk-based systems, but there's a problem.... don't all hard disk systems require expensive add-in hardware and software, to already expensive computers? Not anymore!

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

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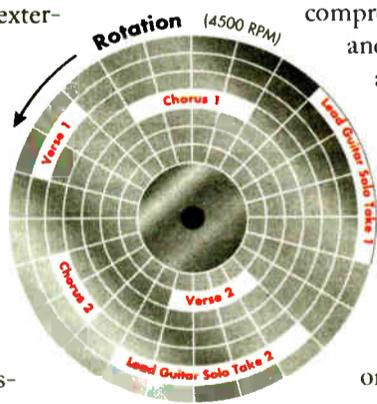
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World Radio History

Artifact Solutions

▶ continued from page 71
established standards.

“The choice may narrow down to two or three...but we'll probably go through many more generations,” Hamdani said. Many developers continue to seek the next level of sophistication, he said.

“There are certainly going to be some that fall by the wayside. There is a natural evolutionary process,” IDB's Dave Anderson said. MPEG standards, apt-X and others that have already gained international acceptance will have the advantage, he said.

However, some believe that compression developers will continue to invent algorithms for specialized situations. “Application-specific algorithms, I believe, are what will happen. I don't believe you're going to get fewer algorithms; you'll get more,” Michael Smyth of Audio Processing Technology said.

Whatever the final outcome, it is clear that the already strong position compression systems have in the radio industry will only get stronger.

The one message compression developers and marketers hope to send is that there is no reason to avoid buying these systems today.

If compression creates audio glitches, there will always be a way to treat them, if not cure them altogether, as long as the industry keeps track of the rapidly changing technology.

“When the first CD players came out on the market, they sounded good, and people said, ‘This is it. We've gone digital.’” ABC's Donnelly said. “But there have been quantum improvements in digital playback that are noticeable because people right away said, ‘Make sure you do this and make sure you do that.’”

The same is true with compression, Donnelly said. It's digital, but people still have to pay attention.

□□□

The conclusion of this report will appear in the March 9 issue, with a look at equipment users' experiences with compression, Herb Squire's response to his critics and a closer look at some of the more important audio compression systems in use today. Those attending the NAB convention will find the March 9 issue at the Radio World booth, No. 4309.

► continued from previous page
the ITU Radiocommunication Bureau (ITU-BR) is "bad news" for Layer III.

While the document recommends Layer III for commentary—low data rate transmission for music and speech in such modes as ISDN—Layer III does not meet specifications under acoustical testing at 60 kbps mono using headphones, Stoll said. Layer III, however, meets the specifications at 60 kbps mono and stereo using loudspeakers.

Yes, this appears to be an insignificant point, but Stoll said users can obtain "the same, maybe better" quality using Layer II with a lower sampling rate. And, as Layer II proponents always suggest, the scheme is easier and cheaper to implement.

As expected Popp does not agree with Stoll. "Of course if you reduce the sampling rate you get different results," Popp said. "But there have been no listening tests of Layer II or Layer III at lower sampling rates. All the arguments are just claims."

According to draft revision from the task group making the recommendation that goes before a review committee in March, different layers of the coding system with increasing complexity and performance can be used depending on the application.

Application is one point on which all proponents agree.

Stoll said he believes the recommendation will allow the market to determine which system gains what share of the different audio sectors.

"You don't get a free lunch," Brandenburg said. "You have to be careful on how you use this equipment."

The recommendation addresses the full spectrum of audio algorithm schemes and applications.

Layer I contains the basic mapping of the digital audio input into 32 sub-bands, fixed segmentation to format the data into blocks, a psychoacoustic model to determine the adaptive bit allocation, and quantization using block companding and formatting. One Layer I frame represents 384 samples per channel.

Layer II provides additional coding of bit allocation, scale factors and samples. One Layer II frame represents 3 x 384=1,152 samples per channel.

Layer III introduces increased frequency resolution based on a hybrid filter band (a 32 sub-band filter band with variable length Modified Discrete Cosine Transform). It adds a non-uniform quantizer, adaptive segmentation, and entropy coding of the quantized values. One Layer III frame represents 1,152 samples per channel.

The recommendation said that there are four different modes possible for any of the layers: 1. Single channel; 2. dual channel (two independent audio signals coded within one bit stream, e.g., bilingual application); 3. Stereo (two left and right signals of a

stereo pair coded within one bit stream).



The fourth mode is joint stereo, which exploits the stereo irrelevancy and redundancy, and can be used to increase the audio

quality at low bit rates and/or to reduce the bit rate for stereophonic signals.

The history of the algorithms dates back to the development of MUSICAM and ASPEC. Layers I and II came directly from the developers of MUSICAM: IRT, Philips and the CCETT. Layer III is a combination of MUSICAM and ASPEC, but mostly ASPEC, which was developed by the Fraunhofer, AT&T, Thomson Brandt and CNET.

However, the lead proponents are the IRT and the Fraunhofer.

The IRT is the standards setting organization for German public

broadcasters, the ARD, and fully government funded. The Fraunhofer is a private research organization that receives some government funding but mainly supports itself as a research and development consulting firm for private corporations and other institutions.

The recommendation now before the ITU followed subjective tests that made a comparison to compact disc quality for applications including emission, such as digital audio broadcasting; distribution, or transmission among member network organizations; and contribution, one-way trans-

mission from the field to a studio.

For emission the results showed that at 2 x 128 kbps independent channels, the specifications were met by: ISO/IEC 11172-3 Layer II; ISO/IEC 11172-3 Layer III, and Dolby AC-2. At 192 kbps joint stereo: ISO/IEC 11172-3 Layer II and ISO/IEC 11172-3 Layer III.

The evaluation for distribution passed a signal through three codecs in tandem at 120 kbps per independent channel. In order not to have the exact same audio signal before each new encoding, repopulation of the binary codes

continued on page 74 ►



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Layers of Disagreement

► continued from page 73

was performed by applying a 0.1 dB gain reduction in the linear pulse-code modulation (PCM) domain. The ISO/IEC 11172-3 Layer II codec was the only system that fulfilled the requirement.

For contribution, the signal was passed through five codecs in tandem at 180 kbps per independent channel. The tandeming was performed using a resolution of 18

Advanced Features of Layer II

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- High error ruggedness of the coded bit stream.
- Simple access in disk-based editors because of constant length of audio frames.
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- Dynamic Range Control (DRC) with individual adaption to the listening conditions.
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- Extension to lower sampling frequencies providing improvements of subjective quality in the range of 16 to 64 kbps per mono signal.

—Source: Institut für Rundfunktechnik

bits linear PCM. Again, repopulation of the binary codes was performed by applying a 0.1 dB gain reduction in the linear PCM domain. The ISO/IEC 11172-3 Layer II codec was the only system that fulfilled the requirements.

And finally, for commentary, the basic audio quality of speech signals reproduced after decoding was to be equivalent to that of a 14-bit linear PCM original.

The actual tests used a 16-bit linear PCM format. Perceptible levels of impairments were tolerated for music sequences of compact disc quality.

In tests conducted in 1992 with loudspeakers at 60 kbps per mono channel only the ISO/IEC 11172-3 Layer III codec alone performed satisfactorily on speech, and it was, on average, the best for music signals.

On speech signals, the grades were always higher—perceptible but not annoying—in both mono (60 kbps) and stereo (120 kbps joint stereo) modes.

Based on those tests, Layer III is recommended for commentary.

But in subsequent tests in 1993, the results obtained using headphones and listening to assess the performance of a 60 kbps Layer III mono commentary codec indicated that this did not meet the required quality with a speech signal. The recommendation calls for additional tests at 60 kbps.

Based on the tests performed for emission, contribution and distribution, ISO/IEC 11172-3 Layer II is recom-

mended for all of these applications. For emission, the recommended bit rate is 2 x 128 kbps. In tests conducted in 1992, the ISO/IEC 11172-3 Layer II only marginally fulfilled the requirements at 192 kbps, and the task group decided that improvements would be required for the use of this bit rate to be reconsidered. A phrase here that Layer III proponents draw attention to states that ISO/IEC 11172-3 Layer III clearly meets those requirements.

Further tests conducted in 1993 did not show improvements at this stage. Additional studies at 192 kbps using joint stereo mode would be required for the use of this bit rate to be reconsidered.

The complexity evaluation for the decoders used for emission showed that Layer II and the Dolby AC-2 decoders are of the lowest complexity.

Layer II was chosen for emission because this codec provides commonality with the distribution and contribution applications. Further, it provides flexibility to improve the encoder and this codec was tested at both bit rates—192 and 256 kbps per stereo program. Eureka-147 decided in 1991, after the ISO/MPEG test results were available, to use ISO/IEC 11172-3 Layer II as the audio coding system in EU147-DAB.

The recommendation concludes by stating that network verification tests were conducted in 1993 with a complete broadcast chain, including five contribution codecs at 180 kbps in tandem, three distribution codecs at 120 kbps in tandem and one emission codec. The results show that the basic audio quality at the extremity of

such a chain is not satisfactory.

Tests also were conducted with eight codecs at 180 kbps in tandem that proved to be a satisfactory configuration for maintaining an acceptable quality.

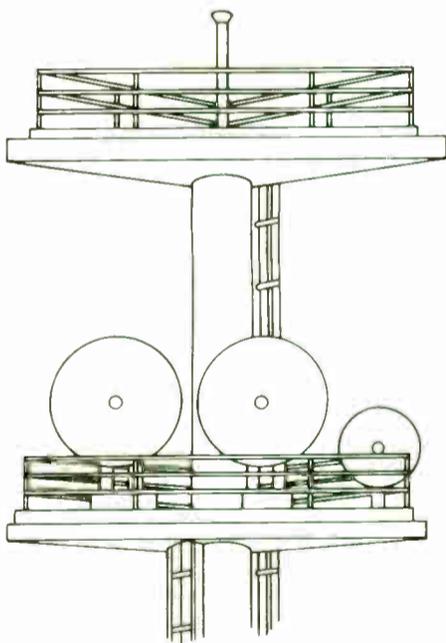
□ □ □

For information on the various layers, contact the Fraunhofer Institute, Wetterkreuz 13, D-91058 Erlangen, Germany at: 49-91-31-7760; fax: 49-91-31-776-399. Contact the IRT, Floriansmühlstrasse 60, D-80939 Munich, Germany at: 49-89-32399-1 or -318; fax: 49-89-32399-415.

Advanced Features of Layer III

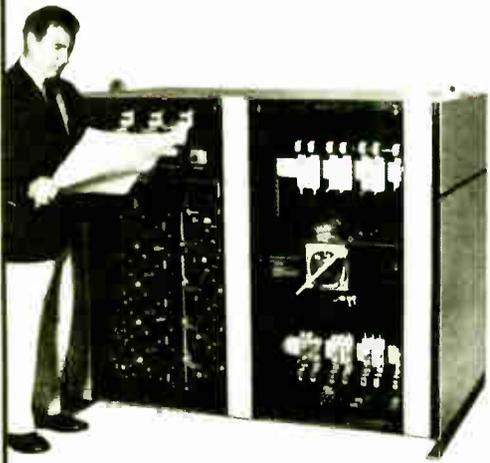
- High Frequency Resolution. Layer III uses 576 frequency bands instead of only 32. A higher resolution allows a more effective bit allocation.
- High Code Efficiency. Layer III exploits the statistical properties of audio signals, reducing the redundancy in the coded data stream.
- Bit Reservoir. Layer III saves unnecessary data bits, using them in critical sequences to suppress artifacts that could become audible otherwise.
- Dynamic Bit Rate Switching. Layer III allows within the ISO standard the free choice of any data rate. For audio memory applications, the encoder may work with a variable data rate to code the signal with any audible artifacts.

—Source: Fraunhofer-Institut für Integrierte Schaltungen



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How to Meet FCC Sample System Code

by Fred Greaves

YORK, Pa. Just what does the FCC mean when it refers to "approved sampling systems?" Ask three different engineers and you will more than likely end up with three different answers.

Part 73.68(a)(1) for the FCC Rules states:

Devices used to extract or sample the current and the transmission line connecting the sampling elements to the antenna monitor must provide accurate and stable signals to the monitor (e.g., rigidly mounted and non-rotatable loops and all system components protected from physical and environmental disturbances).

It is fairly simple to comply with this—install sample loops mounted on the tower or install torroid coils at the base of the tower.

Going one step further, Part 73.68(a)(2) states:

Sampling lines for non-critical directional antennas may be of different lengths, provided the phase differences of signals at the monitor are less than 0.5 degrees between the shortest and longest cable lengths due to temperature variations to which the system is exposed.

Temperature variations affect the operation of transmission lines. The main effect is in the phase delay of the line. Phase sta-

bilized line should always be used.

The term "phase stabilized" simply means that the line has been subjected to severe temperature variations for at least three cycles of change. The manufacturers actually bake and freeze the lines to meet this criteria. If your lines have been in place for three years or more, they are phase stabilized, whether or not they were when they left the factory.

Lines should be installed in such a way that they are all affected equally by environmental changes. Do not bury one tower's sample line and leave another tower's line above ground. Common sense prevails when designing or changing a system.

The remaining problem is proving to the FCC that the phase variation between the

longest and shortest lines will not exceed 0.5 degrees. This can be determined as follows:

$$\text{Phase change (in degrees)} = 3.66 \times 10^{-7} \text{ P L T F where}$$

P=Phase temperature coefficient.
(-5 to +5 PPM/deg. F)

L=Difference in length of lines (longest to shortest).

F=Operating frequency in MHz

T=Average temperature range for the area in which lines are installed. (Call the National Weather Service for the average temperature range for your area. Ask for the average high temperature in July and the average low temperature in January.)

For example, a system was put in operation in 1988 someplace where the average high temperature in July was 86.8 degrees and the average low in January was 22.5 degrees, for a temperature range (T) of 64.3 degrees.

The longest line at this station was 7551.6 feet and the shortest was 457.3 feet. The operating frequency was 910 kHz.

$$P=(3.66) (10^{-7}) (5) (294.3) (64.3) (.91)=0.032 \text{ deg.}$$

This information was submitted to the commission, along with a partial proof, and the license came back stamped "sampling system approved."

Fred W. Greaves is assistant director of engineering, Susquehanna Radio Corp., York, Pa. He can be reached at 717-852-2127.

DAB, EBS on Tech Agenda

► continued from page 35

of TFT has A Participant's Review of the FCC Conducted Tests Leading toward a New Emergency Broadcast System.

Each day more broadcast engineers are opening their own businesses as contract engineers. A bitter truth is that many of them are great engineers and lousy business people. Get a crash course in the basics during The Business of Contract Engineering with SBE Vice President, Terry Baun. Chip Morgan shares his thoughts on Avoiding the Pitfalls in Contract Engineering.

Paul Montoya suggests some Sound Business Practices for Contract Engineers. SBE General Counsel Chris Imlay concludes the session with some suggestions for Jumping through the Hoops: Tips for Keeping Your Contract Business Legal. Remember, one good idea from this session could save your business.

1994 will be a critical year for broadcasting. What are the most important issues for broadcast engineers? NAB's Michael Rau will pose that question to a group of distinguished industry professionals during the FCC-Industry Panel beginning at 9 a.m. Wednesday, March 23. The group includes Buck Perry from Moffet, Larson and Johnson; Bill Hassinger from the FCC; Glynn Walden from Group W and USA Digital; Harvey Arnold from The University of North Carolina; SBE President Chuck Kelly, Dr. Robert Cleveland from the FCC, and Dave Taylor from DirecTV/Hughes Communications. Bring your questions and opinions to share with the group.

DAB is still the hot technology for 1994. The system testing process has begun under the watchful eye of the National Radio Systems Committee. NAB's Ken Springer has recruited two of the NRSC's prime contractors to discuss the testing process during DAB-1 on Wednesday 23 March at 10:30 a.m. Robert Culver from Lohnes and Culver opens with Multipath Propagation Test Results and Implications for DAB. Consultant Tom Keller continues with a full test profile during his NRSC/EIA DAB Test Report.

The DAB debate resumes Wednesday afternoon at 1. Each proponent who delivered a system to the EIA for testing will present a profile of their system. The BBC's Paul Ratliff begins with DAB on Trial—Eureka 147. Don Messer from VOA continues the out-of-band profiles

with the NASA/VOA System Update. Nikil Jayant will offer the AT&T DAB System Update, while John Bingman discusses the closely allied Amati Communications System Update.

Paul Donahue from Gannett Broadcasting presents the USA Digital Radio FM DAB System Update while Glynn Walden of Group W offers the USA Digital Radio AM DAB System Update. The day concludes with the traditional "DAB Bakeoff." System proponents will form a panel to answer questions about the technology.

Thursday morning, Margaret Bryant of WMAQ brings a new feature to NAB 1994 when she hosts the Radio Transmitter Maintenance Workshop. Bill Harland and Tim Bealor from Broadcast Electronics, Dave Chenoweth from Continental Electronics, Jeff Mendenhall from Harris Allied, Jorgen Jensen from Nautel Main Inc., and Steve McElroy from CCA begin by giving you the latest tips for maximizing their companies' transmitter performance. They will then form an expert panel to answer your toughest questions on transmitter performance and maintenance.

NAB Multimedia World also offers several sessions that will appeal to radio engineers. The first, Multimedia Bootcamp, is Sunday 1-5:30 p.m. Tutor David Nash will start at the beginning and give attendees a tool-by-tool, machine-by-machine, process-by-process overview of Multimedia. It is a perfect way to find out what these new technologies can do for you and be ready to make the most out of your time on the exhibit floor.

Also be sure to check out the series of Platform Profiles, presented throughout the day Tuesday through Thursday. These special sessions will examine the capabilities and practical uses of multimedia systems, ranging from the

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Without a doubt, NAB '94 will restock your technical arsenal for 1994.

Andy Butler is a staff engineer with the National Association of Broadcasters Department of Science and Technology.

For last-minute program, registration and hotel information, contact the NAB FAX-On-Demand service 24 hours a day using a touch-tone telephone at: 1-301-216-1847.

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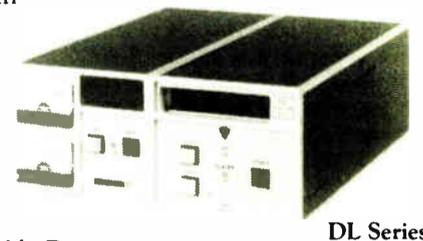
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Constructing a Better Plate Breaker

by John Bisset

FALLS CHURCH, Va. Workbench shared Art Crane's solution to resetting the plate breaker on a CCA 20 kW transmitter last fall (RW, Sept. 22, 1993). Art used a solenoid and string assembly that could be connected to the breaker handle, which was reset by remote control.

(One engineer wrote to take us to task for exposed AC terminals shown in the photo. The protective cover over the solenoid was removed for the picture.)

Well, we haven't heard the last of the breaker reset solutions. Bob Hawkins, the transmitter engineer for WRZQ-FM Columbus, Ind., installed Art Crane's circuit with good results. Bob says that the correct Grainger part number for the solenoid is 4X242 (we were in error).

While looking to mount the solenoid, Bob found that the two holes in the two-inch filler panel about a foot above the plate breaker were perfect. You'll remember Art mounted his solenoid and control relay together on a panel that was mounted to the transmitter.

Bob ran the wires to the solenoid behind the swing-out meter panel, and through a hole at the top of the transmit-

ter. He then mounted his control relay on top of the remote control equipment rack.

He tested the reset solenoid and found that sometimes only two or three phases of the breaker would reset when a single string connecting the breaker to the solenoid was used. The problem was solved by running two strings from the solenoid and connecting each to one side of the breaker.

Even in the flatlands of Indiana, Bob said, the plate breaker will occasionally trip, resulting in 45 minutes of downtime. Thanks to Bob for his follow-up on

If you already have a logo in the computer, and don't mind black ink, you can do the entire business card on a computer.

this circuit. Maybe we can talk CCA into offering this as an add-on modification.

★ ★ ★

Looking to get into the contract business, but don't want to spring for several hundred dollars in business card and stationery printing? Avery-Dennison (the

cart label people) have introduced a new product that produces high-quality, professional-looking business cards from a laser printer. Considering the turnover in radio business, this product is a godsend.

A box of Avery-Dennison's 2 x 3 1/2 inch sheets (total of 250 cards) and a printing guidelines tips booklet costs only \$4.95. Avery-Dennison's Jan Unger said the sheets can be sent to a quick printer to have the station's logo printed in color. As new staffers arrive, the business card is customized with the employees' names.

If you already have your logo in the

computer, and don't mind black ink, you can do the entire business card on your computer.

For information, circle Reader Service 120.

★ ★ ★

One of the more common complaints about the Studer A-810 is that the tension arms stick, or do not move smoothly. The tension arms are dampened by pneumatic dashpots that are, over time, contaminated with dust.

Before replacing the dashpots, try a thorough cleaning. Removal is straightforward. The dashpot is mounted either by a screw into the barrel (on old type dashpots), or by a nut onto a threaded shaft. The optical sensor can be slightly bent back or removed to permit removal of the dashpot barrel.

Carefully clean the dashpot barrel using an acetone-soaked cotton swab. Be sure your work area is properly ventilated

when using acetone, and heed the warnings on the product's label.

Now dry the barrel, but make sure that the barrel bore and plunger are completely free of any contaminants before replacing it. Even a few cotton fibers can prevent the reassembled dashpot from working properly.

If the arm quickly develops the same problems, then the barrel bore or plunger have been scored by the dirt and the assembly will have to be replaced.

If you're puzzled by a particular problem with Studer equipment, call Phil Blyveis at Audio Advantage in Nashville. Phil is a former Studer technician who is willing to share his solutions to problems with Studer equipment.

Phil can be reached at 615-742-3834. For more information on Audio Advantage services, circle Reader Service 131.

★ ★ ★

Ralph Messer at WAJR(AM) in Morgantown, W.Va., was following up on an earlier column on the alternative power supplies for Scientific Atlanta satellite equipment (RW, Nov. 23, 1993), found a couple of mistakes.

The +/- 15 volt Lamda supply can be replaced with an Astec Model 12D1 1.7 supply. The 5 volt Lamda supply can be replaced with a Sola Model SLS-05-030-1.

Kathy Maxwell at Newark Electronics in Richmond, Va. (804-282-3109), would be happy to take your order, or answer any questions. Thanks to Ralph for correcting the part numbers for our readers.

□ □ □

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

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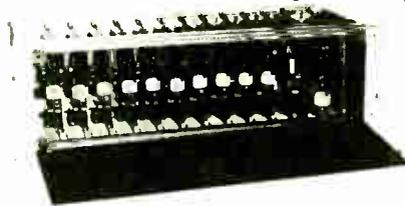
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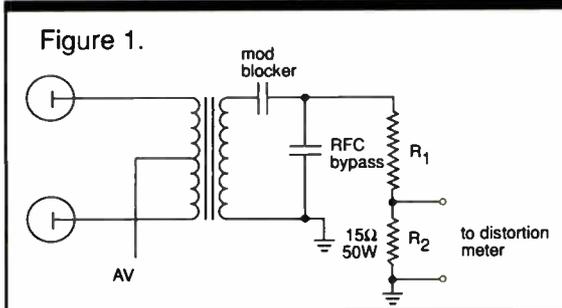
STATION SKETCHES

Where to Find AM Modulator Ills

by Tom Vernon

Part II of II

HARRISBURG, Pa. To follow up last month's column on the repair of errant modulators in AM transmitters (*RW*, Jan. 26), this piece focuses on the problems that exist outside the modulator feedback loop, which covers a lot of territory.



A modulation transformer may develop a few shorted turns and continue to operate, but with degraded audio performance.

The best way to check for this problem is to remove the leads, connect 120 volts alternating current (VAC) to the secondary transformer and measure the voltage across each side of the primary transformer. These voltages should be within 10 percent of one another.

Ohm meter tests might give misleading results, as some transformers are designed with an imbalance in the primary. Likewise, checking a modulation transformer or choke with an impedance bridge may be inconclusive. These bridges typically measure impedance at 1 kC with a very low voltage and will not indicate how modulation components will perform at full load, with high voltage (HV) and elevated temperatures.

If problems with the modulator, modulation transformer and tubes are ruled out, the problem must be in the modulation reactor, blocking capacitor, HV supply or power amplifier (PA) stage.

The quickest way to check modulation reactors is to take them out of the circuit,

connect the modulation transformer for series modulation, reduce power to 25 percent and check performance. If it improves, you have found the problem. If not, move ahead.

Poor low-frequency response and distortion figures suggest a bad blocking capacitor. These are easily checked by substitution.

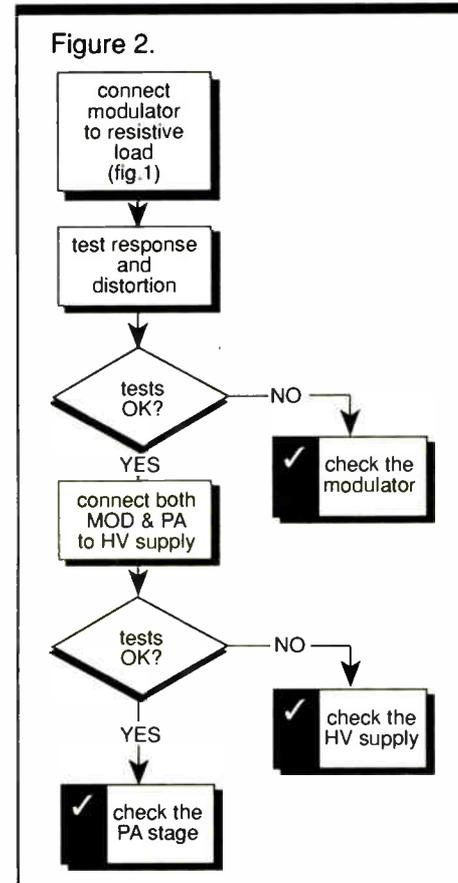
Problems in the HV supply typically show up as flat topping of the modulation envelope with sine waves, negative carrier shift or clipping, especially at low frequencies.

Oil-filled capacitors are the most frequent offender. Check for oil leaking around the terminals and seams. Replace all capacitors showing signs of leakage. Other suspects include bad rectifier diodes in one phase or an imbalance in three phase

transformers.

Several problems may reside in the PA stage. Poor efficiency is one of the most common. (See *Station Sketches*, Aug. 25, 1993) A transmitter with poor efficiency must work harder to produce a given level of modulation.

Low-grid drive, as a function of a weak driver tube or related adjustments, could be the cause. Defective fixed-bias (if that's what is used) or improper neutralization of the PA stage should also be



investigated.

When all else fails, testing the modulator at full power into a dummy load may shed some light on the problem. The procedure involves isolating the modulator from the PA, testing it, then testing with HV applied to the power amplifier. Proper safety precautions regarding high voltage must be followed throughout the procedures.

First divide the PA plate voltage by plate current to arrive at the load impedance of the mod transformer secondary.

Next, construct a resistive load of this value having a power capacity equal to the transmitter output power. Connect it to the modulation transformer, as shown in Figure 1.

Apply sufficient audio for 100 percent modulation. Check response and distortion across R2. If all looks well, the problem is in the HV supply or PA.

Connect the PA RF choke so that the modulator and PA both load the supply and repeat the measurements. If degraded performance is now observed, check the

power supply. If, on the other hand, response and distortion figures are correct, suspect the PA stage. Procedures for testing the modulator at full power are outlined in Figure 2.

Although not under the heading of modulator repairs as such, there are some modifications to the modulation transformer that may improve noise, response and distortion figures. Simply reversing the leads to the primary of the modulation transformer can improve high-frequency distortion and noise, as one arrangement usually gives better performance than the other.

In some instances, improvement to HF distortion may be obtained by connecting a .001-.004 μf capacitor between the high side of the secondary transformer and one side of the primary. Sometimes improvements in HF response can be had by connecting an inductor between the high side of the secondary transformer and the modulation reactor.

These procedures should only be used to improve audio performance of the transmitter, not to try and compensate for deficiencies that lie elsewhere.

□ □ □

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

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To register, contact the Community Education Office, Annandale Campus, 8333 Little River Turnpike, Annandale, Va. 22003. The fee for the course is \$30.

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

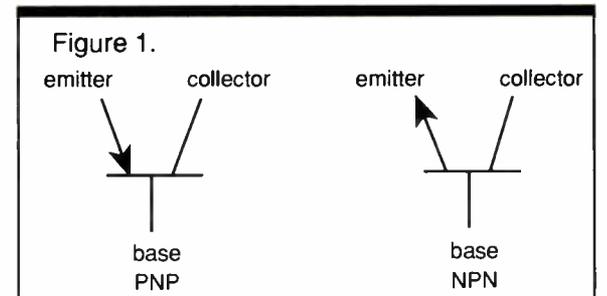
by Ed Montgomery

Part IV

ANNANDALE, Va. As solid state technology developed, the diode PN

junction evolved into the transistor.

It was developed in 1947 by Bell Laboratories to replace the vacuum tube in telephone switching circuitry. The transistor would also prove to be a very good amplifying device. Transistors operate at a fraction of the power of vacuum



tubes while performing essentially the same task.

The word "transistor" is coined from the phrase, "transferring current across a resistor." The component is grown out of a crystal material (either germanium or silicon) and doped to have three separate sections.

Two of the sections are doped with the same charge while the third section is doped with the opposite charge. The three partitions are known as the emitter, base and collector. A schematic for an NPN and PNP version is illustrated in Figure 1.

continued on page 80 ▶

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KEYBOARD CONNECTION

Business Software for Engineers

by Barry Mishkind

TUCSON, Ariz. You can tell 1994 is well underway because those W-2s and 1099s have arrived. Next stop: the accountant's office for the annual list of nasty financial surprises.

It is a good time to check out some financial management software that might make it easier to keep track of your money and avoid some surprises next year.

To be sure, no one really needs a computer to balance their checkbook. But a computer will help you focus on your income sources and expense categories and foresee potential tax liabilities ahead of time.

More business-oriented programs will automate your invoices and accounts receivable.

The big name in personal accounting is Intuit's Quicken, (DOS version 7, Windows version 3). It features an easy-to-use interface, and the necessary tools for financial analysis. Microsoft's Money is a similar Windows-compatible system. Both sell for about \$27-\$40; Quicken is a tad higher, but has more features.

Quicken and Money have interfaces that look a lot like your checkbook. Income and expenses are entered much as they would be in a real checkbook, with the added benefit of having the computer "guess" your entry.

For example, after you enter the name of your phone company, future entries take only a couple of keystrokes. Simply enter the transaction amount, and the computer refers to previous entries, fills in the words for you and prints the check.

The real payoff is in what happens after an entry. Quicken and Money automatically file entries in different categories you designate. You can quickly see or print some or all of your income and expenses. Built-in modules help calculate mortgage and investment accounts.

Quicken also links to CheckFree, an electronic service that makes all your payments via computer, without any envelopes or stamps.

The Intellicharge credit card account compiles your Quicken Visa card purchases and sends them to you by modem or diskette. The program then automatically sorts your purchases, categorizes them and pays the bill.

Contract engineers may need something more than Quicken and Money. Both will handle two checking accounts, but they are just not designed to handle all business needs, such as invoices, inventory and sales tax accounts.

You probably do not need a full-sized accounting package if

you are operating a small business. QuickBooks from Intuit, Profit from Microsoft or Instant Accounting from DacEasy are good options. All are currently at Version 2.

Would you like to bill a client for several hours of work and include the ICs and caps you used? Do you need to know your available inventory? Do you need to calculate IRS and state tax each month?

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as well as accounts receivable, customer histories and listings for mailing labels. Instant Accounting also features a fax interface.

Various preset default categories for income, expense and inventory items, pre-printed checks and forms are also available, similar to the personal packages, although you can customize the features.

Each business's requirements are unique, so decide on the fea-

tures you want and spend a few minutes shopping at your local software store. The OLD RADIO infobase of pioneer radio stations mentioned in an earlier "Keyboard Connection" (RW, Sept. 22, 1993) has drawn a great response. It has grown and I have begun to add historic details about stations on the air in 1928, tracing them from their origins to the present.

If your station has a printed history, especially anniversary books or records, interesting facts or anecdotes about personalities over the years, please send them to me at 2033 S. Augusta Place, Tucson, AZ 85710, and I

will add them to the infobase.

Dorsey Jennings of DacEasy has kindly offered to help with the project by contributing some copies of DacEasy Instant Accounting and Instant Rolodex. I'll be looking through the material sent to OLD RADIO and awarding a copy of one of these programs to those with the best submissions.

OLD RADIO is available on IBM-compatible 3.5-inch or 5.25-inch diskettes for \$7.50.

□ □ □

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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World Radio History

Bias Determines Transistor Usage

► continued from page 78

It might appear as if the emitter and collector are interchangeable when a transistor is in operation. This is not the case. When grown, the emitter is much smaller

Figure 3 illustrates how a bipolar transistor is constructed using the alloyed method. Notice how thin the base of the transistor is.

Transistors come in many shapes and sizes, as illustrated in Figure 2. The size of the case is often determined by how much heat the device must radiate or dissipate while it is operating.

Transistor manufacturers maintain a rather loose standard for labeling the emitter, base and collector. Check the manufacturer's diagram or a

cross-reference guide before installing a replacement transistor.

The transistor must be biased to make it operate. Both forward and reverse bias is used within the transistor (see Figure 4). The emitter-base junction is forward-biased and the base-collector junction is reverse biased. The reverse bias voltage is several times greater than the forward bias on the emitter base junction.

With the base of the transistor being very thin, nearly 99 percent of the current carriers that flow out of the emitter will be attracted to the collector. This is known as transistor action.

If the emitter-base junction is reverse biased or shut off, all current between the emitter and collector ceases to flow. The 1 percent of current that does not flow to the collector can control the total current

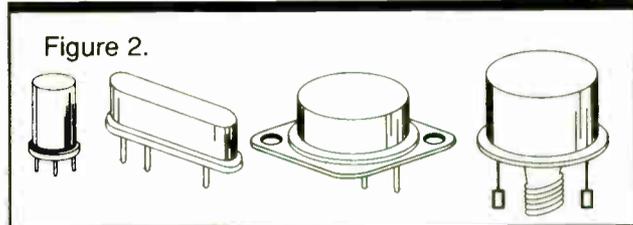


Figure 2.

than the collector. The base of the device is very thin and lightly doped in relation to the emitter and collector.

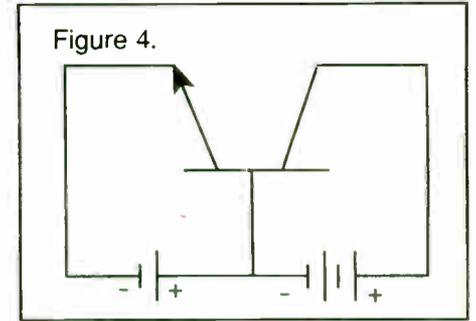


Figure 4.

flow of the device.

In its simplest form, the transistor acts like a switch. Applying forward bias to the emitter-base junction will allow current to flow to the collector.

A transistor can act as an amplifier when the current between the emitter and base is varied. Any small variation of emitter-base current will create a much larger collector current variation.

More details on transistors can be found in many reference texts, including the "American Radio Relay Leagues Handbook."

□ □ □

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

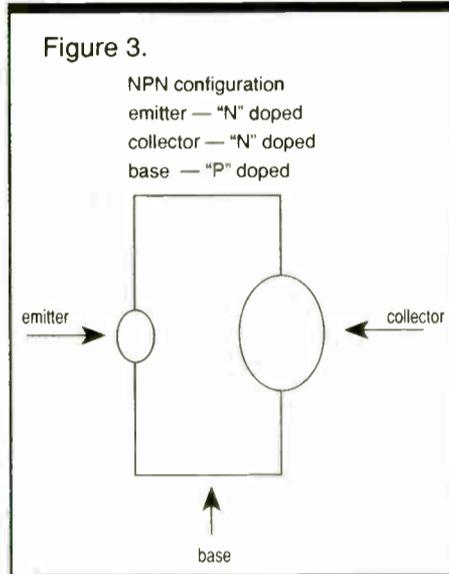
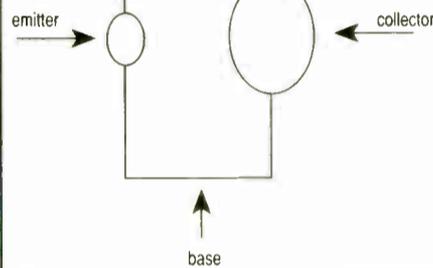
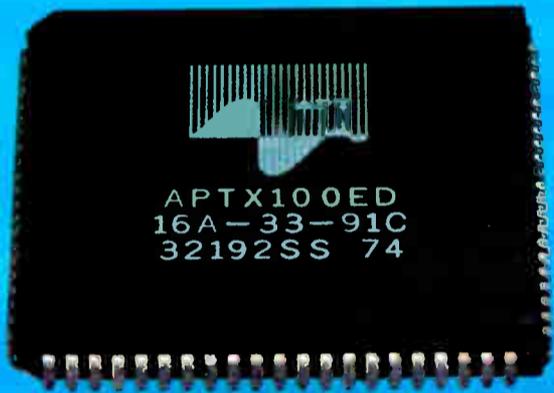


Figure 3.

NPN configuration
emitter — "N" doped
collector — "N" doped
base — "P" doped



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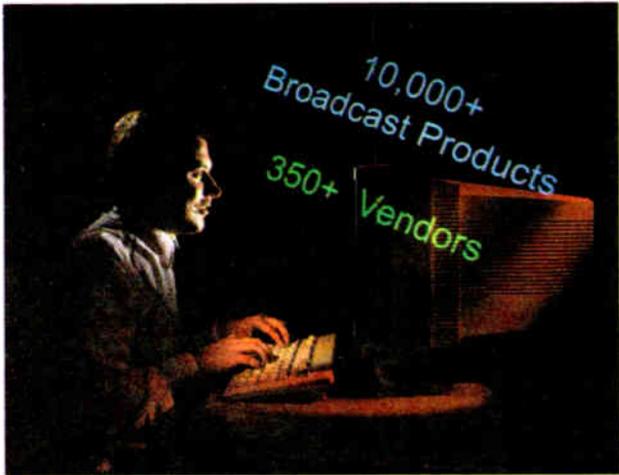
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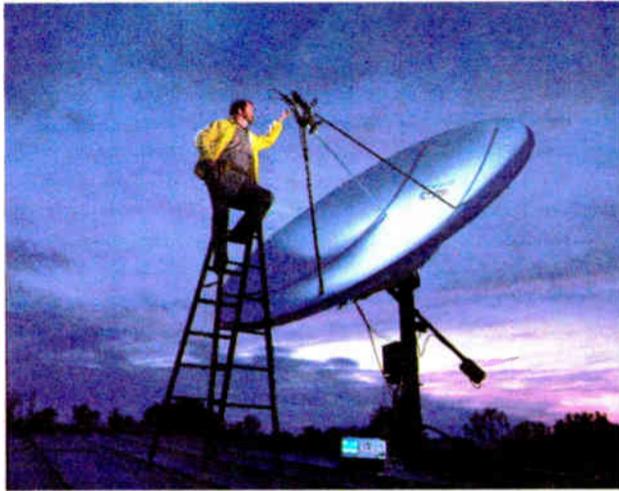
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USER REPORT

SSL Proves Versatile for Radio Production

by Mike King
Owner
Audio Recording Unlimited

CHICAGO In our business, everything needs to be done yesterday and so speed is of the essence. As a result, several years ago we were looking for an audio workstation that was fast, flexible and provided our clients with a high-quality product.

While attending the 1989 NAB show, I first came into contact with Solid State Logic's (SSL) ScreenSound and saw what it could do. I was very attracted by the architecture of the system, but I also felt comfortable dealing with a company with SSL's reputation. In fact, you only have to look at the upgrades and software enhancements made over the past three years to see how serious SSL is in its commitment to work with its users.

In 1990, Audio Recording Unlimited became the site of Chicago's first ScreenSound digital audio editor and SoundNet multi-user digital audio network, and I cannot stress how flexible and reliable the hardware is.

One of the system's great features is its

magneto-optical (MO) drive. We tend to create custom sound effects for our clients, and these are produced in ScreenSound. We then store them to the MO drive, making them instantly retrievable in case we need them again.

For radio production work, this is extremely helpful, because sound effects, music stings and special effects frequently are used more than once. The MO drive, for all practical purposes, loads these into your working disk instantaneously.

Typical day

Let me give you an example of a typical afternoon at Audio Recording:

The producer or writer comes in with a script, and we cut a voice track. Occasionally, not everyone involved is available at the same time, so we record each person individually and leave holes to slot in the missing voice tracks.

ScreenSound gives us immense flexibility in moving individual pieces of audio around, should the client like one better than another. It also lets us try many variations. But we are secure in knowing that we can return to our original at any time.

We are able to place and move tracks around, as well as tighten the final production piece, saving us valuable time and ultimately, the client's money.

With ScreenSound's eight discrete outputs, effects can be added after the fact. For example, imagine a spot that features a telephone call between two parties—one calling from a pay phone on a street corner and the other in an office. I always record voice tracks separately from the effects, because otherwise they then cannot be modified.

The track is recorded in full bandwidth. Then the echo, background traffic noise and additional effects are manipulated after the penultimate version has been mixed on the ScreenSound's decks. As a variety of room presences and microphone techniques are often needed, the ability to record everything flat-out and then modify it to get the required effect is incredibly time efficient.

Multiple projects

Unique to SoundNet is the ability to back up and restore projects off-line. This feature is invaluable. Backups and restores are done on an exabyte 8500

tape system.

I have three working drives on my ScreenSound, and multiple projects frequently are carried out on the same drive. I can back up one drive and copy the files of a second project to another disk. I can then return to separate files.

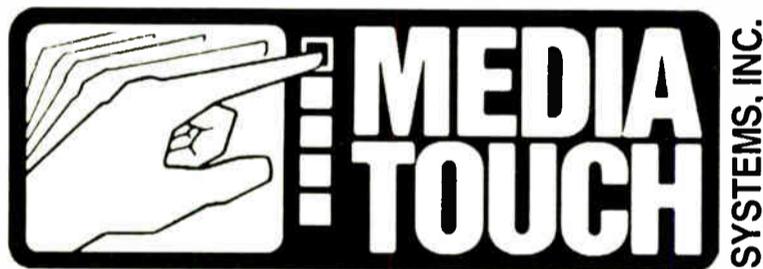
SoundNet allows me to work on ScreenSound, yet restore or backup a file to another drive—all without slowing me down.

Radio production is a difficult medium, sometimes much more complex than audio-for-video, because you rely solely on sound to get your message across. As a friend of my mine once said: "Television without picture is radio. And television without sound is surveillance."

ScreenSound and SoundNet are real time-saving investments. I admit that they are not cheap, but you get value for every dollar spent. After 20 years of manually cutting tape, switching to a machine that "cuts tape" via pen and tablet is a totally amazing concept.

□□□

For information, contact Solid State Logic in New York at 212-315-1111; fax: 212-315-0251; or circle Reader Service 185.



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USER REPORT

Quick Productions with AKAI DR4d

by Mark Ridder
Mark Ridder Productions

NASHVILLE, Tenn. I am like a lot of people involved with audio, I guess. There is a studio in my home where I do audio production for agencies and radio stations. It is not a big operation, but I stay busy.

About a year ago, the business began to take its toll on me. All of my work was being performed on analog multitrack units which meant that I spent a great deal of time locked up in the studio when clients wanted to go back and edit and re-edit a spot.

As business boomed, I knew I needed to get into some kind of digital workstation but the thought of spending \$10,000 or \$15,000 depressed me. Some of my peers already had dropped the big bucks for their studios and I was seeing my future on the line. So, I went to the summer National Association of Music Merchandisers (NAMM) show in Nashville to look at all this stuff.

I picked up some literature on this new thing from AKAI that was supposed to do digital editing on a hard disk and cost about a fourth of what the other guys were asking. I paid my regular equipment dealer a

visit and asked about the AKAI DR4d. The salesperson took me right over to it and said, "Here, play with it." I was intimidated by the thought of just walking up to anything with the word "computer" attached to it—even though I own computers and use them a lot. But I've read all the stories about how big the learning curve is on screen-based workstations and even though this thing looked like a DAT machine on steroids, I knew there was a hard drive inside of it.

Like a pro

The salesperson said, "Look, this AKAI has play, rewind, pause, stop and record, just like your analog gear at home." In about 10 minutes, I was using it like a pro. The best part of the AKAI DR4d is you can edit, move, copy, insert, delete and undo audio just like you would printed text on a Mac or PC word processing program.

You don't like the edit you just did between a couple of music beds? Undo it with the press of a button. You want the last 10 seconds of what you said to be the first 10 seconds of your spot? Move and insert it ... no problem. Your client wants to change the middle of the spot? Delete and re-insert with new copy, music, SFX, or whatever they wanted with little or no effort.

It didn't take long before I realized that we also needed the AKAI DR4d at the radio station where I work. It is a machine that everybody can learn to use quickly. I could never imagine trying to train six people on a screen-based computer workstation. I know Pro Tools and the others

are fine machines with more bells and whistles, but I'm telling you that the client does not know the difference. All they know is that you can crank it out faster and change it at will with little or no effort at all. And you have more time for yourself.

Does everything

I do most of my work on the DR4d. One unit gives me four tracks, but with the super tight editing features I use it like an eight-track. In fact you can slave four of them together for 16 tracks. I can back-up onto a regular DAT machine. I can record at 32, 44.1 or 48 kHz. This gives you about 20 minutes worth of record time at 44.1, but you can hook up to seven SCSI hard drives for almost unlimited recording. It has "vari pitch."

You can store SFX, voice tags, etc. on 108 different location points so you can pull them out and use them over and over again without having to re-record them onto the hard drive. It can do SMPTE and MIDI. A remote control is available. And, I heard that AKAI is developing a MAC-based software program for it.

Because it was so inexpensive, I was able to pay cash for it. I bought it for \$1995 with a 200 MB hard drive installed internally. I took it home and hooked it up to my analog studio in about 30 minutes.

I have run this machine into the ground and it continues to perform flawlessly. The scrub wheel is the only thing I have noticed a little wear on, but even so, it still works better than any other wheel in its present condition.

□ □ □

For information on AKAI products, contact James Martin in Texas at 817-336-5114; fax: 817-870-1271; or circle Reader Service 216.

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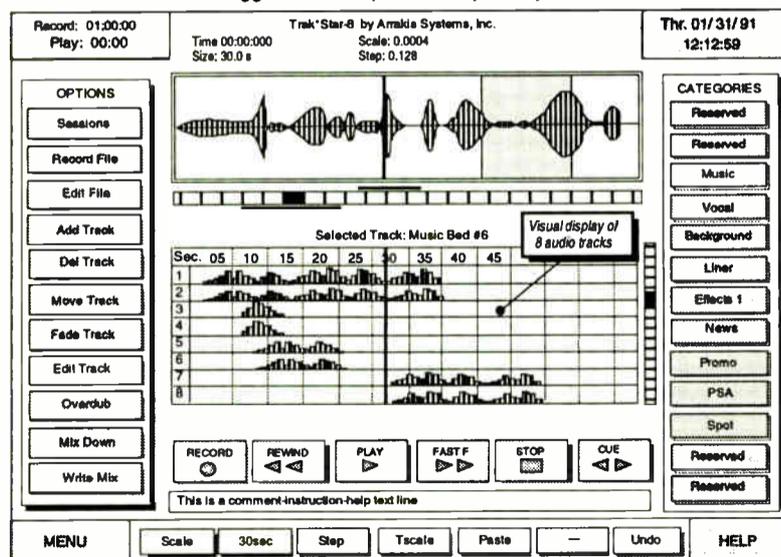
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USER REPORT

Arrakis Helps Station to Give up Its Razor Blades

by Larry Wilkins
Director of Engineering
Colonial Broadcasting

MONTGOMERY, Ala. As more and more stations discard their razor blades and analog tape machines for digital workstations, one major problem arises: Which one do you choose?

With no less than 20 different digital workstations on the market, picking the right one is quite a chore.

When WLWI-AM-FM made the change, we chose the Arrakis Digilink and

Trak*Star. The main reasons were ease of installation and setup, ease of learning to operate and ease on the budget.

The Digilink software is used for on-air operation, either in a fully automated mode with satellite or CDs, or in a live-assist mode. Our FM operates in the live-assist mode and the AM in the satellite mode.

Eight-track production

The Trak*Star software operates on the same CPU and shares a hard drive (SCSI) with Digilink. It allows for full eight-track production, with all the features of analog editing, plus a lot more.

Editing is straightforward. You simply "mark" the section of audio; then you can cut, copy, move, or fade the mark section.

Voice, music, effects, etc. can be recorded in any order, and later moved to the correct location in the production. This saves a lot of time over the "old way" of trying to time copy and music/effects inserts.

If you are not happy with any edit, simply undo the last one and redo. It does not matter how many times you make or change an edit, since it is digital it is always first generation.

The Trak*Star includes a "scrub" feature that simulates rocking a reel back and forth for really tight edits. Tracks can be deleted, added or mixed down at

continued on page 89 ▶

AEV

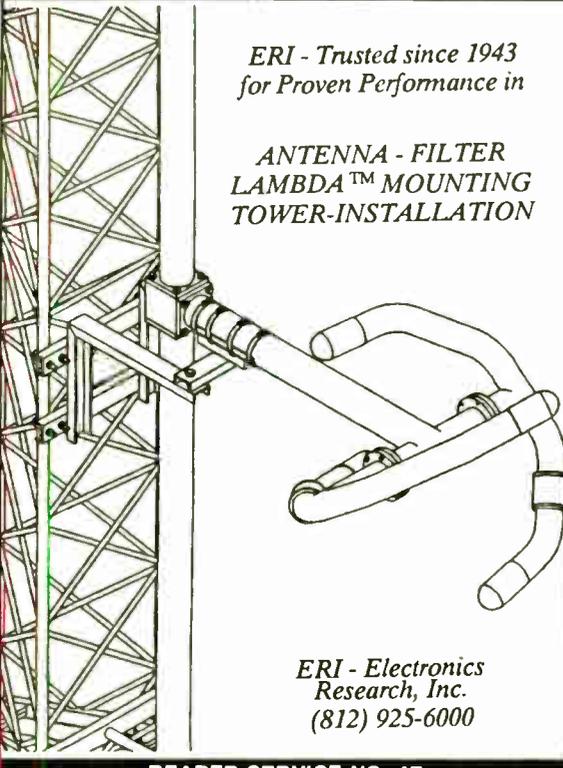
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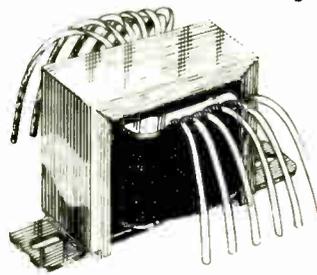
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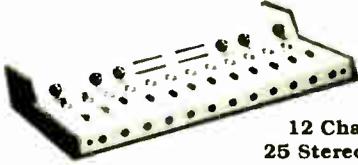
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READER SERVICE NO. 156

USER REPORT

CCS Makes Virtual Editing Easy

by **Kenneth Tankel**
Director Technical Operations
East Coast Region
CBS Radio

PHILADELPHIA Among the powerful capabilities computers offer news organizations is the ability to collect, categorize, file, edit, retrieve and share text information. Realizing the capabilities of a character-based newsroom computer system in an audio system is a daunting task.

Corporate Computer Systems (CCS), in cooperation with CBS Radio, developed the Personal Audio Computerized

Editing system (PACE) to address specifically the needs of news environments.

PACE can be used either as a stand alone workstation or as part of a larger network of PACE workstations. Its operator interface emulates analog tape editing and production. The intent was to create a computer-based system that simulated the equipment found in an edit booth—to make the computer work the way a news person works, and not to make a news person work a computer.

While computer-based audio editing systems are relatively common today, more than 20 are currently available, the user interface and networking capability of the PACE make it unique.

The PACE user interface provides both physical and on-screen controls. The physical controls include four motorized faders with associated start buttons and a shuttle wheel with eight associated buttons. All of the buttons are LCD display buttons, which automatically re-label depending on the task at hand.

There is also an 84-key PC keyboard, a trackball, headphone and monitor level controls and an LED bar graph audio meter. Speaker and headphone amplifiers are built into the unit as well.

The MS Windows-based screen display is largely icon driven. The user sees icons for two tape machines, a mixer, a tape duplicator, a "Robo-Editor," shelves for storing audio and carts, and master reels that represent audio in the system.

Virtual taping

Double clicking on any icon opens that virtual device for use. For example, opening the tape machine icon allows you to begin recording. You can title the recording, select an input, set a timer to automatically start and stop the recording, and there is a note pad area.

When the tape machine is chosen the physical buttons relabel to show transport controls, Start, Stop, Record, etc. Also, a single fader shows "Input Trim" and is used to set the record level. As soon as an input is selected, its audio is heard and the levels can be adjusted.

Once the machine is set up, it can be reduced back to its icon. The icon is surrounded by a flashing red border which indicates that it is recording. Two recorders can be used simultaneously.

If the recorder is left open, you can take notes while you record. Pressing the F1 function key flags an incue and the F2 function key flags an outcue as you make

your notes. F1 and F2 also force a carriage return on the note pad. Elapsed time from the start of recording is automatically entered in the margin with every F1 and F2 keystroke.

When the recording is stopped, you click the "Unload" button and a reel of tape, with its title below it, appears on the screen. If you did not enter a title for the recording, you are prompted to do so before you Unload.

Clicking on the reel moves the focus of the editor to that recording. Buttons relabel to allow "Play," "Stop," "FF," and "Rewind." Now the tape can be played.

Double clicking on the reel opens the editor. There is a global view, showing the entire recording, a zoomed view around the section you are working on and a wave form display to facilitate in making difficult edits.

There are also multiple time indicators showing the real clock time of the recording, elapsed timing from the beginning of the recording and elapsed time between edit marks.

Cart icons

Clicking between flags on the tape moves the notes to the chosen flag. Likewise, clicking on a particular note moves the "play head" to the appropriate flag. You place virtual grease pencil marks on the tape to indicate edit points. Edits can be auditioned and there are both edit-start and edit-end audition buttons.

Unwanted audio can be edited from the master and actualities can be "Cut" into virtual carts. The carts appear as cart icons on the desktop and have complete cart labels.

All editing is entirely non-destructive and edits can be undone nearly endlessly. A "snippet editor" allows an arbitrary number of audio snippets to be cut from the master and played in any order. The resulting audio is made into either a new master or a cart. (The difference between a virtual cart and a virtual master is that carts cannot be edited.)

Icons of carts and master reels can be on the desktop or filed in virtual racks. The racks can be named and racks can

continued on page 89 ▶

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Factors in the Digital Automation Decision

By John Schad, President, SMARTS Broadcast Systems

This digital audio business is getting to the point it's almost impossible to point out the features of your product without publishing a phone book size document!

What makes matters worse, is that there are a lot of digital automation products on the market. All have their good and bad points, but there are real differences that station owners need to know about when making buying decisions!

Let's take one feature as an example. We here at SMARTS Broadcast systems have pioneered in the development of "stretch and shrink". This feature allows a station to "fudge" a bit on the lengths of their spots, and still get the spots into a fixed length break on a satellite network.

We jump through a lot of hoops to create a smooth, natural sounding break. First we evaluate the actual length of the break, and compare it with the spots and other material needed to fill that break. If the break will come up short, we first attempt to find an acceptable PSA, jingle, or other audio to drop in the hole. We might drop in any combination of 60's, 30's, 10's or 5 second spots.

That process will bring us into a 5% window we have established for acceptable stretch and shrink. Now we work some digital magic to actually stretch or shrink the entire break to exactly fit into the allocated time frame.

Our program then gives you other elements of control. You can overlap the audio from spot to spot, and vary the overlap according to the content of the spot so it "sounds right". You can overlap the local break audio with network audio, so you can smooth transitions back into the network music.

This whole package of services is what we mean by "stretch and shrink". However, when we look around, we find others who also claim "stretch and shrink" that do nothing but vary the overlap on the spots so they can cram them into a break, or stretch them out until the last note of the guitar in the background has long since faded, then start the next event. The only thing these things have in common is the name, "Stretch and Shrink".

A station owner looking at competing systems is likely to have two quotes, both of which contain "stretch and shrink" as a feature. But that owner can't know the real difference.

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These systems are used in so many different applications that it's rare to find two running in exactly the same mode.

If you're a talk station, for example, you might have scheduling conflicts that force you to delay one of two programs being fed simultaneously. This is easy. What's hard is figuring a way to automate that delayed program. Not only do you need to record the program feed itself, you also need to store some sort of signal to tell you when to play the spot breaks.

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USER REPORT

Korg SoundLink Is Full of Useful Features

by Frank Scales
Production Director
KLBJ-AM-FM

AUSTIN, Texas If you plan to change to digital production, get the workstation that works best for you. I selected the Korg SoundLink for the LBJ Broadcasting Company's digital production studio last February. It delivers all the features I need, and gives me plenty of room for expansion.

The SoundLink is an eight-track digital multitrack made up of the mixing/control console, disk storage unit and audio unit. The control deck has familiar transport controls, a digital mixer, visual display, track select buttons, MIDI control master and a control center for the rest of its functions.

To prevent the need for tons of switches, knobs and buttons, the SoundLink has convenient mode buttons. Within each mode there are several pages of function choices. SoundLink modes include: miscellaneous, disk, audio, mixer, effect, MIDI and mark.

In the audio mode, the SoundLink is a multitrack recorder. With audio "specs" as good as or better than any CD, it consistently delivers amazingly clean audio. And despite the myth, digital can sound warm. Recording is simple: choose the track, press record and play, and go to work.

The next feature is sound editing. I use this edit feature in audio mode ("splice" page) to move sounds, cut out breaths and pauses, copy tracks and to do music edits and spot updates.

Thanks to the SoundLink's built-in crossfade feature, music-to-music splices sound as good as track-to-track crossfades. The splice page offers three useful functions: move track, erase track and copy track. Simply put the cursor on the beginning and end of a sound and execute one of the functions. All three save a lot of time.

Mixing down in mixer mode on the SoundLink is done easily. Mixing can be either automated or done live. I use the automation "remembers" how you mix. If I mix down a spot to my liking, but think the "sfx: large door slam" needs to be louder, I can go back and update that one track. The rest of the mix is left in place. The updating process can be repeated on any and all tracks until the perfect mix is achieved.



Korg SoundLink Random Access Multitrack Digital Audio System

Like its automated audio mixing, the SoundLink also memorizes track panning, individual track EQ and reverb. These settings also are controlled in the mixer mode, and can be changed endlessly during a spot.

For musicians, the SoundLink includes a built-in 16-track sequencer and a MIDI master control. Although I use a different outboard sequencer for my keyboard work, I do use the SoundLink's sequencer for sending program and volume changes to my Eventide H3500 and Korg A1

effects gear over MIDI.

Another useful feature is time compression and time expansion. If I need a 55-second voice part to be 53 seconds, the SoundLink's time compression takes over. Although variable speed is available, the process is not done with speed change. Instead, the sound wave is squeezed or expanded to the length you want with vocal pitch remaining normal.

"Trigger Record" saves me a lot of time when I'm laying down music or effect tracks. I can turn on the Trigger function, put the SoundLink in record and pause, fire off my CD, and the SoundLink starts recording as soon as it senses audio.

SoundLink also features programmable auto punch in/punch out—a lifesaver when I need to be five feet away at my keyboard.

Auto repeat comes in handy when I'm doing a large dubbing job. I can set the SoundLink to repeat back to the beginning of the spot, roll tape, leave the room and come back with dubs done. Unfortunately, the SoundLink doesn't do labels.

Audio outputs include a left-right two-mix from the SoundLink mixer, eight individual track outputs and two digital outputs. I use the digital outs to send to my DAT deck and Korg A1 effects processor.

We installed the basic SoundLink unit with one hard drive, which gives us a total of 100 track minutes. The unit's backup is an 8mm tape drive. Backup tape costs about \$15 each and come with enough storage room to backup the entire drive.

I must take a moment to praise Korg for its customer support. Anytime a question comes up, they are on the phone within minutes. Korg also provided one-on-one training with all of our staff when the SoundLink was installed.

The Korg SoundLink has been a great discovery for me. Korg has been synonymous with top-shelf quality musical gear

for decades.

If you are in the market for a digital workstation, shop around, test as many of them as possible and talk to people who use them. There are several good workstations on the market, but if you want a great digital workstation, moderately priced and loaded with easy to use features, try the Korg SoundLink.

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For information from Korg, contact Matt Appelbaum in New York at 800-645-3188 ext. 280; fax: 516-333-9108; or circle Reader Service 38.

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Arrakis Unites Football Networks

► continued from page 84

any time in the production. This allows an unlimited number of tracks to be mixed into the production.

After the production is finished, the file can be compressed (if desired) and transferred to the Digilink for use on air.

We discovered that just sitting down and editing is the best way to learn how to operate the Trak*Star. Nothing that you do can break the machine. The screen is arranged so that anyone who can edit on a tape machine easily, in an hour or so, can pick up the Trak*Star.

Loop feature

Our station handles a lot of agency business, and early on Al Mason, production director, discovered the "loop feature." As the name implies, this feature plays a file over and over. It is an excellent way to make multiple dubs for clients.

A comment or two on the Digilink software: Our station has three units and just ordered two more. All of these units, plus two traffic computers are linked together with Lantastic Network. This allows instantaneous transfer of audio and traffic schedules between units.

Our AM station operates with a satellite format, and the Digilink operates

unattended most of the day, switching between several satellite channels, inserting liners, commercials, etc.

The timed record feature is helpful at WLWI-AM-FM. Digilink auto records any audio from any input on its switcher, and plays that file back at any time without prompting. This means no more missing a network feed.

Last year, I installed Arrakis Digilinks for both the Alabama Sports Network and the Auburn Network. As most people know, when it comes to state college foot-



The Arrakis Trak*Star and Digilink help Larry Wilkins smooth over old football rivalries.

ball rivalries, none compare to the annual Auburn versus Alabama game.

Alabama and Auburn fans are about as far apart as night and day, but the networks agree that the Digilink makes the

entire broadcast run smoothly.

Both networks take advantage of the sequence feature on the Digilink. Board operators "build" pre-game, in-game, halftime and post-game sequences, which includes pre-game countdown, opening, commercials and features. If last minute changes come up, the sequences can be edited after they are set up.

This is helpful during the game, because there may be 20 or so spots. By halftime you may be at spot number eight or nine, depending on time-outs, etc. Digilink allows you to insert the halftime sequence at that point, and it resets the remaining in-game spots to start after the halftime sequence is over. That lets you return to where you left off in the game rotation.

Sequences, not carts

In the past, there were carts sitting everywhere and it took a second person just to keep the carts in order for the breaks. Now it can be done by a single operator.

Two hours or so before air time, the networks normally send a network identifier to the satellite so affiliates can check their satellite. Frequently an "endless loop cart" with no stop tone was used. However, the edit function of the Digilink can make a file play over and over.

After a game, a "played log" can be printed or, in the case of the Auburn

Network, put on a disk. Later it is imported to the office word processor for billing.

WLWI-AM-FM and both Sports Networks have been very pleased with the Arrakis products, and especially with the support from the programmers at Arrakis. Like any computer controlled system, it has had a few minor bugs, but Arrakis programmers always respond and correct the problem. They also are very receptive to customer suggestions on features and changes to the software. Updates for both Digilink and Trak*Star are furnished via an Arrakis BBS (computer bulletin board service) at no charge.

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For information from CCS, contact David Lin, product manager, in New Jersey at 908-946-3800; fax: 908-946-7167; or circle Reader Service 150.

CCS Icon-Based System Simplifies Editing

► continued from page 86

even be stored in other racks.

Opening the mixer icon, you find four channels and the four physical faders relabel as "Mix One" through "Mix Four." The other buttons have labels for special mixer functions. The mixer allows carts, masters, and external sources to be loaded in the four channels.

While only four sources can be mixed simultaneously, the external inputs and carts and reels can be stacked in the four channels allowing an infinite number of sources to be presented to the four channels one after another. The output of the mixer can be made into a new master reel or a cart, or it can be output from the PACE. The mixer has a mix-minus bus, for recording live newscasts and interviews directly to disk.

Robo-Editor

The Robo-Editor is a unique feature of the PACE editor. After recording a news piece it is quite common to send it to a number of different stations, each with a unique intro and outro. The Robo-Editor has three "stacks." In the first stack are the intro carts, in the last the outro carts. In the middle stack goes the news piece.

By pressing the "Make It So" button, PACE assembles the items—intro 1, news, outro 1, intro 2, news, outro 2, etc.—until all of the intro-outro pairs are used. If you place a second news item in the middle stack, it is then assembled with the intros and outros until all the news pieces are assembled with all the intro-outro pairs.

The result is one or more master tapes that can be played back to the network

for the participating stations to record. Inclusion of unique signal tones at the start of each intro can allow automated recording by each affiliate.

These are just a few of the features of PACE, the ones most directly concerned with editing.

It should be noted, that all PACE operations occur in the digital domain. Audio is stored using ISO/MPEG Layer II audio bit rate reduction (CCS MUSI-CAM). The maximum storage time on an individual PACE is approximately 18 hours stereo at a 5.5:1 (256 kbps) com-

pression ratio.

Control of external devices, networking capability, audio file, storage and searching, archiving, additional features of the recorders and mixer, and many user-defined capabilities are all part of the PACE workstation.

PACE workstations are currently in use at CBS Radio's Washington News Bureau.

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For information from CCS, contact David Lin, product manager, in New Jersey at 908-946-3800; fax: 908-946-7167; or circle Reader Service 107.

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The new professional D730 and D731 CD players hold several trump cards. The operating concept is identical on both the desktop and rack-mount version. Not only are the RED book standards implemented, but also important parts of the ORANGE book standard. A special scan function allows the user to play CD-Rs on which the TOC has not yet been written: Once the TOC has been created, coded skips are correctly processed. In addition, the remaining time is displayed with great accuracy. This is of special benefit in the intro mode with its high-precision count down.

Safety features are an integral part of both models: The status preservation which guarantees that even after a «power down», the laser is repositioned exactly on the last address; a quality indicator that provides information on the CD playability; program-controlled customization of all operating procedures, comprehensive remote facilities, integrated optional interfaces for special functions, and, what is more, access to all CD sub-code information via the AES/EBU output for advanced data processing.

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USER REPORT

Flexible DM-80 Means More Choice

by **Bill Robinson**
Production Director
WQCD(FM)

NEW YORK When I went looking for a digital editing system, I spent a full year, trying every system I could get my hands on. After awhile, I started playing a game called "if only," as in "if only machine number one had the editing feature of machine number two," or "if only machine number three cost what machine number four did."

In the end I chose the **Roland DM-80** and to this day, I have never said "if only I had bought a different system."

When Tom Stephenson from Roland first demonstrated the DM-80 for me, I loved it. It had everything from simple, intuitive controls that emulate a tape machine to its own mixing board with EQ. However, I was troubled by the way the editing wheel worked. Most of the other machines I had seen had scrub editing and/or waveform editing, both of which I thought were essential.

Editing wheel

The editing wheel on the DM-80 allows you to hear what is before or after the edit. For the first few days of using it on my own, I had trouble understanding what I was hearing. I was confused, but I kept at it.

At first, I thought "if only the DM-80 had scrub editing," but a couple of days later, it finally clicked. At that moment my decision was made.

Now, two years later, I still marvel at the technology of the system. Day in and day out I use the Roland DM-80 for producing spots and promos, and when I think about how it has changed my life, the first thing that comes to mind is the flexibility it gives me.

I cannot tell you how many times I have played a promo or spot for someone at the station and they make a suggestion like "Why don't you try interchanging the second music bed with the third one?" If I was still using tape I would probably scream, but with the Roland, the whole process literally takes only seconds, as does putting it back the way it was.

This flexibility allows me to experiment more, and it gives the program director different versions of a promo to choose from.

Updating a spot or promo also used to be time consuming. With the Roland, updates are done with just the push of a button. With 16 available markers, you can replace something in one location with an update without any guess work.

Markers are also great when you need to hit the musical post. Once again, there is no guessing. And once again, the end result is a great sounding promo.

Easy editing

On the latest software update, waveform editing had been added to the DM-80. I cannot believe that I would ever say this, but I have yet to use it. That in itself is a testament to how easy and efficient editing with the Roland is.

I have learned that when you need to make an edit, whether you can see the sound or not, in the end you have to make the edit based on what you hear.

Price is always a factor in purchasing equipment for a radio station. Before I



tested the Roland DM-80, I intended to buy on a system that was nearly three-times as expensive. After seeing the Roland, however, I weighed the pros and cons of each machine. In the end there was no way I could justify spending three-times as much money when I wasn't getting three-times the machine.

In fact, while I was trying out the Roland, a salesman for the other system stopped by and asked me to show him what the DM-80 could do. It was the first time I have ever seen a salesman speechless.

All in all, the Roland DM-80 has fulfilled all of my expectations for a digital editing system.

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For information from Roland, contact **Bob Todrank** in California at 213-685-5141, ext. 335; fax: 213-722-0911; or circle Reader Service 59.

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PRODUCT EVALUATION

VoxPro Brings DAWs into On-Air Studios

by Tom McGinley
Chief Engineer
WPGC-AM-FM

MORNINGSIDE, Md. A 20-year veteran of morning show broadcasting has created a new digital audio editing system for "on the air" use in control rooms and newsrooms.

Charlie Brown, morning show host at KUBE(FM) in Seattle, and his new company, Audion Laboratories, developed VoxPro™—the first digital audio workstation (DAW) specifically designed to replace reel-to-reel tape recorders in radio control and newsrooms.

As the host of a top-rated morning show, Brown knows a lot about the

on-air personalities seemed to avoid DAWs because of their complexity and cost.

His research confirmed that essentially the DAWs currently on the market are designed primarily for production room use. They reproduce sound better than analog tape, but their complexity is a hindrance in the control room.

Beta test

Rather than wait for a more suitable product to come along, Brown, along with other broadcast veterans, formed Audion Laboratories and began developing VoxPro.

Over the past few months, Audion Laboratories tested VoxPro at several

sound—recording and editing become as easy as "cut, copy and paste."

"This is the first time we have ever used digital audio on the air," said Jhani Kaye, program director at KOST. "We couldn't be more pleased. VoxPro has provided a massive reduction in the editing time of listener call-ins. We love it."

"All of our on-air people have absolutely fallen in love with Audion's VoxPro," added Jay Stevens, program director at WPGC-FM. "There's no more fumbling with tapes, and telephone drop-ins have become a breeze."

The key to VoxPro's success in the control room is the combination of several unique capabilities. These features give the user simple, intuitive editing, with results that are easy to save or archive.

For example, the "Record Insert" feature, dubbed the "glibilizer," allows a user to select a position anywhere inside an existing recording, and then begin a new recording at that point. New sound is automatically and seamlessly inserted into the original recording. This gives a DJ the chance to use the snappy comeback he thought of right after the caller hung up.

Features

Other "speed enhancing" features include:

- Across the top of the VoxPro remote control unit are 10 assignable "Cart Keys." These can be set to any recorded audio—sound effects, jingles, interviews, etc. Once assigned, pressing the cart key plays the selection instantly.
- The "Record" command automatically creates a new file and begins recording instantly.
- VoxPro cuts, copies, and pastes recorded sound from one recording to another.
- A visible waveform simulates tape moving across a tapehead, letting a user

see recorded sound and enabling the "visual" editing of sound.

- A "bleep tone" or dead space deletes unacceptable word.
- Personalized audio items can be stored in one of 20 "jock folders" with password protection.
- On-line pull-down help screens are available for any function.

Fresh sound

"The record insert feature in VoxPro makes me sound quicker on my feet than I really am," said Bob Case, operations manager and air personality at KUBE. "No other digital audio product lets me

The "Glibilizer" gives a DJ the chance to use the snappy comeback he thought of right after the caller hung up.

audio requirements of an on-air studio or newsroom versus a production room. "Analog tape machines work equally well in production rooms and news/control rooms, but the same does not hold true for digital workstations," says Brown.

Time critical

"In a control/newsroom, operations are time-critical. Audio must be captured, edited and replayed very quickly," said Brown. "These performance demands have restricted the use of conventional digital audio products, which are designed primarily for production rooms."

Two years ago Brown began talking with friends and colleagues about DAWs and their potential use in the control/newsroom. He determined that

major market radio stations. They examined the suitability of VoxPro in a variety of demanding control/newsroom environments.

This beta test program involved installing VoxPro at several well-known stations including: KHIS-AM-FM and KOST(FM) in Los Angeles; KYKY(FM) in St. Louis; KKSJ-FM in Portland, Ore.; KIRO-AM-FM and KUBE in Seattle; and WPGC-AM-FM in Washington.

According to the disc jockeys and program directors who have seen and used VoxPro, it is user-friendly and quick to learn. It also costs less than other DAWs.

In the time that it takes to learn how to edit with an old Ampex machine, a user can learn the VoxPro and gain the benefits of digital editing. Others compare VoxPro's operation to that of a word processor for

Product Capsule: Audion VoxPro	
 Thumbs Up	 Thumbs Down
<ul style="list-style-type: none"> ✓ very intuitive ✓ very fast in and out of edits ✓ specifically designed for control/newsrooms 	<ul style="list-style-type: none"> ✓ not an IBM PC-based version ✓ not true stereo configuration
For more information, circle Reader Service 209 ; or call Audion at 206-842-5202.	

add comments to a telephone conversation, after the fact."

In fact, Case's comment points to another advantage of VoxPro. It potentially can make live programming sound fresher, more alive, more focused and more entertaining. VoxPro makes a host sound more informed and more in control of call-ins and interviews.

VoxPro gives hosts and control/newsroom personnel the ability to add important content, to delete dead air or elements that detract from the key points being made by a guest or the host, and to keep the overall program focused on important or entertaining points.

In its present form, VoxPro samples audio at 44.1 kHz, yielding frequency response to 22 kHz. No compression or bit rate reduction is used, so one minute of two-channel input audio summed to a mono output consumes 5 Mb of hard disk space.

Options

A future enhancement will provide 2:1 compression in the form of digital AGC (automatic gain control). Another 2:1 will be available with a selectable 22 kHz sampling rate for 11 kHz response, if desired. With 4:1 total compression, a 60-second recording can be copied and stored to a 1.4 Mb floppy disk.

An external magneto-optical (MO) hard drive option is currently available. It allows the use of removable 160 Mb "floptical disks," each holding about 30 minutes. DJs can use their own disks for all their own recordings and edits.

VoxPro will be available in the United States in March, at a suggested retail price of \$6,495. The system comes complete and ready to use. It includes the VoxPro software plus a Macintosh Quadra 605 computer with 160 Mb hard-disk drive, color display monitor and related peripherals.

For those unsure about the benefits of digital audio in the control room, Audion is offering a bold solution: VoxPro comes with an unconditional, 60-day money back guarantee. You can try it without risk for two months and return it for a full refund if you are not satisfied.

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For information from Audion Laboratories, contact Charlie Brown at 206-842-5202; fax: 206-842-6029; or circle **Reader Service 209**.

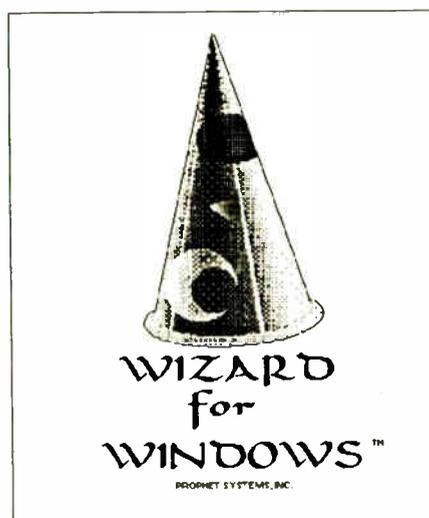
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World Radio History

INDUSTRY ROUNDUP

DAWs: No Longer Just for Production

by T. Carter Ross

WASHINGTON As a quick perusal of this month's Buyers Guide reveals, digital audio workstations (DAWs) are adding features and capabilities. Some units are specialized, high-end multitrack machines, geared toward commercial and program production. Others are designed to be more multipurpose. Some DAWs are being integrated with other equipment, particularly automation systems, while others are replacing cart machines or other studio source equipment.

They all have the capability to reshape

audio items and thus fulfill the function historically performed by reel-to-reel decks, analog tape and razor blades. But it remains to be seen whether future DAWs will be more specialized or more integrated with other units, acting as studio source, automation and editing gear, all in one.

Processor limits

Adrian Charlton of The Management said that at present, the functions of workstations are limited by the processors. "Even the fastest IBM-compatible PCs are not as fast as the slowest digital editor currently on the market. A proces-

sor surrounded by RAM gives DAWs an edge by letting you work in real time.

"DAWs are real one-trick ponies. They can handle 12MB to 18MB of audio, and maybe eight tracks of that in memory in real time," Charlton said. "That's eight times as much as a 486 can handle."

But for the short-term future at least, Charlton feels there will be a well-defined line between playback and editing devices because of the cost and processors.

James Goodman at Otari Corp. notes that the versatility of DAWs is one of their strengths. "One of the things you

find when you go into a workstation, is that depending on the software it uses, it can have applications over a broad range of applications: from post production for video to straight editing to radio production," he said.

Similarly, Larry Lamoray of ENCO Systems sees an eventual convergence of automation systems, DAWs and studio source equipment. "Many of the systems currently on the market are still in their infancy. Eventually they will take over a lot of the equipment functions in a studio."

Mike Palmer of Arrakis agrees that DAWs will assume a larger role: "The goal of all DAW manufacturers is to replace all tape equipment."

Although broadcasters may want more technology to be merged, there are limitations on what manufacturers can offer. According to Lamoray, "Market demands at this point are really forward of what we are able to accomplish technically." Lamoray clarified that the limiting factor is primarily hardware related, not software.

A processor surrounded by RAM gives DAWs an edge by letting you work in real time.

Palmer further noted that manufacturers and customers are not sure where to head next. "Everyone's comfortable with old style studios with different source gear for each major function," he said.

Logical step

Charlie Brown of Audion Labs believes that incorporating voice recognition is the next logical step for DAWs. "For instance, being able to say to your DAW, 'Find the interview with the word fusion.' The software will search its hard drive storage system for any occurrence of the word spoken in any of the recordings stored there."

With increased similarity in the advanced features of these systems, companies are looking for ways to make their own systems unique.

David Lin of CCS said that in the development of its DAW, the company relied heavily on broadcasters and radio news organizations in particular for feedback on making PACE user friendly. "We aimed to incorporate a human interface, at the insistence of broadcasters. We've replaced cart machines with a cart machine icon."

Goodman also said that Otari hopes its dedicated hardware will help make DAWs more user friendly. "People want them to be easy to use. There's still a push in that direction, but it is hard to make DAWs super easy to use. Our dedicated hardware control panel, which is like a tape control panel, but with more functions—cut, edit, scrub—on the panel, is a step in making this kind of device more user friendly," Goodman said.

Charlton notes that The Management designed AXS as a modular system, allowing a consumer to buy enough modules to do the tasks at hand, but always with the option to expand.

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TECHNOLOGY UPDATES

STUDER

Dyaxis Includes 'Plug and Play' MO Option

MENLO PARK, Calif. The modular, multi-track Dyaxis II digital audio workstation from **Studer Editech** provides up to 24 I/O channels and 48 playback tracks in four-channel modules. Designed to provide real-time performance and creative flexibility, Dyaxis II features playback of an unlimited number of "virtual" audio events, regardless of system size.

Each eight-track Dyaxis processor is a complete, independent system equipped with up to nine digital signal processors for the ultimate in real-time editing and completely digital mixing.

Modular design makes Dyaxis II expandable simply by adding processors.

Recent additions to the Studer workstation include the "Plug and Play" option and the MultiDesk hardware control console.

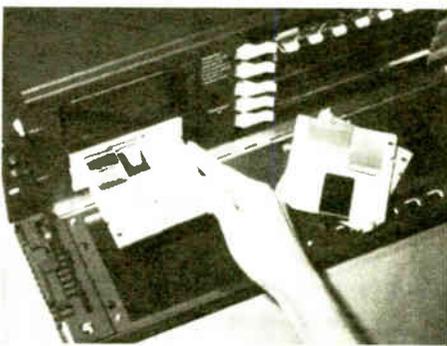
Plug and Play uses cost-effective 3.5-inch optical media, providing instant interchange between projects. Changing between projects is now as

simple as changing tape.

The MultiDesk control console provides moving fader automation, dedicated keys for editing, positioning and transport control within an integrated ergonomic surface.

Dyaxis II is the connectivity workstation, featuring multi-format digital I/O, file format capability with the many audio workstations on the market and machine control over most popular tape machines.

More than 1,000 Dyaxis systems are installed in broadcast production, post production and music recording studios around the world.



For information, contact Gerry Kearby in California at 415-326-7030; fax: 415-326-7039; or circle Reader Service 69.

BASYS

D-CART System Integrates Multiple Users

LANGLEY, England The D-CART system, distributed by **Basys Automation Systems Ltd.**, works with news/talk and music formats, as well as for a range of non-broadcast applications. It records, edits, replays, playlists and stores audio material without using tape. D-CART also supports a variety of semi- or fully automated operations.

Standard computer terminals, PCs or a range of studio interfaces can control record and replay functions. A shuttle wheel facilitates rapid and accurate editing at the screen. The shuttle wheel has a duplicate set of transport controls for users needing to switch between D-CART and another application. Finished items can be linked to each other in a playlist for either assisted or automated playback.

A single D-CART system supports a large number independent projects, or multiple users can edit or audition the same item simultaneously. The current SCSI drives allow approximately 34 users to access a single item on a mirrored system simultaneously.

Current changes in drive technology offer dramatic improvements in both the number of simultaneous users and disk

capacity. Audio storage (uncompressed) is based on high capacity random access mirrored-write hard-disk technology, providing simultaneous database driven access to all audio stored within each D-CART system.

Special purpose signal processing options include: stereo/mono conversion, fading and mixing and level normalization.

One of D-CART's biggest attractions is its reliability. D-CART system components rarely require maintenance attention, and system redundancy means virtually no risk of on-air problems.

For information, contact Kristin Schleiter in New York at 914-376-4800; fax: 914-376-0865; or circle Reader Service 33.

MTU

MicroSound Workstation from MTU Features Trackless Project-Editing on 386/486 PCs

RALEIGH, N.C. Sophisticated, yet easy to use, the MicroSound™ digital audio workstation from **Micro Technology Unlimited (MTU)** uses 386/486 computers to provide two to four balanced analog channels with 100 track simultaneous playback without bouncing.

With its trackless Project-Editing, you can move any audio event exactly where you want it—instantly hearing it overlapped with the other audio—digitally mixed for perfection.

MicroSound lets you change gains up or



down, with up to three minute fades computed on the fly. "Donut" copies can be made for repetitive work in seconds, which saves both time and money. Time change, noise remove, and non-destructive delete edits are made instantly and are modifiable in any order.

MicroSound excels in cost, performance and ease of use, which makes it perfect for any audio production, from short spots to long productions. It lets you perform your work in a fraction of the time versus tape machines or tape-emulating workstations.

Whether used as a single workstation, or multiple units networked together to share resources, users have found MicroSound very easy to use.

For information, contact Warren Keyes in North Carolina at 919-870-0344; fax: 919-870-7163; or circle Reader Service 204.

10

If you see this as a ten, not a binary two, we've got the digital audio system for you.

The DAD486x Digital Audio Delivery System combines the benefits, reliability, and economics of modern computer technology to provide a powerful CD quality digital audio system that does not require a programmer to operate it. With DAD on the job, you can instantly switch between Live Assist and fully Automated formats, and reap the advantages of instantaneous access to hundreds of tracks or completely controlled programming.

Operating DAD requires virtually no learning curve, as it emulates the equipment that you have always used. The optional Touchscreen is the ultimate in intuitive operation, or you can use the same fader starts or other remote controls that you do now. The super fast Graphic Waveform Cut and Paste Editing will make you wonder how you ever tolerated grease pencils and razor blades. And interface to satellite program networks is so easy that it takes only minutes to install, no special software required.

Maybe the most remarkable feature of DAD is that it runs under DOS, the most

commonly utilized software in the world, and on standard off the shelf hardware. Maintenance support, parts, and expansion hardware can be easily obtained anywhere. And you are assured that as computer technology continues to evolve, DAD will grow with it. You never need to be out of date. There are no monthly licensing fees and upgrades are free for the first year.

DAD can be configured to fit any size facility, from a stand alone Workstation that does double duty for both Production and On-Air to multiple Workstations, each equipped for a specific application, operating on a true Local Area Network. Redundancy and backup features can be configured to meet any need or budget. And DAD talks to CD Jukeboxes, Routing Switchers, and more.

DAD486x rates a "Ten" as the ultimate digital audio system!



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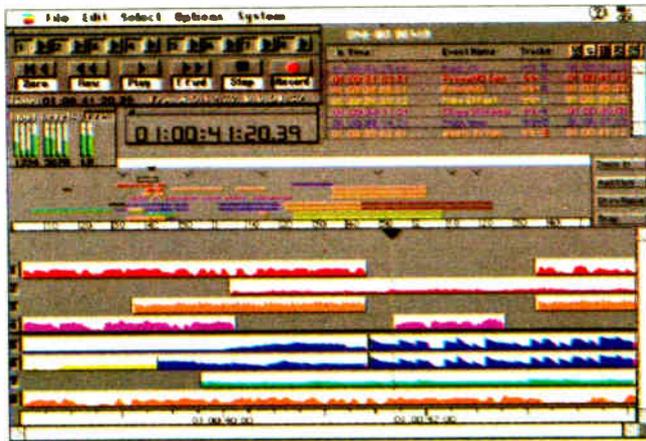
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the Word.

Problem is, many DAWs just can't give you all of these things.

Here's why:

Problem: Some systems use a single computer for graphic user interface *and* for audio information processing. This slows the whole system down, and makes you wait.

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.



We believe you'll find all these answers and more in: the Roland DM-80 Digital Audio Workstation. Call us at (213) 685-5141, ext. 337, or FAX (213) 722-0911 for a brochure. Or better yet, schedule a demo. You're going to like what you hear.

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

— DAVID ESCH
DIRECTOR OF COMMERCIAL PRODUCTION
WPNT CHICAGO



"Edits fast, sounds great, and doesn't break. The DM-80's multilayering capabilities and simultaneous recording on all tracks gives us the flexibility to do whatever we want."

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PRESIDENT
21ST CENTURY SOUND DESIGN, HOLLYWOOD
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"The first DM-80 paid for itself in two months, so we bought a second one... I like the editing ease—no waiting. It's my 'word processor' for audio."

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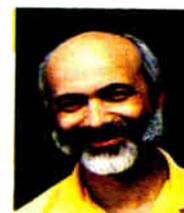


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— RICHARD FREITAS
EMMY AWARD NOMINATED AUDIO PRODUCER
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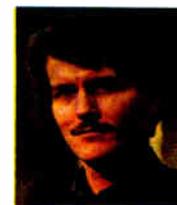


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STUDIO TECHNOLOGIES

StudioComm Series Provides Flexible Monitoring System

SKOKIE, III. The StudioComm series from Studio Technologies lets radio stations set up a flexible, great sounding monitoring and communications system for their digital audio workstations.

A full system consists of the one-rack space Model 50 central controller, the desk-top Model 51 control console and at least one Model 35 or Model 38 talent amplifier. Used together, they supply control room and studio monitoring, an integrated headphone system and a dub output.

The Model 50 central controller has seven stereo line inputs that accept the balanced or unbalanced output of workstations, DAT recorders, etc. Several outputs are available: two sets of balanced stereo line level outputs for control room monitors; one studio monitor output; a dub output; and a

headphone output.

The Model 51 contains all routing, switching and level-setting controls. A built-in microphone provides wide-range voice pick-up for talking to the studio and the control room, or sending voice audio to the dub output.

The Model 51 connects to the Model 50 with a five-pin, five-conductor, MIDI-type cable. The units communicate using system-exclusive MIDI messages.

The headphone output feeds up to four StudioComm talent amplifiers. Both the Model 35 and Model 38 cue modules drive high-impedance headphones. Power and audio reach them via a single, three-pin microphone-type cable. The Model 38 also lets the user adjust the mix in her or his headphones.

With all of their features, StudioComm products help to increase production efficiency.

For information contact Barbara Govednik in Illinois at 708-676-9177; fax: 708-982-0747; or circle Reader Service 134.

SPECTRAL

AudioEngine Provides up to 256 Virtual Tracks

SEATTLE The AudioEngine from Spectral Synthesis currently is used by radio and television facilities around the world for fast, high-volume production of spots, promos, voice tracking and full-length programs.

The system provides up to 256 virtual tracks for recording, a built-in digital mixer and patch bay and up to 16 channels of input and output (soon to grow to 24). It also offers extensive signal processing capabilities, but only takes up the same amount of space as a traditional open reel recorder. Windows-based to keep purchase cost and training time low, the AudioEngine has been installed in more than 350 systems worldwide.

The familiar Windows interface enables the AudioEngine to be operated by a wide range of facility personnel, and the system can be installed in virtually any modern Windows-capable PC. It features a built-in high-speed digital audio bus, plus a SCSI controller for external hard drives or other removable media. The "host" PC is used only to run the system control software. Other approaches to workstation design are limited by relying on the host computer's CPU for signal processing, according to Spectral.

The AudioEngine, on the other hand, is so independent that it can withstand a warm boot ("ctrl-alt-del") of its host computer, while playing up to 16 tracks of audio without interruption.

For information, contact Mark Doenges in Washington state at 206-487-2931; fax: 206-487-3431; or circle Reader Service 22.

ITC

ITC EdItor Designed for Fast, Easy Operation

BLOOMINGTON, III. The ITC EdItor from International Tapetronics Corp. (ITC), is a simple waveform multi-track editing tool designed specifically to meet broadcasters' needs. The EdItor is able to record; edit from two or more channels; change pitch speed; edit non-destructively; perform edits using real-time crossfades to eliminate pop; and record all tracks in mono and playback stereo.

The EdItor has 16-bit linear resolution with multiple sampling rates up to 48 kHz performance without compression. All data remains fully intact instead of permanently discarding audio data information.

When partnered with the cut editor feature on ITC's complete digital audio system, the DigiCenter, the EdItor allows cue tones, intro and outro marks, and Vari-Time—an ITC feature that adjusts cut lengths without changing pitch. EdItor files can be networked to DigiCenter.

In addition to these radio-specific benefits, the EdItor is designed for fast, easy operation; uses standard commands like cut, copy, paste, undo, mix, level set, auto or custom fades and splices, and EQ; and operates on a DOS-based platform.

For information, contact Charlie Bates in Illinois at 800-447-0414; fax: 309-828-186; or circle Reader Service 174.

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SONIC SOLUTIONS

Sonic Solutions Offers Mac-Based Editor

SAN RAFAEL, Calif. The Sonic System™ is a family of digital audio workstations for engineers and producers whose bottom line is speed, flexibility and sound quality. The Sonic System is ideal for dialog and music editing, radio spot production and mixing and editing multi-track radio programs.

Based on the Apple Macintosh computer and advanced signal processing cards from **Sonic Solutions**, the system is easy to use and entirely modular and expandable. All Sonic Systems include high productivity features such as 12 channels of continuous audio from a single hard disk, non-destructive editing and background recording to the hard disks.

Sonic offers a complete line of software options including EQ and mixing, time compression/expansion, digital reverb, sample rate conversion, PQ editing, CD recording and NoNOISE sound restoration.

Multiple Sonic Systems can be lined together through MediaNet, a high speed FDDI or CDDI network. MediaNet supports up to 100 channels of real time digital audio and allow engineers to share soundfiles and processing resources transparently between workstations.

Sonic System can be configured from two channels of digital I/O (12 tracks of playback) to 24 channels of I/O (72 tracks of playback); prices start at \$4,995.

For information, contact Rolf Hartley in California at 415-485-4800; fax: 415-485-4870; or circle Reader Service 7.

ORBAN

Orban DSE-7000 Uses Unique RAM Architecture

ALLSTON, Mass. The Orban DSE 7000 is an eight-track digital sound editor designed especially for radio production. The system combines powerful editing features like automatic backtiming with flexible transport features like vari-speed play.

Transport and mixer controls work and feel just like tape. Edits are marked either by "rocking the reels" or making marks on the fly from any play or transport speed. All mixing is in real time, so there is no need to set up complicated "mixer automation."

All eight tracks and two effects returns can be bounced down to one or two tracks. The screen display is easy to understand, and any edit or mix operation can be undone. On-line help is available at all times.

The system is intuitive, fast and easy to use. Most new users can do full productions in about an hour. No training seminars or computer knowledge is necessary, and there are no DOS or mouse commands, windows or icons.

The system is always ready to record, edit or mix.

The DSE 7000's RAM architecture is unique among DAWs. Up to 70 minutes of audio is stored in RAM at all times, making it much faster and more responsive than hard disk-based workstations. Audio is simultaneously "shadowed" to a hard drive for up to eight hours of secure disk storage. A DAT backup option provides unlimited long term storage.



The system is shipped as a complete unit, including a control panel with full size mixer and tape transport controls, a monitor screen and custom hardware operating on a PC platform.

Frequent software upgrades keep DSE units up to date. Orban plans to release its Version 4.0 software and new digital I/O hardware options this Spring.

For information, contact Orban in California at 510-351-3500; fax: 510-351-0500; or circle Reader Service 180.

DAL

EdDitor and CardD Upgrades Expand Functions

MINNEAPOLIS Digital Audio Labs updated its EdDitor for Windows program and The CardD board. The EdDitor Plus and The CardD Plus offer expanded editing functions and capabilities.

With simultaneous record/playback capability, The CardD Plus plays two channels while simultaneously recording another two channels. The EdDitor Plus waveform display editor takes advantage of this CardD Plus feature.

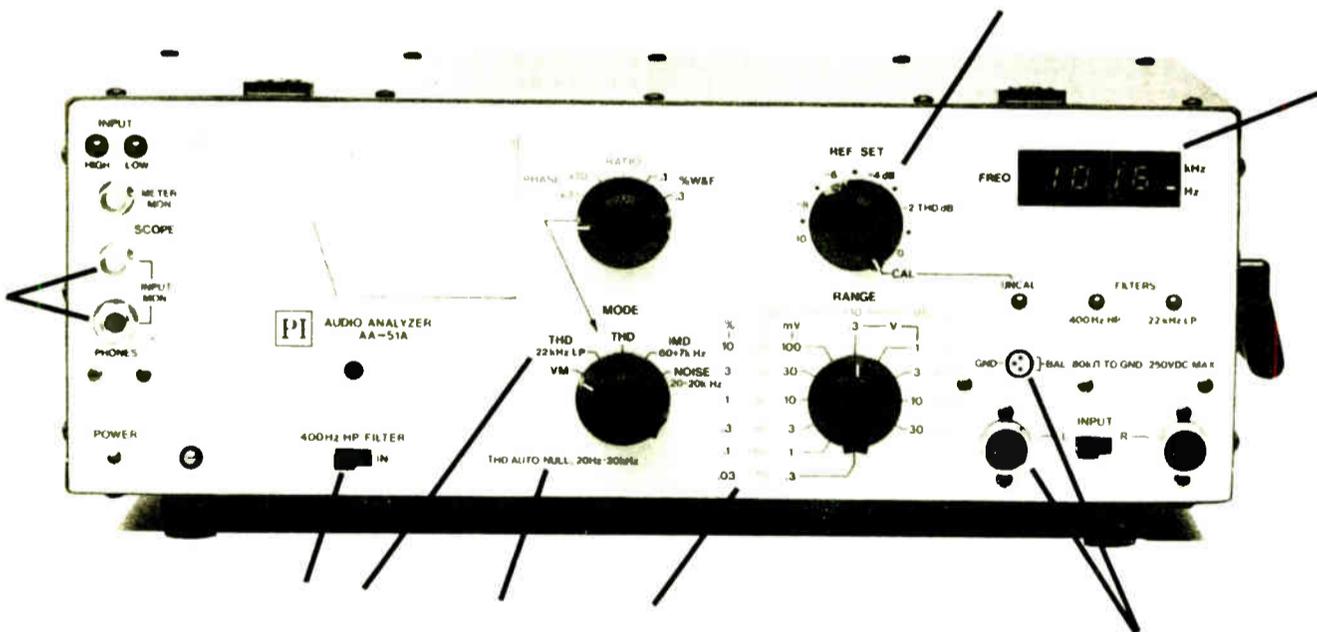
The EdDitor Plus plays one file in the bottom waveform-display window, and records new sound into the top window. When the record/play operation is completed, the time scales of the two windows are locked and synchronized. It also can playback two recordings together, mixing four channels of audio down to two channels in real time.

The "Preset Punch-in" feature helps re-record a section of the top window. Multiple punch-ins can be done, with the EdDitor Plus remembering up to 10 takes that can be compared with "Edit History." A scrub feature is also new. The mouse scrubs the waveform, and the velocity-sensitive playback provides the feel and sound of scrubbing analog tape.

Adding The I/O CardD provides an input and output for direct digital transfer to and from a DAT recorder. It works in the S/PDIF format.

For information, contact Jeff Wilson in Minnesota at 612-473-7626; fax: 612-473-7915; or circle Reader Service 102.

How Many New Features Can You Find On Potomac's New AA-51A?



Multiple Choice

- A. None
- B. 1 to 4
- C. 5 to 9
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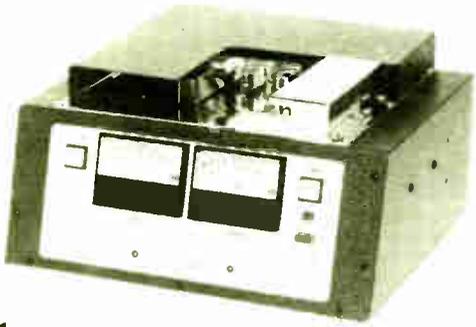


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- Available with built-in AC-2 autocoil to form a dial-up remote control.
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The DTMF-16 is excellent for interfacing various networks to automation, controlling remote satellite receivers, repeaters, etc. The compact, light & rugged DTMF-16 can be put almost anywhere to provide the remote controls that you need. For more info, contact your favorite broadcast supplier or call us.

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OTARI

Quick and Easy Editing Possible with ProDisk

FOSTER CITY, Calif. The Otari ProDisk 464 digital audio workstation includes a host of powerful features designed to make broadcast production faster and easier.

Expandable from four to 64 channels, track arming, sound levels, scrubbing, cutting, pasting, track slipping and fades all can be easily seen and changed either from the optional CB-158 control panel, with all dedicated function buttons, or performed on the screen with a mouse/trackball and qwerty keyboard. Off the shelf MIDI-driven fader panels can be easily plugged into the ProDisk for cost-effective hardware control of gain and panning.

The ProDisk's standard +4 balanced analog I/O make it easy to interface with other professional broadcast equipment. Digital I/O also are available.

The standard four-track system comes with a 650 MB fixed hard drive for 120 total track minutes, but can be expanded to 180 minutes with an optional 1 GB drive.

Projects can be easily transferred between multiple ProDisk systems if they

are equipped with the SoundShare™ option. SoundShare uses either removable magneto-optical or removable hard drives for fast and easy transfers.

An 8 mm Exabyte tape drive for storage and backup is standard.

Otari's new time compression/expansion option allows you to compress or expand a file in time with no change in pitch. Simply set the edit in and edit out



points on the "Guide" screen, push one button and the selected sound file or region expands or compresses to fit the edit in and out points. No time consuming calculations are necessary.

For information from Otari, contact Matt Ward in California at 415-341-5900; fax: 415-341-7200; or circle Reader Service 146.

THE MANAGEMENT

AXS Includes Digital Cut Editor

FORT WORTH, Texas AXS (ax'sess), created and marketed by The Management, is designed as a direct replacement for cart machines both on air and in the production room. Its design allows a single computer to replace cart playback machines and carts in the control room.

With up to three overlapping audio playback sources and one independent record/play source operating simultaneously, there is no end to the flexibility AXS offers on-air personnel.

EOM control is set by individual audio cut for smooth overlap of multiple sources, and spontaneous playback of audio cuts is as easy as pushing a button.

AXS runs on a 486-based computer with 2MB RAM, two serial ports, one parallel port, VGA color monitor and 512k adaptor. Hard disk storage at 32 kHz sample rate (16 kHz frequency response) is approximately 1MB per minute for mono. 2MB per minute for stereo.

Options include a PC-based four-channel switcher, an external eight-channel, Dual buss design, button box, digital cut editor and more, but all of the basics are

already in the system.

AXS uses the apt-X compression algorithm for clean, crisp reproduction with sampling rates up to 48,000. Log-based operation allows for instant information and easy log editing. On screen tags and "copy with preview" mode give your on-air staff unprecedented flexibility and ease of use.

Systems start at \$3,500.

For information, contact Adrian Charlton in Texas at 800-334-7823; fax: 817-624-9741; or circle Reader Service 191.

ENCO

ENCO DAD486x Uses Graphic Waveform Editing

ST. LOUIS The DAD486x digital audio delivery system from ENCO Systems offers users a cost effective solution for total system needs, functionality, future growth and hardware compatibility and a capability of support by any competent computer technician.

As a digital audio workstation, the DAD486x uses visual graphic waveform editing. This editing mode lets a user hear and see the results of head/tail trimming, cue tone placement, cuts and pastes, and segue fade points.

Features of the DAD486x include: production with graphic cut and paste assembly editing; multi-output on-air capabilities for both live assist and automated operations; scheduling management; and interface to other studio equipment. The DAD is simple to learn, easy to use and requires no computer expertise to operate.

The DAD486x operates on MS-DOS, the world's most widely used operating system, and standard off-the-shelf hardware.

DAD486x can be configured for any size facility from a single standalone workstation with simultaneous on-air and production capabilities to large, integrated multi-workstation systems, operating on a conventional high speed local area network (LAN).

Small systems can easily grow large, utilizing the same basic hardware and software. For information, contact Larry Lamoray in Missouri at 800-362-6797; fax: 314-453-0061; or circle Reader Service 125.

TASCAM

TASCAM Designed for Low-Cost Digital Production

MONTEBELLO, Calif. The TASCAM DA-88 is designed specifically for low cost digital multitrack production.

Using Hi8 tape for 108 minutes of recording time, the DA-88's tape transport is designed for the abuse that production studios dish out. It is quiet, fast, accurate and solid. The shuttle wheel moves the tape at one-fourth to eight-times the normal play speed. And the location is easily viewed on the DA-88's eight-digit absolute time display.

The DA-88 works logically and like an analog deck, all functions are operated from the front of the deck. Punch-ins and -outs, for example, can be done on single tracks on the fly by

hitting the track button at the punch-in point or with an optional foot switch. Or, for multiple tracks, select the track numbers and use "Record" to punch-in, "Play" to punch-out. Or, for frame accurate punch-ins, there is an auto-punch feature. In any case, TASCAM's variable digital crossfade technology makes the punch-ins and -outs seamless.

Pitch is user-selectable +/-6 percent, as are crossfade and track delay times. Either 44.1 kHz or 48 kHz sampling rate can be selected. Flat frequency response is 20 Hz to 20 kHz and the dynamic range is greater than 92 dB.

With the addition of the optional SY-88 synchronizer card, the DA-88 becomes SMPTE and MIDI compatible.

For information, contact Bill Mohrhoff in California at 213-726-0303; fax: 213-727-7635; or circle Reader Service 141.

This could be the last cassette deck you'll buy this century.

Since cassette decks are still standard equipment in any studio, it makes sense to turn to a deck that you can rely on both now and in the future: the TASCAM 112 MK II. Because even on the worst of days, the 112 MK II will be the one thing you can always depend on to work right. No prodding, kicks or angry swats needed.

Of course, the 112 MK II offers you key features like three locate points, cue and review and an optional easy-to-install kit for adding +4dBm balanced XLR inputs and outputs.

It's rugged. It's reliable.

It's powerful. What more could you ask for from a professional stereo cassette deck that takes its job just as seriously as you do — and is bent on outliving most of the other equipment that you have in the studio. Pick up a 112 MK II today and make it the last deck you'll buy this side of the 20th century.

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The popular 112 MK II, available with a balanced XLR input/output kit, is the industry's rugged and reliable cassette deck for broadcast and production studios.

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Broadcast Programming tapped radio veteran **Ken Moultrie** as a national programmer and consultant.

Shape Inc. expanded its professional and associated products division with the addition of **John Schattin** and **John Kay**.

Schattin is the new director of associated products sales and is developing a national network of professional and retail distributors and dealers for Shape products.

Kay is professional products sales manager responsible for dealing directly with studios, engineers and other professional users.

Cartwright Communications appointed **David Little** to its engineering ser-

vices department. Little's responsibilities include providing technical assistance to customers and designing custom combiners, duplexers and filters.

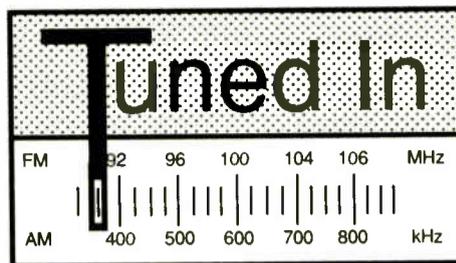
Richard A. Klein announced his retirement from **UNR-ROHN** after 37 years with the company. Klein remains available to the company on a consulting and advisory basis.

Dale Electronics tapped **Mike Bogen** as director of pro audio sales. Prior to joining Dale, Bogen was vice president of **Martin Audio/Video Corp.** and director of sales for the **AFA/Martin Pro Audio Group**.

Otari Corp. announced changes in its sales and marketing department. **James Goodman** was promoted to marketing

manager and **Lee Pomerantz** was promoted to national sales manager.

Andrew Corp. expanded **Barry Cohen's** responsibilities as broadcast antenna products business unit manager



to include the design, manufacture and marketing strategy of Andrew's broadcast antenna product line worldwide.

Also, Andrew Corp. promoted **Debra Huttenburg** to broadcast systems busi-

ness unit manager.

Analog Devices Inc. selected **Christian Kermarrec** to lead the product development group for its new line of RF products. Analog Devices is focusing on complete chip-set solutions for portable and mobile phones.

Symetrix Inc. added **Sherri Swingle** to its team as marketing administrator. Swingle is responsible for implementing all marketing programs, advertising and public relations activities.

Company News

Avid Technology appointed **AudioTechniques** its exclusive representative for the New York metropolitan area. AudioTechniques will represent Avid's Media Composer, digital non-linear editing system, and AudiVision, track lay-up system to sync-lock digital picture to audio.

Clark Wire & Cable opened a new full-service custom cable termination facility at its Deerfield, Ill., headquarters. The facility is staffed by five full-time cable termination specialists to help supply customers with audio, video and A/V cable specifically tailored to individual needs.

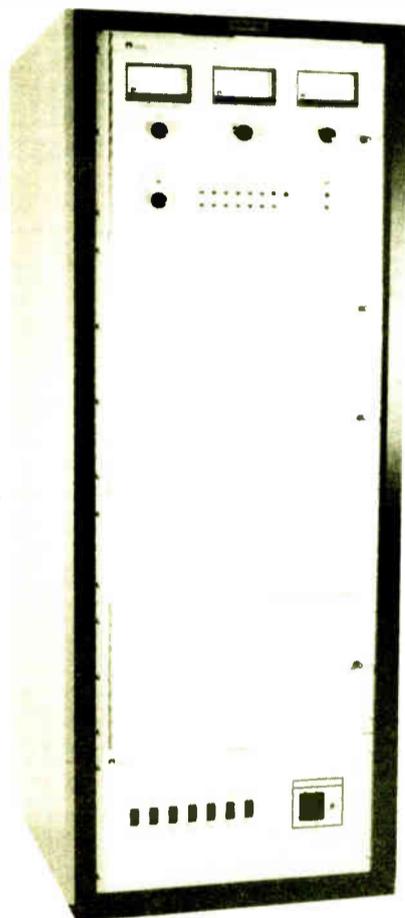
Pioneer New Media Technologies Inc. announced the delivery of 34 Pioneer CAC-V3200 300-disc CD autochangers to **Digital Cable Radio (DCR)**. DCR is a satellite-delivered digital audio service, offering subscribers commercial-free music in specialized formats.

Scientific-Atlanta Inc. received approval of its **MariStar-M** and **MariStar Multi-M** satellite communications terminals from **Inmarsat** to provide maritime facsimile services.

Sabine Musical Manufacturing Co. doubled its factory space and production capacity. The company now covers 20,000 square feet in the Gainesville North Industrial Park in Florida.

Sabine manufactures electronic metronomes and accessories, as well as instrument tuners and feedback control devices.

Wegener Communications supplied **DR180** digital audio subcarriers to **USA Overnight**, a new radio network providing entertainment news and music programs to affiliate stations across the U.S.



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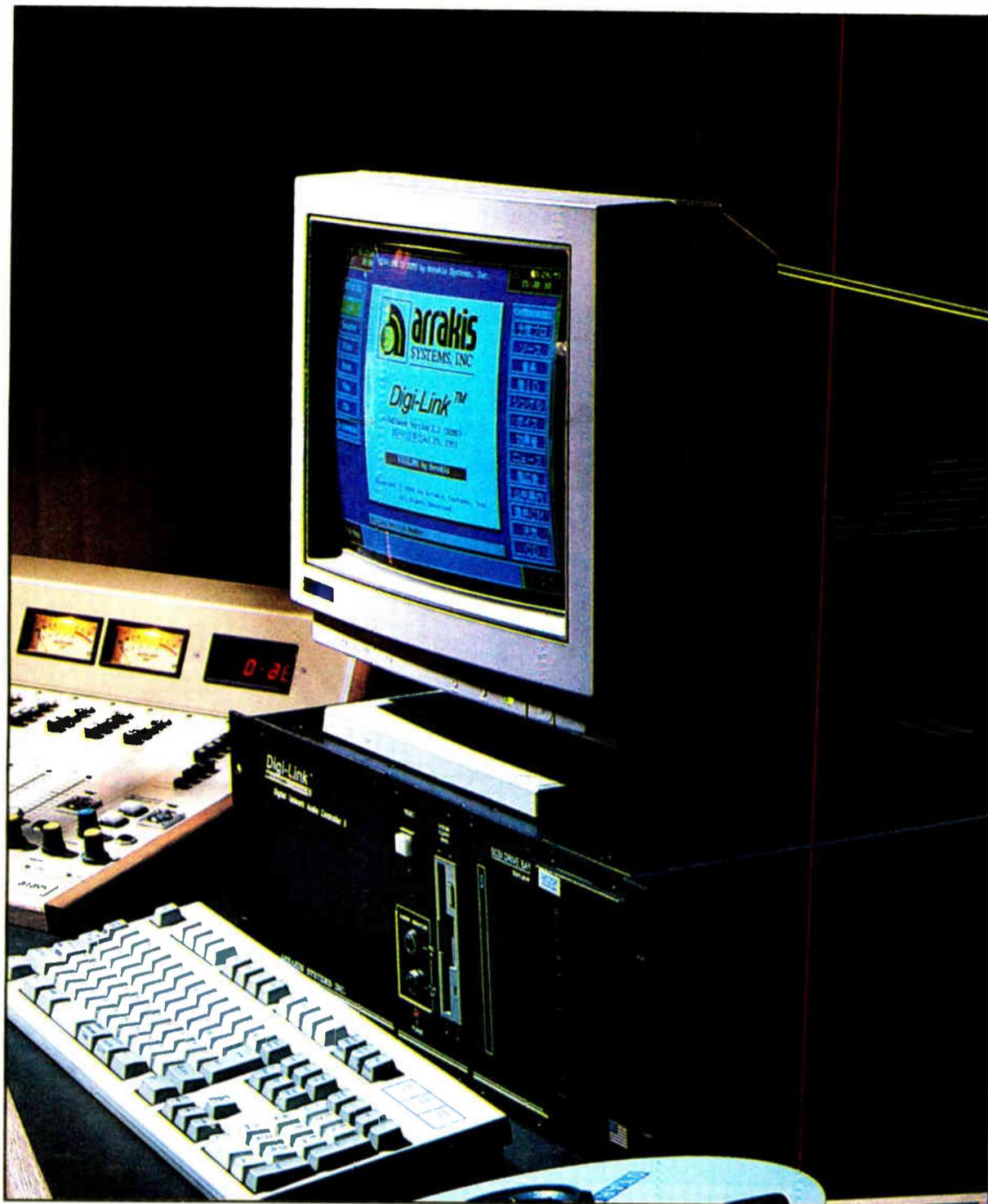
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or been impossible with tape. Digilink is also easy to schedule. You can use the standard Digilink traffic & CD scheduling system or import music

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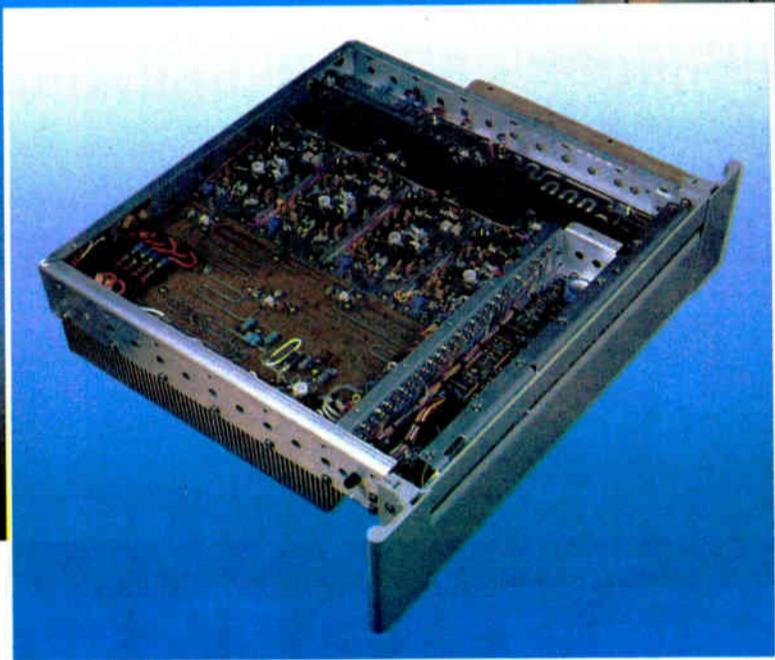


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Want To Sell

RTS-405 stereo TT preamp (2), \$145/ea + shpg, used 6 mths. B Lord, Lord Bldg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Perma-Power S-102 amp w/S1420 batt pack, mobile/portable PA unit, 12 W out, excel cond, \$4100. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

New 10 kW FM amp under \$24,000. Call for details. Bill Hoffman, 518-743-1601.

Dynaco stereo 120 solid state, rack mt \$229, Dynaco stereo 70 tube amp all new tubes! Dynaco PAT 4 preamps \$59. W Gunn 619-320-0728.

ANTENNAS/TOWERS/CABLES

Want To Sell

HJ8-50B, 3" Helix, 350', new, \$5000 or best offer; 87R/87N/87L-3, 1-5/8" connectors, new, \$110 each. MBS Test Equipment Sales Corp, 305-477-6192.

Copper wire for radials also copper strap/screen, BO, ASAP. E Prendergast, KAO, 318-882-0243, FAX 318-882-6731.

ERI FMH 12AC parts for old miter cut antenna, cheap; Myat 301-007 3" rigid transmission line, Myat & Phillips EIA flange, \$100/ea. T Wortmann, WJAG/KEXC, 309 Braasch, Norfolk NE 68701. 402-371-0780.

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Jampro JSLP 6 bay on 97.9 MHz, excl cond, replaced for upgrade, incl 45' of 1 5/8" coax & one EIA connector, BO. A Crane, KWAZ, 2636 Hwy 95 #10, Bullhead City AZ. 602-763-5227.

ERI FML-3 3 bay tuned to 95.9, \$1000. F Troiani, WMRF-WIEZ Radio, 12 1/2 E Market St, Lewistown PA 17044. 717-248-6757.

Andrew 5" air coax 500' on I-80 in Iowa, connectors incl, \$10000. R Henry, WPIO, 505 Josephine St, Titusville FL 32796. 407-267-3000.

Andrew EW63A waveguide w/ends, (2) new rolls, 75' & 140' in boxes, BO/trade. M Kestler, KAWZ, 241 Main Ave W, Twin Falls ID 83303. 208-733-3133.

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RCADielectric BCF-6B antenna, 6 bay tuned to 90.5, \$4000, (6) radomes, \$1500. A Clawson, WPF, 1715 Michigan St, Sturgeon Bay WI 54235. 414-743-7443.

Jampro JMPC-10 10 bay circular FM antenna on 107.1, new cond, stored inside, \$9500/BO. B Zellmer, 303-353-6522.

Phelps Dodge CFM-LP3 3 bay FM on 92.1 MHz, removed 12/93, \$2500/BO; Cablewave HCC158-50J, 1-5/8" air coax, approx 260', \$800/BO. G Reinheimer, WYYD, POB 4108, Lynchburg VA 24502. 804-237-4700.

Andrews various 3" & 1 5/8" connectors, 100' of 3 1/8" Andrews line, (2) RF chokes Continental 814B + manual, BO; Continental ERI Rototiller tuned to 97.7, 3 bay, 1 5/8" lead, 1.5588 gain, BO/trade. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

ERI FMH-10AC 10 bay antenna, CP tuned to 105.5, \$19,500. M Wodlinger, WIXI, 3337 Tamiami Trail N, Naples FL 33940. 813-262-1000.

Phelps Dodge CFM-3, 3 bays, tuned to 98.3 MHz, gd cond w/heaters, \$1500. D Heinen, KRSE, POB 127, Yakima WA 98907. 509-248-1390.

Windcharger 200, 100', on ground, BO. J Kesler, WOBZ, POB 220, Livingston KY 40445. 606-843-9999.

Want To Buy

Coax switch (4) port 1 5/8" motorized, Bird 5 kW dummy load, RCA 11706 on-air light. L Lindstrom, WPOK, 315 N Mill, Pontiac IL. 815-844-6101.

3 or 4 bay antenna tuned to 90.7 MHz with brackets for small tower, w/w heaters or raydomes. K Austin, KFXI, 1101 Hwy 81N, Marlow OK 73055. 405-658-2556.

Used 700-980' tower; (2) used 400-500' towers. K Kuenzie, KFXE, 511 W 5th St, Washington MO 63090. 314-239-6800.

Looking for (4) 1 5/8" connectors to go on 1 5/8" cable. K Diebel, KTJC FM, 318-728-5852 days, 318-728-3578 nights.

ERI G5CPM tuned to 96.7, 180' Andrew HJ5-50 7/8" line. A Clawson, WPF, 1715 Michigan St, Sturgeon Bay WI 54235. 414-743-7443.

AUDIO PRODUCTION

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CRL Dynafex DX-2 single ended stereo noise reduction, \$225; Belar Audio Sentry AS-1 (4), 3 years old, \$95/ea; Aphex M250 Aural Exciter III, \$415; Gentner TC100R w/DTMF decoder, \$245; (5) Trimm/ADC 2 rows of 1/4" jacks, half-normalled, brought out to ADC Ultrapatch, \$165/ea. Wes, 818-798-9128.

Eventide Ultra Harmonizer H3000, excl cond, \$2300. J Webb, KBZN Radio, 257 E 200 S #400, SLC UT 84111. 801-364-9836.

dbx 155 4 chnl encode/decode Type I NR (2), \$200 ea/\$375 both. P Cibley, Cibley Music, POB 751 Murray Hill Sta, NYNY 10156. 212-986-2219.

Kurzweil Midboard, \$1199; Kurzweil 1000 Px Plus sound module, \$799; Kurzweil 1000 Hx sound module, \$699; Kawai Q-80 sequencer, \$199; all mint. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

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Sparta 25 Hz tone gen & filter, \$200; (3) Sparta cart PB w/rack, mono, \$900; Sparta A-20B 8 chnl mono 1973 console, \$1000; (2) Sparta TTs w/tonerms & mono preamps, \$300 ea. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-778-8257.

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Digidesign Audiomedia I digital recdgy & editing system, analog in & out, stereo w/Audiomedia Vol 2 software & deck 1 4-trk automated mix software, manuals. J O'Leary, 1717 Euclid St NW, Washington DC 20009. 202-332-8377.

Demeter 4 channel rack mount tube direct box NEW \$795. W Gunn 619-320-0728.

Sine Systems Stereo Watchdog, rides stereo balance, phase flip, subs loss of left or right chnl, \$425/BO. D Evans, KALW, 2576 Harrison, San Francisco CA 94110. 415-695-5740.

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UREI 537 33 band graphic equalizers (3), gd cond, will sell separate or together, \$250/ea or 3/\$600. Jeff, 703-297-1188.

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ADC 96 & 144 Pr TT patchbays, excel cond, 1 rack space, 3 rows of 48, top 2 rows normalled, \$149, 96 is 2 row normalled, \$129 (you remove old wiring) or we totally refurbish w/new front panel, ready to install, \$199-229. TT cords up to 10 per bay at \$9 ea, reg \$13.95, also 1/4" bays. Audio Village, 619-320-0728, or Fax 619-320-2454.

Want To Buy

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

AUTOMATION EQUIPMENT

Want To Sell

Cetec 7000 automation system w/terminal encoder & cables, (3) ITC PB reels w/rack, (3) IGM 42 tray Go-Carts w/racks, (2) IGM tray Go-Carts w/racks, 3" disk drive for backup, printer, case of paper 12-6" rolls, all cards, cables, switches for system, all machines have been rebuilt by fact & in service, will deliver within reasonable distance. T Yarbrough, WCDD, Winchester TN. 615-967-2201.

SMC DP 2 automation system, stereo, 2 Carousels, 3 Otari R-Rs PBs, PDC 5 clock, DS 20 switcher, computer, \$3500. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-778-8257.

SMC MSP-1 automation system, complete w/4 Otari ARS-1000; (3) 350RSB Carousels, SMC 712 dual cart plyr, Universal interface, all in 3 matching SMC custom deluxe racks, manuals, in use, \$6000/BO; Harris 9001 automation incl 2 Otari ARS-1000, (2) IGM 24 Go-Carts, (2) snl play ITC cart decks & 2nd system for spares or standby which incl brain, switcher, pwr spy, terminal, keyboard & manuals, \$4000/BO. R Wynne, KFLS/KKRB, 503-882-4656.

Control Design 25 Hz tone sensor, rack mount, \$150. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-778-8257.

Panasonic SV-3500 DAT mach (2), \$750/ea. P Fowle, Common Mode, 50 Northfield Ave, West Orange NJ 07052. 201-736-7191.

Harris 9002 (5) ITC 750/770 PBs, 48 tray mono Instacart, 3 count deck PBs, 2 VDTs, manuals & schematics, now in use. J David, KMPL/KSTG, POB 907, Sikeston MO 63801. 314-471-1520.

Sono-Mag Mini-Pro w/remote head, (2) RS-350 Carousels, RSC-100 random programmer, (4) PR-99s, will sell sep or together, \$2750. S King, KGFL/FKPK, Box 33, Clinton AR 72031. 501-745-4474.

SMC 350 stereo Carousels (6), will sell one or all, you pay shpg, \$300/ea. J Leutz, KFSB, 2620 Dogwood Rd, Joplin MO 64801. 417-624-1310.

Auto Jock, gd cond, \$1000/BO. M Skinner, KSGI, 341 S Bluffs St, St George UT 84771. 801-628-1000.

Smartcaster 8 kHz hard drive audio computer, 4 hrs storage time, interfaces to major satellite networks or live assist, recently reconditioned, \$3000. R Miller, WTM/WCNL, Taylorville IL 62568. 217-824-3395.

Sparta automation system, stereo, 2 Carousels, 2 Revox R-Rs, 2 tone sensors, clock, RS 250 random access, 1052 program controller, silence sense, \$2500. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-778-8257.

Sentry Systems cntrlr/interface automation w/16 Pioneer PD TM3 CD plyrs, XT computer, complete AC CD library & Computer Concepts DCS, under 1 yr old, \$26K/all or priced separately. M Rollings, Rollings Comm, POB 882, Chesterfield MO 63006. 314-458-5595.

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Harris 9001 automation w/(2) Otari ARS-1000, (2) IGM 24 Go-Carts, (2) single play ITC cart decks; also second system for spares or standby w/Brain, switcher, pwr supply, terminal, keyboard & manuals, \$4000/BO. R Wynne, KFLS, POB 1450, Klamath Falls OR 97601. 503-882-4656.

Schafer Series 7000 w/(4) Audiobites, (2) R-R, (3) racks, unknown cond, gd for parts, BO. G Reinmeimer, WYYD, POB 4108, Lynchburg VA 24502. 804-237-4700.

Smartcaster 8K mono, will interface w/satellite, (2) 60 MEG hard drives, \$3900. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

Scully automated system, useful for non-commercial AM/FM, BO. J Kesler, WOBZ, POB 220, Livingston KY 40445. 606-843-9999.

SMC MSP-1 automation system, complete w/(4) Otari ARS-1000, (3) 350RSB Carousels, SMC 712 dual cart player, universal interface, all in 3 matching SMC custom deluxe racks, manuals, in operation, \$6000/BO. R Wynne, KFLS, POB 1450, Klamath Falls OR 97601. 503-882-4656.

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Want To Sell

ITC PDII mono, R/P, gd shape, \$250 + shpg. W Wawro, WFAA, 606 Young St, Dallas TX 75202. 214-977-6260.

Tapecaster R/P cart mach (2), \$1500/BO. M Skinner, KSGI, 801-628-1000.

ITC R/P stereo cart machine, gd cond, \$950 plus shpg; ITC 3 deck stereo PB cart machine, all tones, gd cond, \$900 plug shpg. R Statham, WSTU, 1000 NW Alice Ave, Stuart FL 34994. 407-692-1000.

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Marantz PMD 360 port, gd cond, \$135 + shpg; Otari 5050 full trk, remote, gd cond, \$650/BO. J Rudisill, Audio Independence, POB 640742, San Jose CA 95164-0742. 408-321-8373.

ITC erase, splice finder machine (2), one in gd cond, other needs work, \$800/both plus shpg. R Statham, WSTU, 1000 NW Alice Ave, Stuart FL 34994. 407-692-1000.

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Uher 4200 Report Monitor, R-R stereo 1/2 track portable, 3 heads, 4 speeds, new in box, \$500. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Otari MX 5050, \$1800. R May, KULF, 306 E Main, Brenham TX 77833. 409-836-9411.

Revox B-77 open reel recorder, 7.5-15 ips, 1/2 track, good condition, \$575; Sony PCM-F1 digital recording system, F1 digital processor modified with Apogee input filters & external sync input, \$1500/complete system, \$1000/F1 processor only. R Streicher, Pacific A/V Enter, 545 Cloverleaf Way, Monrovia CA 91016. 818-359-8012.

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Otari ARS-1000 (2), mint cond, BO. J Kesler, WOBZ, POB 220, Livingston KY 40445. 606-843-9999.

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ERI FML-3 3 bay tuned to 95.9, \$1000. F Troiani, WMRF-WIEZ Radio, 12 1/2 E Market St, Lewistown PA 17044. 717-248-6757.

Andrew 5" air coax 500' on I-80 in Iowa, connectors incl, \$10000. R Henry, WPIO, 505 Josephine St, Titusville FL 32796. 407-267-3000.

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ERI FMH-10AC 10 bay antenna, CP tuned to 105.5, \$19,500. M Wodlinger, WIXI, 3337 Tamiami Trail N, Naples FL 33940. 813-262-1000.

Phelps Dodge CFM-3, 3 bays, tuned to 98.3 MHz, gd cond w/heaters, \$1500. D Heinen, KRSE, POB 127, Yakima WA 98907. 509-246-1390.

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dbx 155 4 chnl encode/decode Type I NR (2), \$200 ea/\$375 both. P Cibley, Cibley Music, POB 751 Murray Hill Sta, NYNY 10156. 212-986-2219.

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Panasonic SV-3500 DAT mach (2), \$750/ea. P Fowlie, Common Mode, 50 Northfield Ave, West Orange NJ 07052. 201-736-7191.

Harris 9002 (5) ITC 750/770 PBs, 48 tray mono Instacart, 3 count deck PBs, 2 VDTs, manuals & schematics, now in use. J David, KMPL/KSTG, POB 907, Sikeston MO 63801. 314-471-1520.

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SMC 350 stereo Carousels (6), will sell one or all, you pay shpg, \$300/ea. J Leutz, KFSB, 2620 Dogwood Rd, Joplin MO 64801. 417-624-1310.

Auto Jock, gd cond, \$1000/BO. M Skinner, KSGI, 341 S Bluffs St, St George UT 84771. 801-828-1000.

Smartcaster 8 kHz hard drive audio computer, 4 hrs storage time, interfaces to major satellite networks or live assist, recently reconditioned, \$3000. R Miller, WTIM/WCNL, Taylorville IL 62568. 217-824-3395.

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Sentry Systems cntr/Interface automation w/16 Pioneer PD TM3 CD plyrs, XT computer, complete AC CD library & Computer Concepts DCS, under 1 yr old, \$26K/all or priced separately. M Rollings, Rollings Comm, POB 882, Chesterfield MO 63006. 314-458-5595.

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AUTOMATION EQUIP...WTS

SMC 452 bi-directional, stereo Carousels, \$800 ea. R May, KULF, 306 E Main, Brenham TX 77833. 409-836-9411.

Harris 9001 automation w/(2) Otari ARS-1000, (2) IGM 24 Go-Carts, (2) single play ITC cart decks; also second system for spares or standby w/Brain, switcher, pwr supply, terminal, keyboard & manuals, \$4000/BO. R Wynne, KFLS, POB 1450, Klamath Falls OR 97601. 503-882-4656.

Schafer Series 7000 w/(4) Audiolies, (2) R-R, (3) racks, unknown cond, gd for parts, BO. G Reinmeimer, WYYD, POB 4108, Lynchburg VA 24502. 804-237-4700.

Smartcaster 8K mono, will interface w/satellite, (2) 60 MEG hard drives, \$3900. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

Scully automated system, useful for non-commercial AM/FM, BO. J Kesler, WOBZ, POB 220, Livingston KY 40445. 606-843-9999.

SMC MSP-1 automation system, complete w/(4) Otari ARS-1000, (3) 350RSB Carousels, SMC 712 dual cart player, universal interface, all in 3 matching SMC custom deluxe racks, manuals, in operation, \$6000/BO. R Wynne, KFLS, POB 1450, Klamath Falls OR 97601. 503-882-4656.

CART MACHINES

Want To Sell

ITC PDII mono, R/P, gd shape, \$250 + shpg. W Wawro, WFAA, 606 Young St, Dallas TX 75202. 214-977-6260.

Tapecaster R/P cart mach (2), \$1500/BO. M Skinner, KSGI, 801-628-1000.

ITC R/P stereo cart machine, gd cond, \$950 plus shpg; ITC 3 deck stereo PB cart machine, all tones, gd cond, \$900 plug shpg. R Slatham, WSTU, 1000 NW Alice Ave, Stuart FL 34994. 407-692-1000.

Audi-Cord DL Series stereo R/PB, \$700/BO. R Wynne, KFLS/KKRB, 503-882-4656.

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Audi-Cord DL Series (3) stereo play only, \$3500 ea, DL/RS R/P, \$900. R May, KULF, 306 E Main, Brenham TX 77833. 409-836-9411.

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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 3-D stereo w/tones or Delta 3 stereo, stereo SP's ok, need not be in wrkg order. L Lindstrom WPOK, 315 N Mill, Pontiac IL. 815-844-6101.

ITC PD-II, need one R/P unit, one PB for simple newsroom operation, nothing fancy, no junk. A Sutton, WBCU, POB 70, Union SC 29379. 803-427-2411.

ITC, BE, Fidelipac cart machines: single, triple, mono, stereo, play & record/play. Call M O'Drobinak @ 619-758-0888.

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Conex CG 25A 25 Hz tone gen, adjust tone levels, timing intervals. Paul, 612-222-5555.

Studer B67 1/4" 2-trk 7.5, 15 & 30 ips w/stand, gd cond, \$1500. D Harris, Studio B Prod, 1018 Central Ave, Charlotte NC 28204. 704-372-9661.

Marantz PMD 360 port, gd cond, \$135 + shpg; Otari 5050 full trk, remote, gd cond, \$650/BO. J Rudisill, Audio Independence, POB 640742, San Jose CA 95164-0742. 408-321-8373.

ITC erase, splice finder machine (2), one in gd cond, other needs work, \$800/both plus shpg. R Slatham, WSTU, 1000 NW Alice Ave, Stuart FL 34994. 407-692-1000.

Revox A-77 R-R R/P tape machines (2), \$600 ea. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-778-8257.

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Ampex 350 transports (3), \$35 ea or all for \$100 plus shpg. L Houck, Rollin Recdng, 210 Altgelt, San Antonio TX 78201. 210-736-5483.

Tascam 688 cassette multitrack recorder/mixer, mint condition, \$1900/BO + shpg; Revox PR99 recorder 7.5-15 ips w/carry case & speaker, good condition, \$800/BO + shpg. W Wawro, WFAA, 606 Young St, Dallas TX 75202. 214-977-6260.

Uher 4200 Report Monitor, R-R stereo 1/2 track portable, 3 heads, 4 speeds, new in box, \$500. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Otari MX 5050, \$1800. R May, KULF, 306 E Main, Brenham TX 77833. 409-836-9411.

Revox B-77 open reel recorder, 7.5-15 ips, 1/2 track, good condition, \$575; Sony PCM-F1 digital recording system, F1 digital processor modified with Apogee input filters & external sync input, \$1500/complete system, \$1000/F1 processor only. R Streicher, Pacific AV Enter, 545 Cloverleaf Way, Monrovia CA 91016. 818-359-8012.

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Telex 235 3:1 cassette duplicator, like new, \$650 plus shpg. S Russell, 60410 Klett Dr, Decatur MI 49045. 616-782-9256.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 4646 Houndshaven Way, San Jose CA 95111. 408-363-1646.

Otari ARS 1000 (2) gd cond, w/25 Hz, \$400/ea. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

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Otari 5050 MK III-8 trk, heads excellent, \$2450. Wayne Gunn 619-320-0728.

Otari ARS-1000 (2), mint cond, BO. J Kesler, WOBZ, POB 220, Livingston KY 40445. 606-843-9999.

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16 track 2" \$3450, MCI JH110C-8 \$2800, 110C-8 play only \$500, ATR800 mono or Tascam 7300 or 2502 \$600 ea, MCI Locator III \$1195, Tascam 52 2 trk \$1200, Ampex AG350 electr \$50/ch. W Gunn 619-320-0728.

Want To Buy

Ampex tube recorders and mixers. W Gunn, 619-320-0728.

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: _____

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Hands On Engineer with over 30 years of AM/FM/TV. MF/HF/UHF background, desires position with Int'l SW bdcg facility, FCC Gen SBE Cert, IEEE, AE Degree. Lou, 904-383-8457.

Freelance writer available for radio/TV infomercials, rare combination of direct mktg & bdcg skills, 24 hr FAX. Call Doug, 510-531-2404.

Ready to go to work for your station, young prod man w/multi-media exper, willing to relocate, recent graduate. Brad, 405-329-5632.

Broadcast engineer w/high pwr RF exper, instructor in training & safety skills, seeks career opportunity. Ed C, 207-732-5185.

If you master analog music tapes for radio stations & need more assistance, I have exper/equip. R Bass, 4100 O'Hare, Mesquite TX 75150-4454.

Creative, fun radio is only a call away! Dedicated, experienced air personality, recent morning gig w/prod skills, will relocate, AC/CHR/Oldies. Kevin, 609-863-1991

20 year vet in radio announcing & some part time sales, seeks full time announcing in AR, OK, MO, KS, TX. Call after 5PM, 501-337-5249.

Mama's Dead radio talk host David F Diamond is ready for new, major market. 901-761-5577.

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Proven travel program personality writes, performs, produces ratings thru roof show, can handle callins, British accent. Phil, 408-866-8542.

Custom Voice IDs, spots, breakers, promos, etc, 25 year pro of Boston, NYC, Philly & DC. Write: JLC, Box 2733, Spring PA 19609.

Creative air personality, producer & copy-writer seeks music intensive country station in midwest, 12 years exper-encer. Tom, 319-568-2198.

Arizona only, chief engineer, experienced all phases of high power AM & FM, 20 yrs experience incl Top 50/100 mkt, dry warm climate, chief, group chief or contract. Send replies to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box 94-01-26-01 RW.

Radio pro for hire, programming, management, versatile. Roger, 615-235-6889.

Radio dynamo seeks news job at medium mkt station, call for tape. M Kunkle, 814-226-9259 or 412-744-3270.

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CASSETTES/R-R...WTB

Sony TC-105, need motor. D Meish, Mobile Radio Comm, Box 100, Chester SD 57016. 805-489-2497.

Sony TCD-5M stereo cass recorder in bad to fair condition for parts/salvage. J O'Leary, 1717 Euclid St NW, Washington DC 20009. 202-332-8377.

Tascam 58 1/2" 8 trk wanted to buy or trade for Otari 5050 MK III-8 or...? Wayne Gunn 619-320-0728.

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

Spotmaster TP-60B tape timers from cart tape winders (TP-1A or TP-1B). Mel Crosby, 408-363-1646.

CD PLAYERS

Want To Sell

Sony PCM-1630 CD mastering system in excellent condition, system including PCM 1630, DABK 1630/31, DMR 4000, DTA 2000, 9" monitor, printer, comp manuals, (2) rd cases, call for price. N Sarikananda, Masterworks Rec, 1020 N Deaware Ave, Philadelphia PA 19125. 215-423-1022.

Audiometrics AMCD5-1000A multi-disk (100) CD players with RS232 control interface (2) avail, new optics, \$1000 ea. J Stromquist, WNCB, 2828 Piedmont Ave, Duluth MN 55811. 218-722-3017.

COMPUTERS

Want To Sell

Heathkit H89 has floppy drives, \$50. T Wortmann, WJAG/KEXC, 309 Braasch, Norfolk NE 68701. 402-371-0780.

Tandy 6000HD w/at least 1 floppy drive. Mel Crosby, 408-363-1646, FAX 408-363-0957.

CONSOLES

Want To Sell

Gates Executive 10-chnl stereo board w/manuals, some modules missing, taken out of service 1/93, \$500. R Miller, WCNL/WTIM, Taylorville IL 62568. 217-824-3395.

Soundtracs MR Series 24x8x2 recording console with 16 monitor returns, excellent condition, \$4000/Best Offer + shipping. W Wawro, WFAA, 606 Young St, Dallas TX 75202. 214-977-6260.

Arrakis 500 stereo 1986 console, \$2000. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-778-8257.

McCurdy SS8808A broadcast console, 10 chnls, 2 chnls have multi-input selectors, 3 spare power supplies, BO. P Fowlie, Common Mode, 50 Northfield Ave, West Orange NJ 07052. 201-736-7191.

Teac 15, 24 in mixing board, \$2500. HL Sewell, Oakridge Music, 2001 Elton Rd, Haltom City TX 76117. 817-838-8001.

Ramko DC-8 mixer, needs work w/some parts, \$150. D Heinen, KRSE, POB 127, Yakima WA 98907. 509-248-1390.

Dynamax stereo 8 channel for air or production, like new condition, \$3200/Best Offer. Terri, GMN Inc, Box 2205, Cincinnati OH 45201. 606-572-9446.

Arrakis 500 SC excellent condition, 8 chnl stereo, will trade for studio or on air processing, \$1750. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

LPB S12 5 pot 10 input stereo, excellent condition, very clean, \$1295; LPB S13C 8 pot 24 input stereo in excellent condition, good clean working order, \$1895. J Travis, WCIK, POB 506, Bath NY 14810. 607-776-4151.

BE 450, \$1500. R May, KULF, 306 E Main, Brenham TX 77833. 409-836-9411.

Soundcraft Spirit 163 mixing console, \$1550; Quantum 12A mixing console, \$1300 complete; Fostex 2050 line mixer, \$100. R Streicher, Pacific A/V Enter, 545 Cloverleaf Way, Monrovia CA 91016. 818-359-8012.

Collins/Autogram IC10, good condition, \$2500. Mike Starr, WKLS-FM/Atlanta, 404-325-0960.

Want To Buy

BE 5M-5250A or 4M50A for simple newsroom operation, no junk. A Sutton, WBCU, POB 70, Union SC 29379. 803-427-2411.

DISCO-PRO SOUND EQUIP

Want To Sell

JBL ceiling speakers (2), \$35/each, used in suspended ceilings, incl hous-ing, speaker & control knob. B Lord, Lord Broadcasting, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Cerwin-Vega DM-1 mixer, \$125/Best Offer; JVC BP-5 biphonic processor, converts bialural to stereo, \$125/BO. J Rudisill, Audio Independence, POB 640742, San Jose CA 95164-0742. 408-321-8373.

Rane AC23 crossover, \$250; JBL 2445 horns 12" mid mounted in cabinets, excl cond, \$1400; JBL crossover, \$90. D Kocher, Digital Sound Makers, 1901 Hanover Ave, Allentown PA 18103. 215-776-1455.

Want To Buy

dbx 902 (2), 903 (4), & 905 (2), not frame, just modules. R Streicher, Pacific A/V Enter, 545 Cloverleaf Way, Monrovia CA 91016. 818-359-8012.

Roland DEP5 needed. S Russell, 60410 Klett Dr, Decatur MI 49045. 616-782-9258.

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Want To Sell

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CRL FM-3G SGC-800/SEC-800, like new, \$2500. G Leonard, KWWR, POB 475, Mexico MO 65265. 314-581-5500.

Orban Optimod 8100 A/1 with Texar Card 5 & original card 5 included, excellent condition, (2) Texar audio Prism, excellent condition, MSI CP-803 composite clipper, all equipment comp with manuals & will be sold as complete processing system for 1 price, \$6000/all. Tommy, KNFM-FM, 2911 La Force Blvd, Midland TX 79711. 512-563-5636.

Valley People 440 limiter, compressor & sibilance processor, excl cond, little use, \$300. P Russell, Baudoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Optimod 8000A (2), one works, one doesn't, \$1900/both. R Henry, WPIO, 505 Josephine St, Titusville FL 32796. 407-267-3000.

Optimod 8100A/ST studio chassis only, gd cond, \$400. D Heinen, KRSE, POB 127, Yakima WA 98907. 509-248-1390.

Orban 414A dual chnl stereo compressor/limiter, \$425/BO; Aphex 700 studio dominator multi-band audio processor, \$600/BO. D Evans, KALW, 2576 Harrison, San Francisco CA 94110. 415-695-5740.

Want To Buy

Orban 8100A1 w/XT2 chassis, MSI CP-803 composite clipper, Valley 400 mic processor, Orban 412A or equiv stereo comp/limiter. L Lindstrom, WPOK, 315 N Mill, Pontiac IL. 815-844-6101.

Gates Sta Level audio level amp, will consider other brand, up to \$50. E Lightman, WEDL, 550 Merchant St, Ambridge PA 1500C.

Volumax 4000A, UREI LA-4, needed. Tom Scher, 716-634-2545 10AM-4PM EST.

Fairchild 670 or 660 tube compressor/limiter, Teletronics LA-2A tube compressor/limiter or UREI LA-3A solid state compressor/limiter, call after 3PM CST. 214-271-7625.

MICROPHONES

Want To Sell

Shure EQs (3), \$75 ea; Shure remote sports pkg, mixer, 2 headsets & HP amp, \$350. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-778-8257.

RCA 77DX gd cond w/yoke, \$650; RCA 74B in clean gd cond, \$350. AC Elliott, Quiltman Bldg, POB 33, Quiltman MS 39355. 601-776-6197.

Electro Voice RE27ND's (2), new, still in case, \$425 ea/\$800 both. W Harris, WNPC, POB 189, Newport TX 37821. 615-623-8743.

RCA 77DX-44BX, chrome, excel cond, BO over \$800 for ea. RF Burns, RF Studios, 1326 High Meadow Dr, Garland TX 75040. 214-271-4386.

AKG C422EB in excel cond, \$1850; AKG D-140 dynamic cardioid mic, \$225/pr; HME System 82 diversity wireless mic system, complete, \$425. R Streicher, Pacific A/V Enter, 545 Cloverleaf Way, Monrovia CA 91016. 818-359-8012.

AKG C34 stereo mic w/remotes, cable, Suspensoon mount, windscreen & caring case, \$1450; (2) AKG 414B ULS matched pr, \$1600; (2) Nakamichi CM300 w/2 capsules & case, \$600. J Burke, Reels on Wheels, 2824 Sherwin, Chicago IL 60645. 312-338-1977.

Manley Labs CR3A, new, \$795 w/shockmount, windscreen & case, no risk trial in your studio. Also have used mics & everything else. Get our catalog! Liberal trade policy too. Audio Village, 619-320-0728.

Want To Buy

Shure SM-5B reasonable, EV RE-20 w/shockmount. L Lindstrom, WPOK, 315 N Mill, Pontiac IL. 815-844-6101.

Hewlett-Packard 15109, 15108, 15119 & 15118 lab reference mics, any cond. S Dansey, WCWM, Williamsburg VA 23185. 804-229-1547.

RCA 77DXs/44BXs ribbon, chrome/TV grey, gd cond, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

77-DX's, 44-BX's, WE KU-3A's On-Air lights, recording lights & audition lights. Top price paid. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131, FAX: 615-292-3434.

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MISCELLANEOUS

Want To Sell

Lil Miss Moffat 48 volt Phantom power supply, (2), \$20/each; (2) new 6' rack rails, \$20/each; other size pieces available, free with purchase, all items + shpg. B Lord, Lord Bldg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Topaz 93550 AC line regulator 50 KVA 3 phase 208Y/120, \$400; Topaz 93445-21 isolation transformer 45 KVA 3 phase 208Y/120, \$400. T Wortmann, WJAG/KEXC, 309 Braasch, Norfolk NE 68701. 402-371-0780.

Northern Technologies TCS-LAPE surge supressor, 240 V, 3 phase Delta config, 3 years old, great condition, \$700 + shpg; Magnatek 223-3212 Jefferson Electric dry transformers (2) input 240 V Delta, out 208 V WYE, \$700/ea + shpg. D Morgan, KJYE-KNZZ, 1360 E Sherwood Dr, Grand Jct CO 81501. 303-241-9230.

360 Systems AM161B, 16x16 digital patchbay w/XLR Elco breakout box, \$800. W Sarokin, Sarokin Films, 23 Rutland St, Mt Kisco NY 10549. 914-666-0233.

Time & Temperature TTA-1 PC based telephone service, 2 lines with forecast option & commercial rotation, on line now demo, like new, \$3000. B Wilson, WTND, 207 Glenburnie Dr, New Bern NC 28561. 919-514-2100 X124.

Choke 15 hy 5 kv 400 mA, not swinging, will trade an MC-60 amp & C-8 audio compensator by McIntosh, amp has bad output xfmr. Fred, 6922 Furness Ave, Oxon Hill MD 20745. 301-567-2012 (eves).

Want To Buy

Cutting lathes, Neumann, Westrex, Gramplan, tube amps, 16" tables/arms, 45/78 records. K Gutzke, Custom Recording, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

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

Radio transformers by Chicago, UTC, Triad, Peerless, Freed, Sola, send list. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

MONITORS

Want To Sell

TFT EBS rcvr, decoder & encoder, does not work, problem unknown, \$100 + shpg. K Austin, KFXI, 1101 Hwy 81N, Marlow OK 73055. 405-658-2556.

Belar FM RF amp currently tuned to 107.1, \$400/BO. R Wynne, KFLS/KKRB, 503-882-4656.

Belar FM RF amp currently tuned to 107.1, \$400/BO. R Wynne, KFLS, POB 1450, Klamath Falls OR 97601. 503-882-4656.

Want To Buy

Belar FMM-2 & FMS-2. M. O'Drobinak, 619-758-0888.

C-QUAM modulation monitor, must be in gd cond. M Mauney, KCON, POB 1406, Conway AR 72033. 501-327-6032.

FM mod & stereo monitors needed immed for new non-commercial 90.3 FM going on air in March, working/solid state only, inexpensive or donations, will pay shipping. M Sophos, WDFH, 21 Brookside Ln, Dobbs Ferry NY 10522. 914-693-3963, 4PM-midnight.

McMartin (buy & sell) any model. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886 or fax 402-493-6821.

RECEIVERS & TRANSCEIVERS

Want To Sell

Yaesu FTS-6 tone encode decode for FT 1123, 1143, 209, 727, 109, 409 radios, (2), \$20/ea; Motorola Spirit VHF tone & voice pagers w/chrg & tone rcvrs, (3), \$20/ea. P Russell, Baudoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

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| Amplifiers | Disco-Pro Sound Equip. | Stations |
| Antennas & Towers & Cables | Financial Services | Stereo Generators |
| Audio Production (Other) | Leasing | Tapes, Carts & Reels |
| Brokers | Limiters | Tax Deductable Equipment |
| Business Opportunities | Microphones | Test Equipment |
| Cart Machines | Miscellaneous | Transmitter/Exciters |
| Cassette & R-R Recorders | Monitors | Tubes |
| CD Players | Receivers & Transceivers | Turntables |
| Computers | Remote & Microwave Equip. | Positions Wanted |
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Zenith TransOceanic AM SW port tube type, wkg gd cond, \$50 + shpg. E Lightman, WEDL, 550 Merchant St, Ambridge PA 15003. 412-266-2802.

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REMOTE & MICROWAVE EQUIPMENT

Want To Sell

Marti STL 8 950 MHz xmtr & rcvr w/2-4' parabolic antennas, 250' jacketed coax w/4 connectors, \$2715; Marti M30 BT RPU xmtr & rcvr, mic & antennas, 161.7 MHz, \$1750. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-778-8257.

Marti STL-10 2 TX, 2 RX, stereo w/manuals, excl cond, \$4200. J Salov, WHGR, POB 546, Jackson MI 49204. 800-968-4636.

TFT 7610 remote cntrl has 20 chnl monitoring w/7615 status monitoring/direct cntrl units, some spare parts, \$600. E Gehringer, WKEE Radio, 134 4th Ave, Huntington WV 25701. 304-525-7788.

Harris Sentinel 16 remote cntrl w/manuals, just taken out of service, \$500. R Miller, WCNL/WTIM, Taylorville IL 62568. 217-824-3395.

COMREX RENTALS

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TFT STL units (2) rcvrs, (2) xmtrs, on pair on 450.98 & other on 450.01, both work great. Jeff, 703-297-1188.

Marti STL 8 & STL 10 type approved on 951.5 & 947.125 both in gd cond, STL10/\$2000, STL8/\$1500. J Black, KSEN, 830 Orfield Ave, Shelby MT 59474. 406-434-5241.

QEI Cat Link, needs repair, not in service, \$6000/BO. D Fielder, WVLT, 638 Landis Ave, Vineland NJ. 609-692-8888.

Moseley MRC-1600 telco boards, \$40. S Swanson, KBNL, Box 440029, Laredo TX 78044. 210-724-9211.

Marti STL-10 stereo (2) xmtrs (2) rcvrs on 950.375 & 950.625, type approved under new rules, \$3000/both. J Gallagher, WBEC, 211 Jason St, Pittsfield MA 01201. 413-499-3333.

Want To Buy

UHF Marti RPT-30 or 25 xmtr & rcvr, 2 chnl preferred but 1 chnl ok. L Lindstrom, WPOK, 315 N Mill, Pontiac IL. 815-844-6101.

TFT 8300 receiver unit. P Lotsof, KAVV, Box 18899, Tucson AZ 85731. 602-290-9797.

Harris 9161 remote control, mainframe, CEPs, electr memory modules & high speed comm modules. B Lockhart, KXXY, 101 NE 28th, Oklahoma City OK 73105. 405-528-5543.

Mark 4' grid dish. M Grubbs, NTL, POB 1047, Luling TX 78648. 210-875-2555.

SATELLITE EQUIPMENT

Want To Sell

Adcom/SA 7550 sat rcvr on Unistar AC II format ready to go, took out 12/93, stereo w/block down converter, all manuals, \$3500. J Leutz, KFSB, 2620 Dogwood Rd, Japlin MO 64801. 417-624-1310.

Drake sat rcvr, tuneable audio great for networks such as USA, PRN, Salem, etc, used w/30 day warranty, \$65. D Littleton, WAZF, POB 47, Yazoo City MS 39194. 601-746-2372.

Universal SCPC-100 audio receiver, front panel tuning, 50 channel memory, receiver C & Ku band, new, \$425 plus shpg. D Littleton, WAZF, POB 47, Yazoo City MS 39194. 601-746-2372.

Equitorial 5100 controller/receiver, \$60. T Wortmann, WJAG/KEXC, 309 Braasch, Norfolk NE 68701. 402-371-0780.

Fairchild Dart 7.5 & 15 KHz audio cards for Dart 384 receiver. Paul, 612-222-5555.

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Adcom 7550 excellent condition, Best Offer or trade. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

Scientific Atlanta 15 kHz DATS cards (2), \$750 ea or \$1500/both. S Tefft, WWSC, 217 Dix Ave, Glens Falls NY 12601. 518-793-4444.

Want To Buy

Wegener system for Unistar, need spare cards. L Lindstrom, WPOK, 315 N Mill, Pontiac IL. 815-844-6101.

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STEREO GENERATORS

Want To Sell

Moseley SCG-3T, stereo gen, gd cond, \$350. D Heinen, KRSE, POB 127, Yakima WA 98907. 509-248-1390.

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Want To Sell

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Fidelipac 300s, approx 100 40s, 70s, some usable as is, some need reloading, \$1/ea for lot. B Oostenburg, KCKY, POB 6, Coolidge AZ 85228-0006. 602-723-5448.

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TAPES/CARTS/REELS...WTS

Ampex 10 1/2" metal reels, hubs, boxes, \$1.50/ea + shpg. J Rudisill, Audio Independence, POB 640742, San Jose CA 95164-0742. 408-321-8373.

Audiopak AA-4 over 1000 avail, gd cond, music lengths, \$1.75/ea; Soundstacker II storage racks for 1000+ carts, \$.25/cart. G Jablonski, WHMI, POB 935, Howell MI 48844. 517-546-0860.

AOR prod facility deleting classic rock collection, all on 7" reels, \$300. 703-751-9346.

Ampex 407 mastering tape, 10.5" reels, 1/4" x 3600', new in box, \$10/reel, \$90/box of 10; 3M/Scotch #20 1/2" x 1000', 2.5 mil uncoated white paper on 7" reel, \$4/reel, \$3/reel/quantity. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Radio sales training tapes, 16 VHS tapes covering 30 topics, excel, \$2500. R Trumbo, KNLF, 800-397-4146.

Carts, 1500, all kinds & length, ail or part, we pay shpg, \$.50/ea. J Bacon, KTAN Radio, POB 2770, Sierra Vista AZ 85636. 602-458-4313.

TAX DEDUCTIBLE

Want To Sell

Educ/non-profit AM-FM needs lw pwr xmtrs, prod, studio equip, s/h & receipt provided. Dr Newcomb, Grand River Radio, 19130 Nelson-Parkman, Garrettsville OH 44231. 216-548-2053.

School in ME needs 1 kW amp or FM xmtr, modulation monitor or misc studio gear, will pay shpg. 207-255-4735 days; 207-255-4722 nights.

Christian mission needs studio equip, stereo gen, exciter, 175' twr, 600' 1 5/8" or 3" coax for FM, will pay shpg & PU. L Harper, Western Indian Ministries, POB F, Window Rock AZ 86515. 505-371-5587.

New non-comm has its CP, need all types of studio equip, CD & cart machines, consoles, TTs, EBS, mics, etc 501(c)3. J Wong, KOOP-FM, POB 49340, Austin TX 78765. 512-472-5667.

TEST EQUIPMENT

Want To Sell

Hitachi V1150 quad trace 150 MHz scope w/on screen counter & DVM, will display in dbR, \$1085; Sound Tech 1700B distortion measurement syst w/auto set level, \$765. Wes, 818-798-9128.

Tek spectrum analyzer 7L18 plug in freq range 1.5 - 60 GHz, also 453 Tek scope, will trade for needed equip. 207-255-4735 days; 207-255-4722 nights.

Custom transmission measuring set, L, R, L&R, L-R, preset mod levels, precision attenuators, transformer isolation. D Johnson, DC Electronics, 2815 Pleasant Valley Rd, Cogan Sta PA 17728. 717-998-3169.

Heathkit 10-4510 scope needs work, will sell cheap, 15 MHz dual trace. T Wortmann, WJAG/KEXC, 309 Braasch, Norfolk NE 68701. 402-371-0780.

Nems-Clark 102E AM FS meter, case fair, panel meters clean, \$450. AC Elliott, Quitman Bdcy, POB 33, Quitman MS 39355. 601-776-6197.

Nicolet Scientific 44A computing spectrum analyzer, \$100. B Dickerson, WEAG, 1421 S Water St, Starke FL. 904-964-5001.

HP 334A 5 Hz to 600 Hz, auto nulling, 0.1% distortion, AM detector covers 550 kHz to 65 MHz, excel cond w/manual, \$795; Bruel & Kjaer 2033 high res FFT sound & vibration analyzer, 0-20 kHz, 11 baseband ranges, amplitude of 40 dB, 80 dB & linear, excel cond w/manual, \$3995. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Potomac Instruments AT-51 audio test set, complete w/IX-51 transformers, cables, books, mint cond, \$5000. J Seaman, 301-540-2089.

Tektronix 529, mod 188D waveform monitor, multi-standard version w/PAL frame selector, excellent condition, \$525; Tektronix 520A NTSC vector scope, measures amplitude & phase of color video signal, excellent condition with manual, \$1495; Tektronix 454A portable 150 MHz dual trace oscilloscope, calibrated sweep delay, excellent condition with manual, \$495. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

HP 5245L microwave freq counter w/(2) plug-in freq converters 5253B & 5255A, other converters avail thru surplus sources, \$800. J Seaman, 301-540-2089.

Bird 3128 wattcher alarm/RF power monitor, up to 10 kW, 450 kHz to 2300 MHz, mint condition with manual, \$350. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Want To Buy

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TRANSMITTERS

Want To Sell

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1 KW AM	Gates BC-1F	5 KW FM	RCA BTF-5D
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Gates FM5H 5 kW FM transmitter on 95.9 with McMartin BFM8000 exciter, just taken off air, with transmitter harmonic filter, \$10K/pkg. R Miller, WCNL/WTIM, Taylorville IL 62568. 217-824-3395.

Energy Onix MK30 30 kW FM transmitter, 3 years old, mint condition, with exciter, on 100.1 MHz, available early '94, with spare tubes/parts, \$27500. H Kneller, WEEJ, 3151 Cooper St, Punta Gorda FL 33950. 813-639-1112.

Collins 21-E 5 kW AM tuned to 550 kHz, very good condition, still in use, \$5000 FOB Puerto Rico. A Gimenez, WPAB, Box 7243, Ponce PR 00732. 809-840-5550.

Gates Harris FM5C complete with manuals, good condition, no exciter, \$3800/BO. M Kestler, KAWZ, 241 Main Ave W, Twin Falls ID 83303. 208-733-3133.

RCA BTF-5B 5 kW FM on 92.1 MHz, removed 12/93, no exciter, \$3500/Best Offer. G Reinmeimer, WYYD, POB 4108, Lynchburg VA 24502. 804-237-4700.

RCA BTA 1R1 AM 1963 xmtr, \$2500; RCA AM mod mon, \$200. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-776-8257.

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10" reels (450), Bonneville Ultra format for production use, \$5/ea or \$2000/all. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

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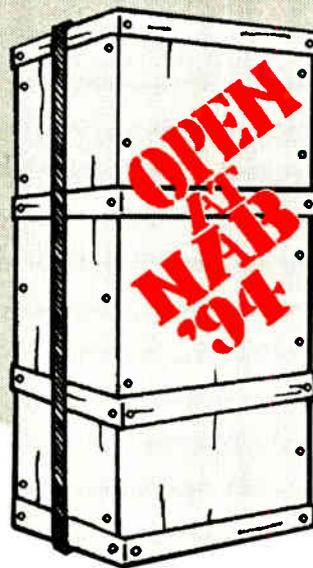
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Harris THE-1 FM exciter, like new condition, \$3000. J Gallagher, WBEC, 211 Jason St, Pittsfield MA 01201. 413-499-3333.

Full Class A FM package with mix of new & used. Harris FM-2.5H3 transmitter, 8000A Optomod, ERI antenna, coax, studio, etc. Call 816-628-5959.

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ORK-Russco TTs (3), \$40 each or all for \$100 plus shipping. L Houck, Rollin Recording, 210 Altgelt, San Antonio TX 78201. 210-736-5483.

Rek-O-Kut TT w/tonearms & stereo preamps, \$300 ea. P Bridges, KGKO, 202 E Cross, Benton AR 72015. 501-778-8257.

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Technics SP-15 (4), excellent condition, tonearm, case, manuals, isolator feet, \$350. J Rarst, KRRV, 1515 Jackson St, Alexandria LA 71301. 318-442-1410.

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Andy & Debbie Montgomery and Capt'n. Pat Adams, the morning team at KIX-106 in Memphis, Tennessee.

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"It's hectic on our morning show and we get lots of phone calls, especially Debbie. This new telephone mix minus system makes them so much easier to handle."

"There are always the three of us on the air in the morning, but it's not unusual to have 5 or 6 people in the studio and on the air at the same time ... plus the music, the commercials and the phone calls. And we still haven't begun to max out the console. It's so reliable that I don't think Doug has had to make even a minor adjustment or anything since we started using it."

If you want to find out what Doug and other users had to say about the Auditronics 800 console, call your favorite Auditronics dealer or Auditronics today.

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