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ONLINE AT WWW.BERADIO.COM

ON THE COVER: The wide world of broadcast technology comes to you in this NAB preview. Cover design by Michael J. Knust.

Broadcast Quality

Date: Wed, 02 Jun 1999 14:50:08
From: Curtis Law
To: Ike Moore
Subject: Telewave FM Dipole

Good afternoon Ike:

Just a little note and a request. Your station survived the winter with flying colors. Joe and I have been able to get to the mountain for the last week and a half, and inspected all the equipment. Your antenna and feedlines are doing fine.

Now for the request. I would like to know your point of contact at Telewave for the dipole antenna you had them make. Let me tell you something: it works in an area where other 100 watt translators can't even be heard. I've personally heard your station with about 2 mountains in the way. Nothing else is heard on FM from that location, other than yours.

Needless to say, Joe and I are impressed and we'd like to talk to Telewave about some antennas for KMXT.

Let me know...

Curt Law
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Attachment: dipole-tower.jpg

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The next step

What are you looking for at NAB? You will hear that question over and over as the show approaches, even more so when you are on the show floor. At last month's European AES convention, radio was prominent (because there really is not a dominant radio convention in Europe). Since it was held in February this year, the convention provided a glimpse of what to expect at the NAB. Walking the show floor and attending the program sessions at this year's NAB should give you some fresh ideas. Here are some of the items I expect to see in this and coming years.

Like all industries, radio continues to evolve. In some ways, radio stations function like they have since the inception of radio. The basic process includes the creation of program content, program delivery to the transmission system and transmission to the public. The ways in which stations complete the first two steps vary greatly. These three steps have typically been considered as a complete process. This is no longer the case.

The process of content creation has taken many new forms. Computer storage and automation, digital editing, the Internet, ISDN and many other technologies have changed how we gather, assemble, rearrange, reuse and sometimes share content. For the creation aspect, look for changes and improvements in audio acquisition methods (portable recorders), audio distribution from the field to the studio or studio to studio, and increased computer-networking capabilities. We have already seen a change in the way audio is distributed and mixed within a facility. These enhancements will continue to grow.

The evolution of STLs from dedicated telephone lines to microwave transmitters, back to dedicated telephone lines (T1) and back to RF transmitters (like wireless T1) opens the door to other new possibilities. Changes to this aspect of radio will likely be more subtle.

The basic RF transmission facilities have not really changed in function, just in form and efficiency. This is the area undergoing its biggest change. In the U.S., IBOC continues to its progress toward becoming a reality. In Canada, Eureka DAB ensembles are on the air already. The next big step for RF transmission will be the S-DARS services.

According to its most basic definition, radio is delivery of audio content to a listening audience. This will never change. We have already seen the introduction of a new audio transmitter: the streaming audio encoder. If you have walked into the Sand Expo Center over the past few years, you know it is almost a completely different world. Some interesting new ideas are shown in this area of the convention. The ideas will certainly come into use for radio, some sooner than others.

Internet audio streaming can still work on the same broadcast ideas as conventional transmissions. The biggest difference is that there is no coverage contour to consider; the entire world is your listener. It will, however, take some time for Internet radio to replace conventional radio. The biggest obstacle is the simplicity of a dedicated listening appliance. Pressing the power button and having instantaneous audio is just not yet possible with a PC. Software-based radios do have the advantage of being upgraded with minimal effort. A new player or algorithm can be downloaded and ready to go in moments.

As you start planning your visit to the last NAB of the millennium (sorry, I'm sticking to my guns on this one) you should keep a firm grasp on the realities of radio. You should not, however, be afraid to loosen your grip a little as you go around the next corner.

Chriss Scherer, editor
chriss_scherer@intertec.com

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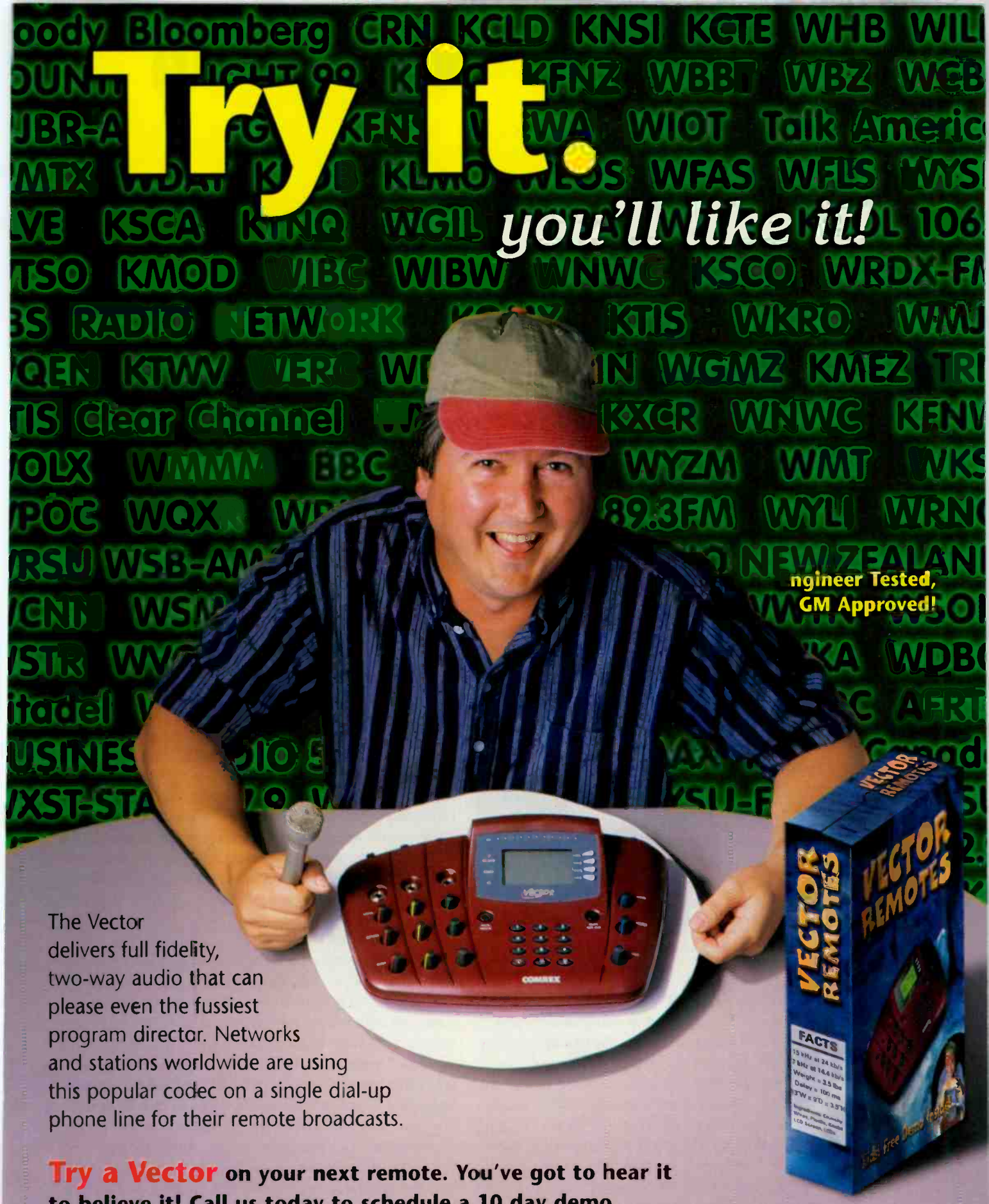

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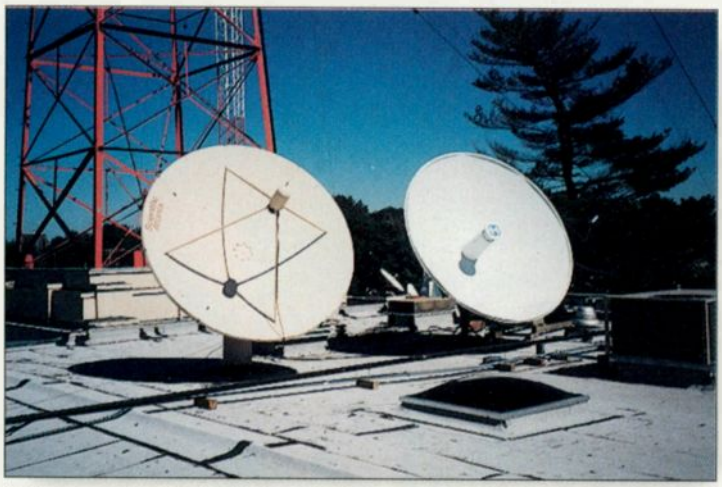
Spring checkup (part 2, transmitter site and outdoors)

By Kirk Harnack

Transmitter sites and outdoor equipment tend to be ignored during the winter. Warmer weather may not come along every day this month, but when it does, take advantage of it by maintaining your transmitter and outdoor equipment. Proper transmitter-site maintenance requires time and effort. Arrange the site in such a way that your visit is as productive and enjoyable as possible.

Getting ready

Making a list of items to bring to and retrieve from the site is worthwhile. My list includes rodent traps, trash can liners, wasp spray, paper towels and fresh air filters. Add a broom and dustpan to your list if your transmitter site is not already equipped with them. I also gather the items I have collected for my next trip. These include parts ordered since the last trip, legal postings and reminders of maintenance items. A few minutes of preparation will make the maintenance trip more productive and prevent return trips.



Antennas and satellite dishes should be checked for ice damage and any effects from the extreme cold.

Preventive maintenance should be a regular part of any transmitter visit. What exactly is preventive maintenance? Some engineers regard it as simply logging transmitter parameters and checking modulation levels, but beneficial preventive maintenance involves a bit more. The first element in such maintenance is a thorough inspection. A pilot's preflight inspection comprises walking around the aircraft and visually checking important systems and functions. Similarly, walking through the transmitter site and around the building perimeter and tower(s) usually will reveal (or remind you of) needed maintenance items.

When checking transmitter readings, it is wise to check and log all available readings. A simple grid form can be devised to log all possible readings. This form can be kept on a clipboard at the site. Completing this form takes only a few minutes, yet it can make subtle changes in transmitter operation much more apparent. The same form may also contain other critical readings at the site, such as STL signal strength, nitrogen tank and line pressure, building and exhaust temperature, and other system-status indications. Figure 1 shows part of a form for a typical site.

A second useful form comprises a checklist of items to inspect, similar to the pilot's preflight checklist. Try to think of everything in and around the site that could hamper safe and legal operations if it were not up to par. Several brainstorming sessions may be necessary to finalize this checklist. A typical form might include the following: Note condition of fences, guy anchor points, fence gates, locks, alarm system, air handler motors and belts, air-conditioner filters and belts, generator fuel, and generator battery. Note the presence of FCC tower registration signs, RF warning signs, station licenses and other required signs and documentation.

Vacuuming, sweeping and changing air filters are as much a part of preventive maintenance as inspecting the transmitter. Ten minutes spent creating a cleaner environment for your air-hungry transmitter will pay off in the long run.

Generator maintenance

More stations are equipped with backup power generators now due to Y2K preparedness efforts. Generator sets (gensets) require their own set of preventive maintenance procedures. As with transmitter site maintenance, making a checklist to direct and record your inspection is especially useful. In addition to those procedures indicated in the genset's manual, the following are items worth inspecting: Open any enclosure doors to check for pests and their nests, then clean out infestations; set out poison or repellants to keep pests down; check the age and condition of the battery, leads and charging circuit; exercise the generator weekly and test under load monthly; make basic engine checks of oil, coolant and fuel.

Diesel gensets require the following additional inspections: Check for good fuel monthly and use fuel additives as recommended by the manufacturer or local fuel

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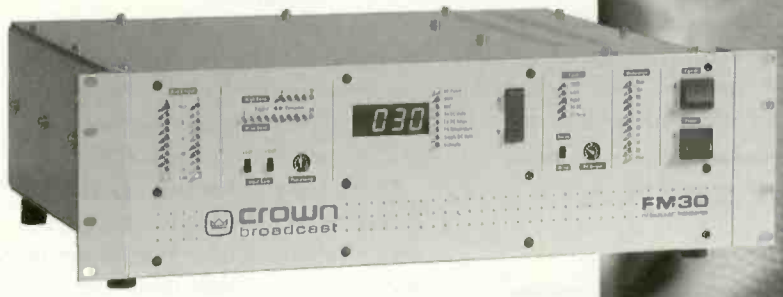

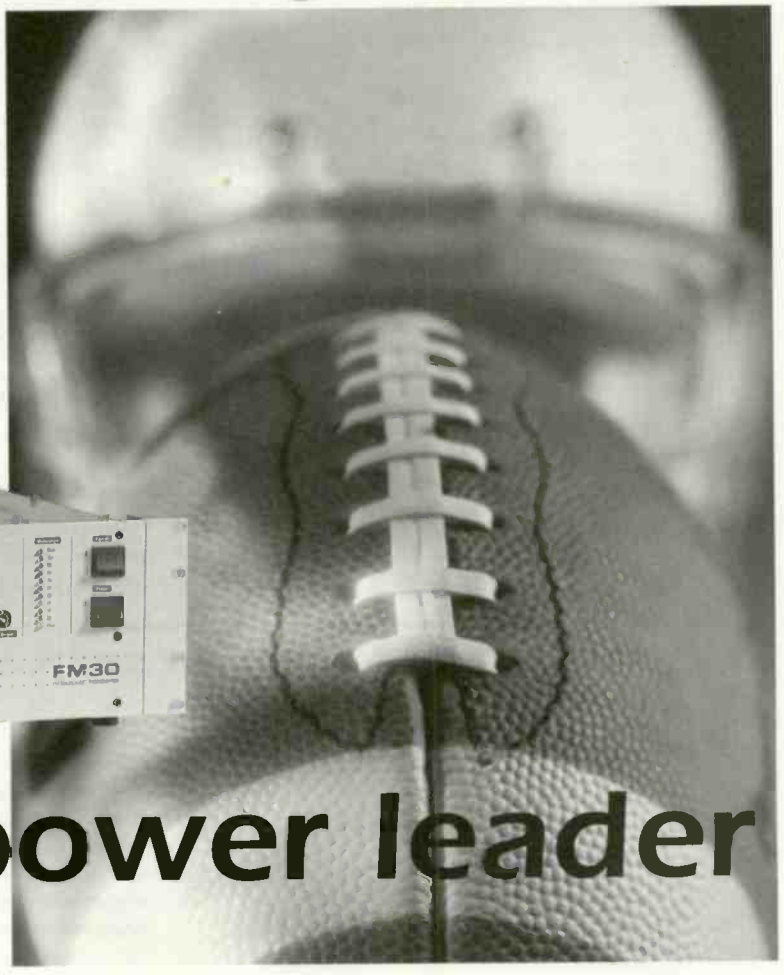

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supplier; check for proper operation from the "day tank" or other small pump-fitted holding tank; check for good operation from engine heaters or oil warmers; run the genset at 60 percent or more of rated load at least monthly for continued good engine operation; check and change fuel filters at least as often as recommended.

Winter weather — especially ice — can damage outdoor equipment. Although it may take a tower crew to inspect a station's transmitting and STL antennas, there are likely other antennas and outdoor items worth looking at yourself.

Many stations' studio buildings bristle with a variety of auxiliary antennas. These antennas range from police-scanner antennas to AM and FM receiving antennas. Many fall in the "consumer" category of construction and quality. Hence, a long and carefree life of service is doubtful. It is often not worth the time to repair or refurbish consumer-grade antennas. You should install new ones where necessary along with new baluns and coax connectors. After receiving antennas are repaired or replaced, the news department may stop having signal problems. It may also be surprised to hear more emergency radio calls and to no longer have signal problems in the control rooms.

Date	10/11/99	10/30/99	11/14/99	12/02/99
Transmitter				
AC Phase A (V)	208	209	209	208
AC Phase B (V)	206	206	207	206
AC Phase C (V)	210	211	211	210
Blower	OK	OK	OK	Some noise
IPA Fil E (V)	6.2	6.2	6.2	6.1
PA Fil E (V)	6.8	6.8	6.8	6.9
IPA G1 E (V)	70	70	71	71
IPA G1 I (mA)	18	18	18	18
IPA Ip (mA)	140	142	142	142
IPA Ep (V)	1160	1170	1170	1160
PA G1 E (V)	110	110	112	110
PA G1 I (mA)	150	150	155	150
PA G2 E (V)	710	715	715	710
PA G2 I (mA)	180	180	185	180
PA Plate E (V)	3800	3850	3850	3800
PA Plate I (A)	1.10	1.12	1.12	1.10
Forward Pwr (%)	97	100	100	96
Reflected Pwr (:1)	1.08	1.08	1.06	1.08
Check Tuning	✓	✓	✓	✓
AM Noise (dB)	-54	-53	-53	-53
Remote Control				
Check Calibration	✓	✓	✓	✓
Check Time/Date	✓	✓	✓	✓
STL Receiver				
Signal Strength (mv)	380	390	380	350

Each transmitter visit should include a complete set of transmitter readings.

Coax checkup

Satellite-dish antennas need springtime care, too. Check first for signs of *frost heave* at the base of dish installations. Next, look for damage from ice expansion in feedhorn supports and other tubular members. A careful examination of the LNA or LNB cable is worthwhile as well. Water ingress here can cause intermittent problems or knock the whole system out.

Coax cables fitted with grounding straps should also be checked. Water can invade at the ground-strap installation and travel inside the outer jacket if everything is not properly sealed.

Check coax grounding attachments wherever possible at the transmitter site. Winter may have been harsh on these outdoor connections and, you will need them during the upcoming lightning storm season.

Springtime preventive maintenance at the transmitter site also includes a review of the overall grounding scheme. Check for tight connections to the tower, ground rods, common-point ground system and equipment. These connections should be mechanically secure and unyielding to movement or vibration.

Before it gets hot

Think about the maintenance chores coming up in the next few months. If any involve dealing with hot rooftops or attic crawl spaces, you may want to do those sooner rather than later. Pulling cables through a 130-degree attic in July is a chore I try to avoid by doing it now — when it's only 100 degrees.

Kirk Harnack, BE Radio's consultant on contract engineering, is president of Harnack Enginering, Cleveland, MS.

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Attracting new engineering talent

By John Caracciolo

In a recent survey released by *The Wall Street Journal*, unemployment is at an all-time low. This means American businesses need help finding qualified people. In a recent career section of a local paper that polled human resource executives, most of the executives commented that quality workers were a scarce commodity. This condition in American business is having a catastrophic effect on radio engineering.

Other industries are drawing existing and potential technical talent away from broadcasting.

The industry as a whole is suffering from a scant supply of quality, full-time engineering help. Look at the help-wanted section of any trade publication; there are always numerous positions available for qualified engineers.

We are to blame. We have not created a career path for radio engineering. We have no accredited university courses, no training ground and no fundamental plan for the future of radio engineering.

Consolidation brought many positives to the industry as a whole. However, one major negative was that it exposed the lack of engineering talent in the radio industry. When consolidation hit, competent quality engineers were brought into the larger groups and offered jobs with great pay and benefits, but with longer hours and a huge increase in responsibility. Instead of just one or two stations, in some situations, their responsibilities tripled overnight. The engineers that were left out moved into other industries like computers, the Internet, PCS or cellular. Here, they were offered jobs with nine-to-five hours and no pagers. Our radio engineering talent was depleted.

Where does the problem start? It starts with us. If you ask 10 general managers to write a job description for a chief engineer, you will get 10 different answers. The radio engineer's role has changed so dramatically in the last few years that we have single-handedly driven young, fresh talent away from this industry.

Time to step in

We need to reenergize the engineering industry. We need to get young minds and fresh faces into the field and make them want to stay in it. However, this takes training and the ability to work with someone who is young and inexperienced. There is a tradeoff, though. You might not get all of the experience you are looking for, but you will get someone that is eager and energetic. You will get someone who is willing to give 110 percent and go the extra mile.

So, where do we find this person? It could be a college radio station or a high school audiovisual club. Remember, this is still the entertainment business, and some do consider it a very sexy field. Let's start with a job description that does not ask for the world and pays a little more than minimum wage.

The job description should read something like this:

Wanted: fresh dynamic individual to work in the field of radio engineering. Entry-level position for the right candidate. Applicant must be willing to give 110 percent, go the extra mile, be a solid communicator and have a high desire to learn the inner workings of a radio station. The applicant must possess technical skills and act as a team with the promotional, programming and sales departments of the station. Only candidates who desire a career and are willing to make an investment in their future should apply.

The right stuff

The implementation of a maintenance program and the ability to develop and grow with the station are two essential components any applicant should possess. These are qualities best taught to someone who is just starting in the field. An entry-level position at a small station or a college station provides a wonderful opportunity for the eager young engineer that wants to pursue a career in

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electronics, not just radio. Computers, PCS and cellular all require trouble-shooting and signal-tracing skills that need to be practiced. There is no better place to learn than at the small station or the educational broadcaster.

In 1984, I started my engineering career as an assistant engineer at WLIR. I was given the ability to learn new skills, but most of my day was spent in a fast-paced environment that left little time to learning. In 1985, I took a position with Hofstra University as the chief engineer of WRHU. Who was I kidding? I was certainly not qualified for this position. I was okay when I was with another engineer, but on my own, I was a little rusty. WRHU gave me the opportunity to develop my skills and work in an environment that nurtured growth. The university maintained a consulting relationship with the former CE of WRHU during most of my tenure. This individual was a valuable asset to me and the school throughout the years. He would coach me, develop my talents, and serve as an advisor to the constantly changing technical world that I was growing up in.

On major projects or large growth planning, the consultant would come in for the day to offer his expertise and oversee the planning and blueprint stage. I would work at my own pace following the plans, and he would always be just a telephone call away. As the years passed, the telephone calls became few and far between.

The demand for skilled technical people is increasing every day. Just look at the want ads of your local paper — MIS, cellular, cable and PCS companies are all looking for qualified and entry-level technical people. We are not just competing with other radio companies for these individuals; we are competing with other businesses that offer lucrative employment packages. We must create a desirable environment for young, energetic and technical people to enter into this field. It is up to us.

John Caracciolo is vice president and general manager of Jarad Broadcasting Company, Garden City, NY.

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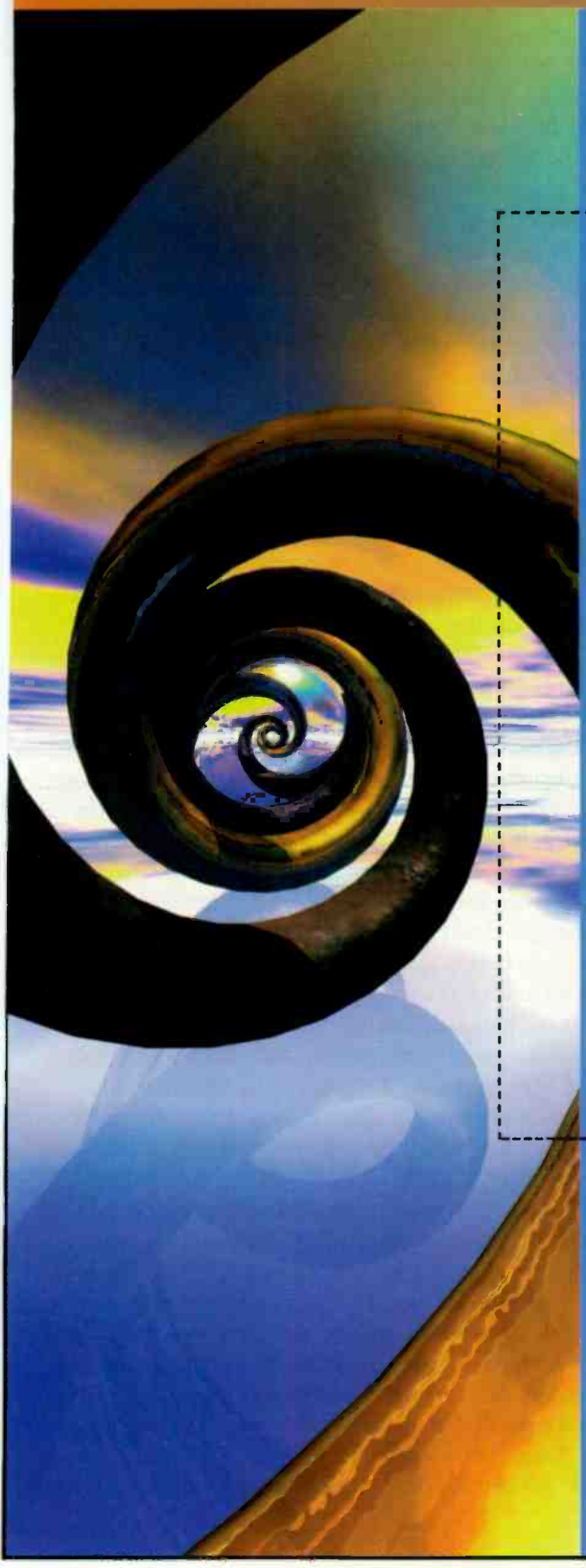

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Leaders Look to BE

Lightning protection

By John Battison, P.E., technical editor, RF

Lightning protection continues to be a year-round challenge for broadcast engineers. RF engineers are concerned about the effect of heavy discharges in the area of their transmitting equipment as well as the associated audio equipment that is part of the overall transmitter installation.

The audio engineer's concerns involve the studio equipment, and its associated lines to the transmitter, as well as its effects on telephone installations. For the audio engineer, lightning problems probably stem from spikes, surges and pulses carried into the studio by power and telephone lines, rather than from direct lightning hits.

The damage caused by lightning strikes is unpredictable.

Grounding the FM site

The FM transmitter engineer views lightning differently from his AM counterpart. He may have fewer towers to worry about and perhaps fewer instruments to protect, but his "lightning rod" (and protection) is often more poorly grounded than his AM colleague's site.

At the typical FM site, there is a tower with a side-mounted FM antenna near the top. At the base of this lightning conductor is a concrete block buried in the earth to support the tower. Often, there is a piece of #4 gauge wire connecting the tower to a ground. Sometimes, the connection is to only one tower leg. The thin wire and the grounding rod are supposed to conduct kilovolts to ground when lightning strikes.

When a strike occurs, the wire is often vaporized. If it does remain intact, its relatively high impedance produced by the very short rise time of the lightning strike diverts the energy to other paths (e.g., coaxial cables and power lines on the tower). These undesired paths lead to transmitters and other associated equipment. Once in the equipment, lightning runs wild, burning and melting everything between it and ground.

I advocate at least one ground rod per tower leg and a miniature, AM-like ground system around the tower base for FM or TV transmitter installations. Anything that will allow the hundreds of amps to get directly to ground will reduce the risk of expensive equipment damage.

When a tower is struck, voltages are induced into everything on and adjacent to the tower, resulting in damage to items on the tower as well as in the transmitter building. If these devices are not efficiently grounded to the tower, a difference in voltage potential between the device and the tower will exist. Once inside a transmitter, lightning will take any convenient path to ground.

Don't get struck

We cannot do much to prevent lightning strikes. However, we can reduce the likelihood of being struck. For years, aircraft have used *static wicks*. We have all seen the short wires protruding from the rear of aircraft wing surfaces. Their purpose is to drain away the charges accumulated on the aircraft's body as it passes through the air. Because these wires are much smaller than the aircraft, the potential gradient causes the voltage to be higher on them. Basically, they stream away the accumulated charges. A similar system has been developed by several manufacturers for radio-tower use.

Each system is slightly different, but all work on the principle of dissipating the charges induced in a tower by lightning clouds in the vicinity. A lightning strike is produced when the voltage between a grounded tower and a charged cloud exceeds the breakdown voltage of the dielectric between them. Providing many points at the top of a tower has several effects: The induced ground voltage is continuously dissipated or streamed away, the potential difference between cloud and tower is reduced, and there is no dielectric breakdown, or lightning strike.

One type of system resembles barbed wire, with many spikes pointing upward. Another consists of individual, sharp rods attached to the topmost parts of the tower. All the systems work on more or less the same principle and, in general, they all work well. These systems are particularly effective in areas with blowing sand or dust that can charge an insulated tower. The lightning rods often seen on top of many towers serve the same purpose and help protect the beacons, which are natural lightning targets.

One problem can occur on the ground near a lightning strike that goes directly to ground. As the current passes through the ground material away from the strike point, a voltage gradient develops (see Figure 1).

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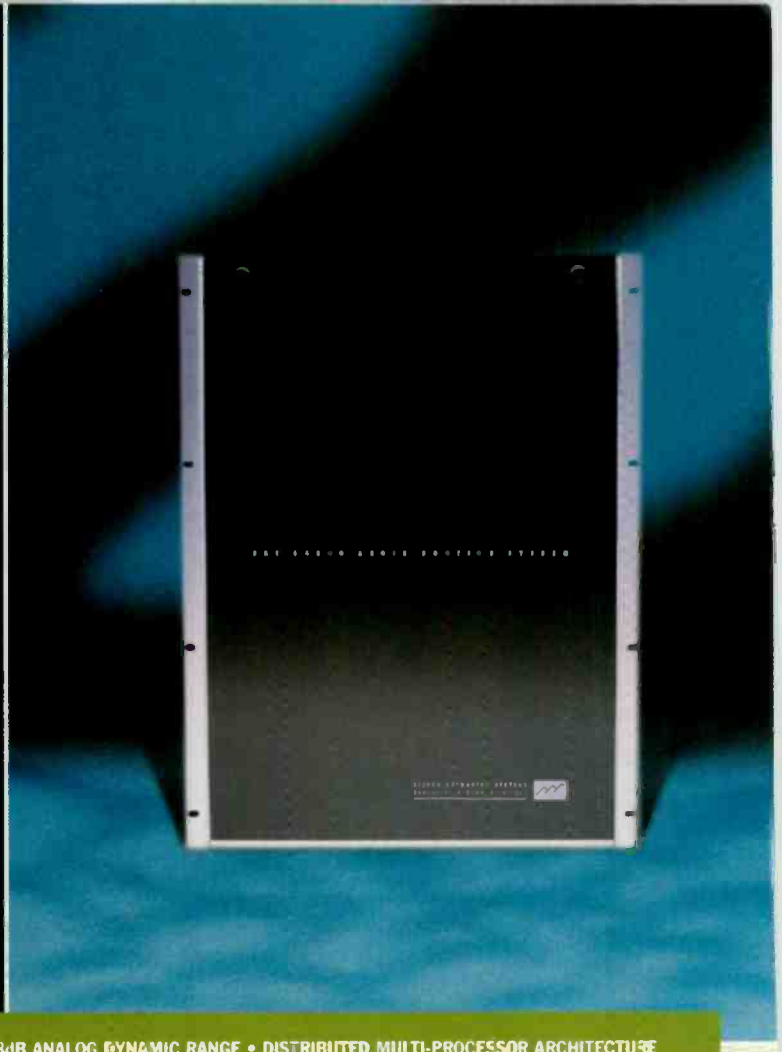

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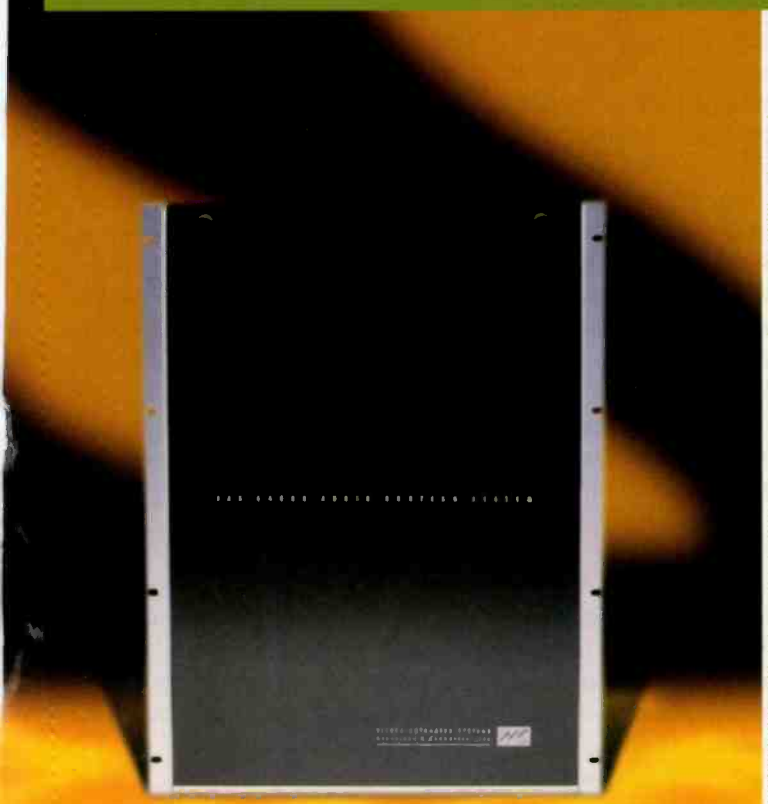

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RF Engineering

The ground is shown as a resistance commencing at the strike point and superimposed on the ground surface. A voltage V will develop between any two points on the ground near the strike. Its strength will depend on the resistance of the soil, the distance between the points, the resistance's rate of change per foot and the current running through it.

An object of any appreciable size close to the tower base will develop a voltage across it that will depend on the spacing between its edges. For instance, a small building with separate ground connections at each side could conceivably have a potential difference develop across its base. If different grounding points were used for the equipment inside, damaging voltages could occur on this equipment, despite being grounded. This effect may explain why apparently disassociated equipment in a building at the base of a tower is sometimes damaged, although it is grounded.

Precautions for AM sites

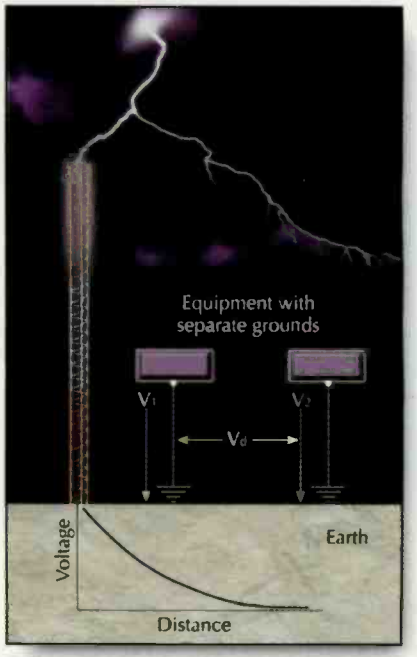
The AM transmitter site is already well-protected by the excellent ground system that the FCC requires. In general, the area around a tall tower is protected to a distance that is about the same as the tower height. Therefore, buildings shorter than the tower are protected from strikes. However, a hit on the tower can still affect the equipment inside these buildings.

Hits on a series-fed tower can be more damaging than on a shunt-fed tower (i.e., folded dipole) if adequate precautions have not been taken. The most ignored safety device is probably the ball gap at the base of the tower.

Often over the years, various "engineers" have adjusted the ball gap position so that it no longer offers any protection. The intent of the gap is that, if a strike causes a flashover between the balls, a "Jacob's Ladder" arc will occur, which then moves up the increasing distance between the balls until the RF arc is extinguished.

Quite obviously, balls mounted one above the other, as I have often found them, will not work properly. Spacing should be set so that, with correct modulation, they do not arc and then set so that they trip at just over 150-percent modulation. This value often depends on individual preference. Some transmitters have a sensing circuit to extinguish sustained RF arcs.

The standard static-drain RF choke can be replaced by a resistor of comparable reactance in ohms should the RF choke fail. In general, the low DC resistance RF choke is preferable to a straight resistor.



Different ground points can result in a voltage differential between devices. The differential will cause equipment damage.

In dry, windy areas that are dusty or sandy, guy-wire sections and towers can acquire static charges. These charges can jump the inline guy insulators, producing a loud discharge that can be heard on the ground as well as in the air signal. Sometimes, high-value resistors are placed across the higher insulators to discharge the guys. Be aware that this tactic could change the antenna resistance slightly.

The extensive use of 4-inch copper strap for all ground connections is usually effective in maintaining constant ground potentials among equipment. All equipment should be grounded to the common transmitter/antenna ground.

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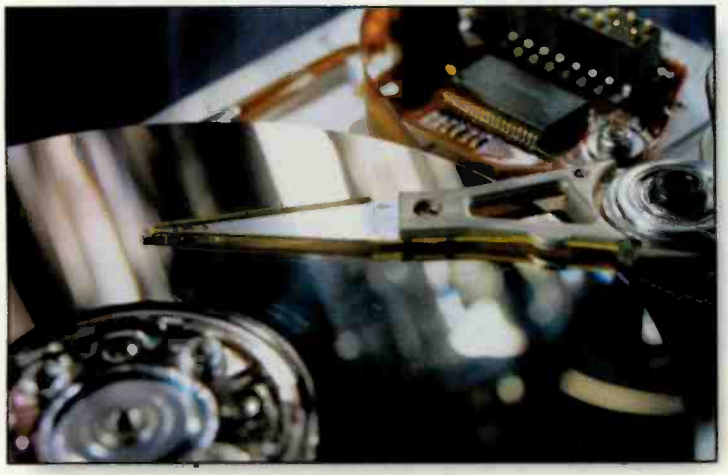
Computer tune-up

By Kevin McNamara, CNE

Spring is almost upon us. This is a good time to focus on general preventive maintenance on the PCs in your facility as well as establishing and verifying your maintenance documentation procedures. In general, I view the maintenance of PC equipment, including network servers, in four categories: physical, disk drive, network and software.



Hard drives require little physical maintenance.

Maintenance log

If you have not started a maintenance log, you should. A good maintenance log includes, at a minimum, the following information:

- Date the system was put into service, purchase location, purchase price and warranty information
- Make, model and size (if applicable) of installed components (i.e., CPU, RAM, modem, network interface card, drives and video card)
- Specific component information, such as drive size, card settings and installed location
- Installed software, including software license numbers.

You should also maintain a file containing the original manuals and driver disks for each machine in current service as well as any software licenses. If you are operating software under a bulk license agreement, a separate folder should be created that includes those license agreements as well as a current listing of computers operating the software.

I have seen several methods for keeping maintenance information on PCs and PC networks, ranging from notes written in a book to information entered into a sophisticated database. Make sure the necessary information is easy to find, regardless of the method chosen.

Physical maintenance

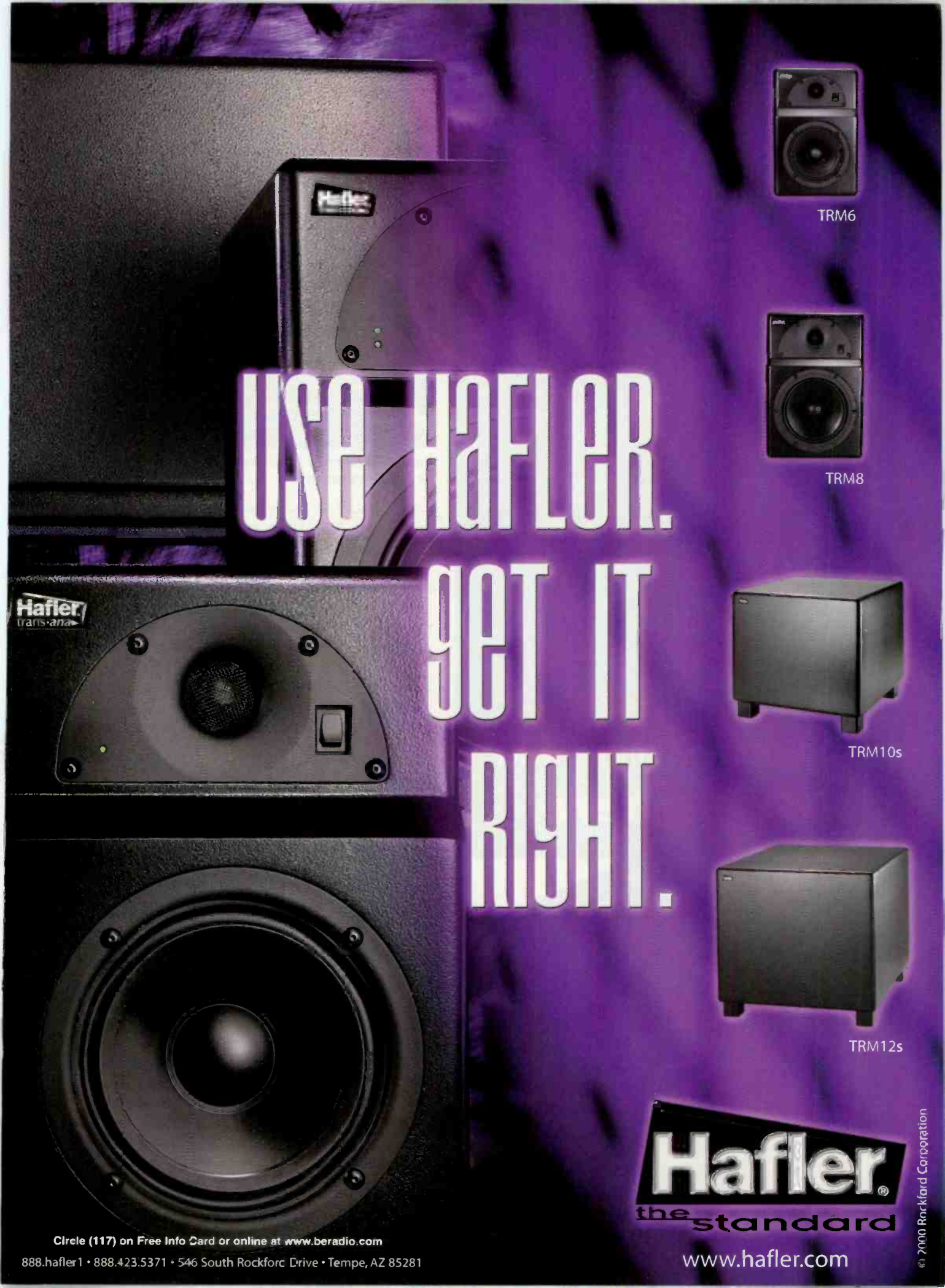
Physical location will dictate the amount of physical maintenance needed for your PCs and your network equipment. Generally speaking, any PCs located in less than desirable locations should be unplugged, taken out of service and cleaned thoroughly using compressed, dry air. Pay particular attention to the cooling fins on the CPU and the power supply. Also, make sure all of the fans are operating and cabinet vents are clear of debris. Open the monitor (after you unplug it) and clean the inside of it with the dry air, since monitors attract a lot of dust. Dust buildup will shorten the life of any PC and may pose a significant fire hazard.

Before you put the cabinet cover back on, remove each plug-in card and reinsert it. Do the same for the connectors on each end of the ribbon cables connecting the drives. This also is a good time to get model information from the various components that can be entered into your maintenance records. Finally, make sure the connectors attaching the monitors, printers and other devices are securely attached using the thumbscrews.

Disk drives

Although they are sealed units, hard-disk drives can be damaged over time from the physical contact of the magnetic pickup touching the disk media. In a perfect world, the disk drive tends to write sequentially as data is written and erased on that disk. However, contiguous space to write new files becomes unavailable and the disk writes the data files in nonsequential locations. This is called *fragmentation* and, if allowed to become excessive, it will reduce the performance of the computer — or worse, lose portions of a file that may render your program or data unusable.

Back up data files daily on each server and move the backup media to an off-premise site. If you use a T1 link to your transmitter or other studio location, consider splitting the excess capacity to back up data to an off-site computer.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Network

Once configured properly, most network problems are related to faulty cabling or a faulty network interface card. Cable installation contractors can provide data sweeps of e ach cable run. If you don't have this information, it is worth obtaining a cable sweeper to get it. This information will be valuable in repairing cable-related network problems. Re-check cable sweeps each year against the originals.

Common cable-related network problems are due to physical wear on cables and connectors.

Look at each of the network cables connected to the wall jack or hub. These exposed cables are subject to marring and kinking, which will affect network performance. A common network cabling problem arises when additional cabling is installed to accommodate new demands. The original cable may not be rated to support the higher performance requirements and thus may cause a general reduction in overall system performance.

Check patch panel cords for wear and kinks and unplug and replug each point, especially those that don't get used often. Check the tension of tie wraps used to bundle twisted-pair cabling; too much tension can kink the cable and cause problems.

Software

Software piracy can be costly and cause a career-altering event in the life of those found guilty of it. Maintaining a proper inventory of all software should be a priority. Unlicensed software should be removed and reported in writing to the appropriate manager. Be especially careful that licenses cover any software upgrades that have been made.

In my opinion, all software should reside exclusively on the network server. This makes the upgrade and licensing procedures easier on the network administrator. Make sure your company has a written policy in place to address software brought from employees' homes and downloaded files from the Internet.

A virus-scanning program should be added to every PC and network server in your facility, particularly if you have any external connections to the Internet. Antivirus programs should be updated every two to three days.

Even if your computer equipment is under a maintenance agreement, taking these simple steps will save you a great deal of aggravation down the road.

Kevin McNamara, BE Radio's consultant on computer technology, is president of Applied Wireless, New Market, MD.

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New EEO rules adopted

By Harry Martin

In April, the following new EEO recruitment and record-keeping requirements will become law. The new rules provide broadcasters with two options, A and B, to meet their basic recruitment obligations. On or about June 1 an election between these two options must be made and reported to the FCC.

Recruitment Option A

Option A stipulates that employers must send notices of full-time openings to qualifying organizations that request such notices; and also undertake two (for employment units with five to 10 full-time employees) or four (for larger employment units) longer-term recruitment initiatives within a two-year period.

Specific examples of these initiatives include: participation in at least four job fairs by station personnel who have substantial responsibility in hiring decisions, hosting a job fair, co-sponsoring job fairs with women's and minority groups in the business and professional community, participation in scholarship programs directed to students pursuing a career in broadcasting, or sponsorship of at least two community events designed to inform the public of broadcast employment opportunities.

Records of the employer's efforts must also be kept by collecting, but not routinely submitting to the Commission, listings of all full-time jobs filled, identified by job title; a list of the recruitment sources (including the address, contact person and telephone number) used to fill each vacancy (including any organizations which requested notification); dated copies of all advertisements, letters, e-mails, faxes, etc. used to fill each vacancy; the documentation necessary to demonstrate performance of supplemental outreach initiatives, e.g., job fairs, mentoring programs; records indicating the total number of interviewers for each vacancy and the referral source for each interviewee; and the date each job was filled and the source that referred the hiree.

Annually, a report that includes the following information must be placed in the station public file: all full-time jobs filled during the previous year; recruitment sources used to fill those vacancies; the address, contact person and telephone number of each recruitment source; the recruitment source for each hiree; the recruitment source for each interviewee; and a description of any supplemental initiatives implemented during the previous year.

Recruitment Option B

Employers may design their own broad and inclusive outreach program and demonstrate that the station is widely disseminating information concerning job vacancies by analyzing the recruitment sources, race, ethnicity and gender of the applicants attracted by its recruitment efforts.

The employers' recordkeeping responsibilities are similar to Option A. The employer must collect, but not routinely submit to the Commission, listings of all full-time jobs filed, identified by job title; identify the recruitment sources used to fill each vacancy; obtain the address, contact person and telephone number of each recruitment source used to fill each position; retain dated copies of all advertisements, letters, e-mails, faxes, etc. used to fill each vacancy; and retain data reflecting the recruitment source, gender, and racial/ethnic origins of applicants for each full-time job filled.

The public file requirement also is similar to Option A in that an employer must annually place a report containing all a list of all full-time jobs filled during the previous year, a list of the recruitment sources used to fill those vacancies, including the address, contact person and telephone number of each recruitment source; and the race, gender and national original for each applicant.

Reporting requirements

In addition to the new public file requirements stated for Option A and Option B above, broadcasters must file a Statement of Compliance (Form 397) every second, fourth and sixth year of the license term, on the anniversary of the date the station is due to file its renewal, stating whether the station has complied with the EEO Rule. A copy of their latest Form 397 must be kept in the public inspection file.

By September 30 of each year, broadcasters also will be required to file and place in their public files, a Form 395-B ("Broadcast Station Annual Employment Report"). These reports will not be used in evaluating EEO performance; rather, the FCC plans to use them to track overall industry performance under the new EEO Rule.

At renewal time, stations must file a modified Form 396 ("Broadcast Equal Employment Opportunity Program") and submit their station's EEO public inspection file for the year prior to filing the renewal. Such public file materials also must be submitted midway through the license term by stations with 10 or more full-time employees.

Harry Martin is an attorney with Fletcher, Heald & Hildreth, PLC., Arlington, VA. E-mail martin@fhh-telcomlaw.com.

Dateline

The next deadline for the filing of biennial ownership reports will be February 1, 2001. The first annual ownership report will be due September 30, and annual regulatory fees will again be due in mid-September.

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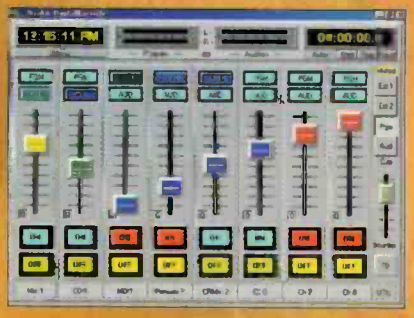

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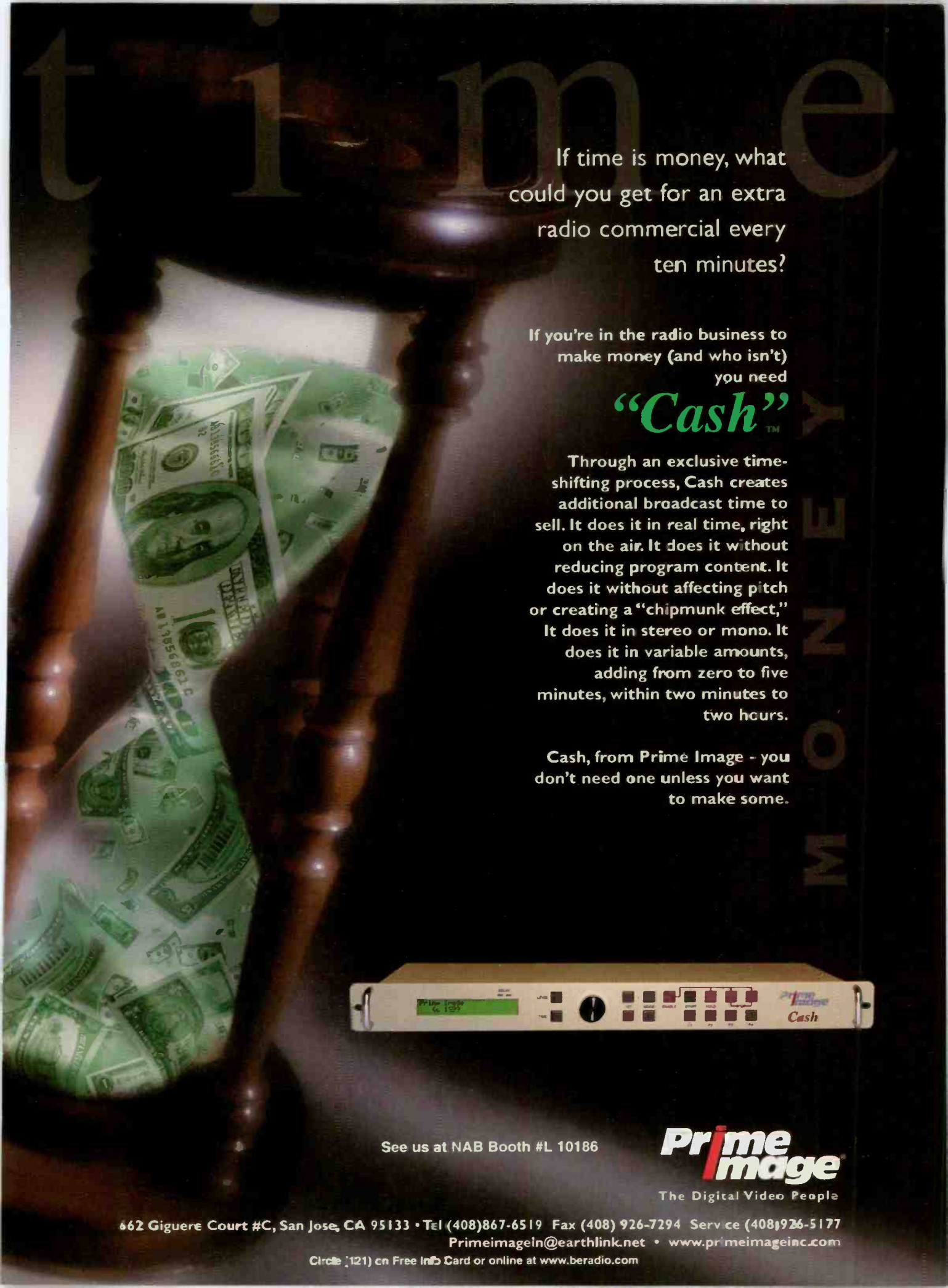
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Sonifex Ltd
Booth R2296

◀ **RB-MM1:** Ideal for consoles that do not provide a mix-minus output. Has inputs for a main stereo program feed from the console and a mono output back to the mixer, with mono XLR connections to and from the telephone hybrid. The level for all of the XLR inputs and outputs can be adjusted.

207-773-2424; fax 207-773-2422; www.sonifex.co.uk; sales@sonifex.co.uk
Circle (280) on Free Info Card

Audio card accessories
Ward-Beck
Booth R3763

▶ **8200 Series Additions:** Has four new additions to the card frame platform. All four new cards operate from 22kHz to 96kHz sampling rates and offer 20- or 24-bit resolution. The D8205 (shown above) is an adjustable-gain distribution amplifier with built-in sample rate converter. The D8206 is a digital audio reference signal generator able to produce continuously variable signals from 20Hz to 20kHz from digital silence to 0dBfs. A sample rate converter, the D8207 can convert a maximum ratio of 1:3 or 3:1. The D8208 is a dual-channel audio-processing amplifier for level matching of two AES audio signals. The two channels can also be mixed.

800-771-2556; fax 416-335-5202; www.wbsltd.com; wbsltd@istar.ca
Circle (265) on Free Info Card

FM antenna
Propagation Systems
Booths L9086, R1495

▼ **FHR Series:** Employs a rototiller design. Intended for high-power FM applications, it features a series-fed design with an internal feed point. Accepts power levels up to 60kW and can be used for multistation applications. Can be ordered with pattern optimization or directionalization.

814-472-5540; fax 814-472-5676
www.angelfire.com/biz/psinc
psiba@surfshop.net
Circle (269) on Free Info Card

TALK DIGITAL TO ME

The advantages of ISDN are clear: Faster set-up, intelligent call handling and the superior performance of digital audio. And now Telos Systems brings the benefits of ISDN to the talk show environment.

The TWOx12 digital talk show system plugs right into ISDN BRI phone lines. Your callers sound louder and cleaner with the isolation performance that only a true four-wire system can deliver. And if you don't have ISDN in your studio yet, the TWOx12 lets you start with POTS and upgrade to ISDN whenever you're ready.

Call management is so fast and easy with our new Desktop Director, a fully integrated telephone and switch console. Intuitive operation is enhanced by the exclusive Status Symbols,™ graphical icons that convey line and caller status at a glance.

Finally, a breakthrough in telephone technology. Up to 12 callers can be routed to the two all-digital hybrids. Self-contained, easy-to-install and maintain, the new TWOx12 simplifies even the most complex talk shows.

Ready to talk digital? For more information or to get in touch with your Telos Systems dealer, contact us or visit our web site.

Telos SYSTEMS

TELOS SYSTEMS 2101 SUPERIOR AVENUE CLEVELAND, OH 44114 USA
TEL: +1 (216) 241-7225 FAX: +1 (216) 241-4103
E-MAIL: info@telos-systems.com www.telos-systems.com

TELOS SYSTEMS EUROPE
JOHANNISSTRABE 6 D-85354 FREISING GERMANY
TEL: +49 81 61 42 467 FAX: +49 81 61 42 402
E-MAIL: europe@telos-systems.com www.telos-systems.com

NABExtra!

CAT-5 network accessory
Gefen
Booth L7038

Ex•tend•it CAT 5-2000 extender: Extends any keyboard, video and mouse combination up to 300 feet using standard CAT-5 cables, to provide a quiet and clutter-free environment. Can be used to extend computers with noisy components. The units extend USB, VGA, ADB and PS/2 connections.

800-545-6900; fax 818-884-3108
www.gefen.com; gsinfo@gefen.com
Circle (254) on Free Info Card

Eight-channel mic pre-amp/mixer
Audio Toys
Booth R3496

8MX2: Combines eight microphone preamplifiers into a 1RU mixer package. Up to six units can be linked together for multiple unit connection of the cue and mix buses. Includes a built-in limiter.

800-642-3063; fax 415-381-5025
www.audiotoys.com; sales@audiotoys.com
Circle (271) on Free Info Card

ISDN codec/POTS extender
AEQ
Booth R4066

▶ **TLE-02D:** Offers three units in one audio codec, with terminal adapter, to establish high-quality connections on ISDN lines with low delay codings. A digital hybrid, with echo suppression and frequency extender, for use on analog telephone lines; and a portable mixer with returns, headphone amplifiers and four-wire (I/O) connection to use on dedicated circuits and radiolinks. Includes double system power supply through standard dry cells or external transformer. Two microphone inputs and one mic/line, with level controls. Two headphones outputs, with independent level control and monitor signal selector.

+34 91 686 13000; fax +34 91 686 44 92; www.aeq.es; aeqsales@aeq.es
Circle (256) on Free Info Card

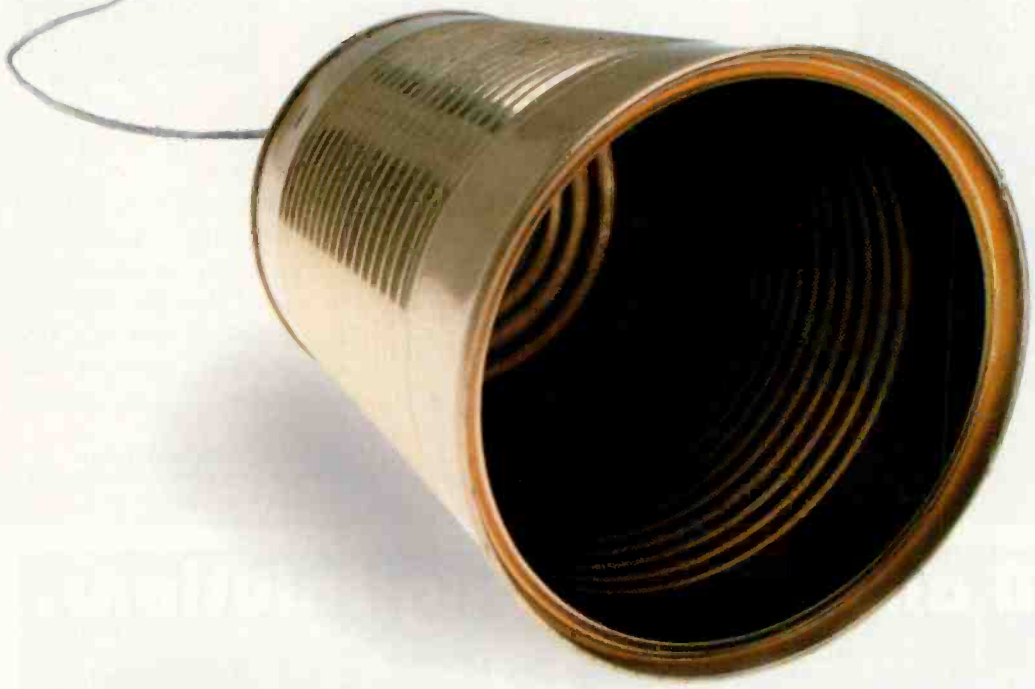
Power pentode
Svetlana Electron Devices
Booth R2854

◀ **4CX20,000C:** A high-performance ceramic/metal power tetrode designed for audio and radio frequency applications. Particularly well-suited for use in VHF FM broadcast transmitters in the Band II 88MHz to 108MHz frequency range.

800-578-3852; fax 650-233-0439
www.svetlana.com; sales@svetlana.com
Circle (284) on Free Info Card

Caller... are you there?

Are you there caller...?



"...Let's try line 2". On-air hosts don't want to hear themselves saying those words. And, with the help of the PROtalk4, they won't.

The PROtalk4 is designed around the features busy talent depend on to keep calls flowing smoothly.

Backlit, icon-based buttons make operation quick and simple. Talk to all four callers at the same time, with automatic level balancing for a consistent on-air sound. Independent digital hybrids provide exceptional audio quality in the studio and between callers.

Plus, the PROtalk4 stands up to your most demanding work environment, with a robust but elegant housing, compact footprint, and straightforward rackmount connections.

Before call management problems leave your on-air talent all strung out, take a closer look at the easy-to-use PROtalk4.

Call or visit us online today for more information.

PROtalk4

We hear you

BTS Broadcast Telephone Systems • www.broadcast-telephones.com • 1-888-890-7424

Circle (125) on Free Info Card or online at www.beradio.com

NABExtra!

Solid-state AM transmitter
Broadcast Electronics
Booth R3682

AM-5E: This 5kW AM transmitter has high-efficiency PA modules for more power with fewer components. Has redundant PA power supplies and built-in AC line voltage protection. Also meets all CE requirements. The small footprint is ideal for tight installations.

217-224-9600; fax 217-224-9607; www.bdcast.com; bdcast@bdcast.com
Circle (276) on Free Info Card

Portable mixing console
Calrec Audio
Booth R491

◀ **M3:** Designed for portable recording, production and live broadcast use, the M3 is available in two frame sizes. The 19-inch rackmount version is a 10×4×2 and the desktop version is a 20×4×2. Features include four auxiliary sends, choice of input module types and a mix-minus send on each input. Has an internal power supply. The monitor section has multiple source selection, control room, studio and headphone outputs, and LED bargraph meters.

+44 1422 842 159; fax +44 1422 845 244; www.calrec.com; clairch@calrec.com
Circle (282) on Free Info Card

Dry reed switch
Veetronix
Booth L12320

▶ **06series switches:** Manufactured with the same technology as the company's existing switches with an hermetically sealed dry reed. Offers a smooth feel and extended reliability. Mounted on ½-inch centers, the switch can be non-illuminated or LED illuminated. Keycaps are available in 0.485-inch and 0.585-inch versions with the relegendable, concave style in various colors.

800-445-0007; fax 308-324-4985
www.veetronix.com; sales@veetronix.com
Circle (274) on Free Info Card

VIENNESE TWINS

C3000B
STUDIO MIC

C3000B
STAGE MIC

ONE MICROPHONE • MULTIPLE PERSONALITIES

The New
C3000B
FOR STUDIO OR STAGE

AKG
A Harman International Company

AKG Acoustics, U.S. • 1449 Donelson Pike • Nashville, TN 37217 • Phone: (615) 360-0499 • Fax: (615) 360-0275 • Web Site: http://www.akg-acoustics.com • E-mail:akgusa@harman.com

NABExtra!

Rackmount UPS
North Star/Best Power
Booth L12852

Fortress Rackmount: Provides pure sine wave power to protect sensitive equipment. Available in capacities of 750-, 1050-, 1425- and 2250 VA in 2, 3, or 4RU packages. All units have user-adjustable settings for sag-, surge- and output-voltage settings. Batteries can be replaced while the unit is online. Also has status LEDs, audible alarm, RS-232 port and six outlets (seven on the 2250 model).

800-842-1671; fax 954-927-0501
www.nstpower.com; nstpower@aol.com
Circle (268) on Free Info Card

Studio condenser microphone
Sennheiser Electronic
Booth L7530

▲ **MKH800:** The redesign of the MKH80, this mic has a frequency response extending up to 50kHz and a dynamic range of 126dB at a self-noise of only 10dB (A). Soundfield interference is minimized at high frequencies by keeping the mic dimensions small and by carefully redesigning both the capsule and the acoustically important parts of the housing. The entire frequency range from 30Hz to 50kHz is captured by a single wideband transducer operating on the push-pull principle for extremely low distortion.

860-434-9190; fax 860-434-9022
www.sennheiserusa.com
lit@sennheiserusa.com
Circle (252) on Free Info Card

Outlet systems
Furman Sound

PlugLock PRO: Designed for fixed and mobile rack installations, the systems feature Furman's award-winning PlugLock brackets to securely lock wall warts and plugs into place. The PGP-60 is 60 inches tall and provides three 20A circuits and 24 Edison outlets. The PGP-20 is 30 inches tall and provides 14 outlets distributed between two 20-amp circuits. Connection is via ¾-inch conduit and a Furman PGP-S 60 Amp Remote Power Switcher or any user supplied junction box. Twelve PlugLock brackets (eight with the PGP-20) are supplied with the unit. Additional sets of six brackets are available.

707-763-1010; fax 707-763-1310
www.furmansound.com
info@furmansound.com
Circle (285) on Free Info Card

Tame Your Remote Demons

See us at NAB Booth #R3178

COMREX
www.comrex.com

Broadcaster's General Store
2480 S E. 52nd Street,
Ocala, FL 34480-7500
(352) 622-7700 Fax: 352-629-7000
Email: bgsbuck@atlantic.net

Circle (129) on Free Info Card or online at www.beradio.com

www.bgsfl.com

NABExtra!

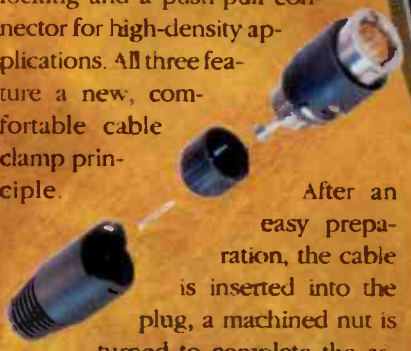
Internet audio processing
Circuit Research Labs
Booth R679

Millennium.com: Based on the original Millennium with 32-bit floating-point processing array, analog and digital interface, two RS232 serial ports for complete PC and modem connectivity. This version is designed for webcasting and includes an internal codec, flexible internal ethernet, and assignable IP addresses and 32-bit floating point dynamic audio processing.

800-535-7648; fax 602-438-8227 www.crlsystems.com
crl@crlsystems.com
Circle (255) on Free Info Card

New connector series
Neutrik
Booth L12139

▶ **BNC connectors:** Offers three versions: a nonlocking, budget friction-fit connector, a bayonet version with easy accessible locking and a push-pull connector for high-density applications. All three feature a new, comfortable cable clamp principle.



After an easy preparation, the cable is inserted into the plug, a machined nut is turned to complete the assembly and crimp machined contacts are inserted. This innovative design virtually guarantees an absolute constant wave propagation resistance of 75Ω or 50Ω, which is guaranteed throughout the connector into the mating chassis connectors up into the lower gigahertz area.

732-901-9488; fax 732-901-9608
www.neutrikusa.com; neutrikusa@aol.com
Circle (251) on Free Info Card

Digital audio codec
MUSICAM USA
Booth R2685

▲ **Prima LT:** Sports many of the features users value in the CD Prima 120 codec. Bidirectional unit accepts one ISDN, V.35 or X.21/RS422 interface module. Comes with 24-bit A/D and D/A converters and provides Musicam-enhanced MPEG Layer II, MPEG Layer III and G.722 coding. Front panel includes a large LCD display, large-dial keypad and a simplified menu tree. Comes with a speed directory capable of storing more than 250 addresses.

732-739-5600; fax 732-739-1818
www.musicamusa.com
sales@musicamusa.com
Circle (286) on Free Info Card

"My Two Stations Save $130,000 per Year Using Scott Studios Voice Trax"

Ron Castro, co-owner and GM, KRPQ Q-105 and KMHX MIX 104.1 Santa Rosa, California

A former San Francisco and nationally syndicated Concept Productions air personality, Ron has recorded 300,000 voice tracks for automated stations across three decades. Ron's own stations have used Scott Studios' Voice Trax systems for several years.

(Continued from upper right) "I wouldn't ask the staff to use anything I don't use myself. If it didn't work great, it wouldn't be here."

Scott Studios has money-saving *features you can't get anywhere else*. Scott's exclusive Voice-Music Synchronizer *guarantees* every voice track plays *only* with the intended songs, in spite of log updates. Worst case, you'll still sound great because your Scott system airs replacement tracks with the right voice for the shift. Scott has exclusive watchdog circuits that make our systems more self-healing than any other. Scott also predicts most problems *before* they occur, usually as soon as logs are done. Scott also pages people who can make last minute adjustments off-site by modem if needed. After years of trouble-free operation, Ron Castro says his two "Scott Systems are truly 'lock-the-door-and-go-home' reliable."

Ron Castro says his KRPQ and KMHX, Santa Rosa, California *save serious money* because "Scott Studios' Voice Trax automation cuts voice-tracking time to 5 minutes per hour for a 'live-sounding' show. Our Air Personalities are freed up to do other work at the stations, drastically reducing the need for additional management, music, production and promotion staff. That cuts boredom, burn-out and turnover, while increasing productivity.

"Scott Studios' Voice Trax lets the talent hear their music, spots and voice-over, running the show the way they would live, including air-tight talk-ups. Scott's whole recording process is handled with just one button. We hardly ever use a mouse or keyboard. Each voice track takes only seconds.

"Not only am I an owner and GM, but I'm also an Air Personality. I produce 34 hours each week of voice tracked programming using Scott Studios' Voice Trax.

The Scott System is radio's most user-friendly. You get instant airplay or audition of any song simply by spelling a few letters of its title or artist. You see when songs played last and when they'll play next. You also get voice tracking while listening to music in context, hot keys, automatic recording and graphic waveform editing and scrub of of phone calls, all in one computer!

Ron's "two station combo saves at least $130,000 a year using Scott Studios' Voice Trax. When we put our second station on the air 3 years ago, we debuted with the best ratings of any sign-on in the history of the market!"

Scott Systems are delivered with pre-dubbed custom music libraries, time-saving CD rippers that digitally transfer music to hard drive in seconds, no-dub instant LAN spot uploads from Sonic Foundry multi-track production, MPEG and uncompressed digital audio (at a compressed price) and a week of staff training at your station. You get Cart Walls for instant requests, a phone recorder with waveform and audible scrub editing, AutoPost to make announcers sound better and minimize re-cuts, title and artist displays for your website, time announce, plus Cat. 5 audio wiring for fast installation. Our SS32 System plays 8 simultaneous recordings thru 8 separate console channels, feeds different spots to webcasts or second stations, plus auto-transfers spots and Voice Trax to distant stations over Internet or WAN. Scott Studios offers optional temperature announcers, wire capture and newsroom editors, unattended school closing reports and 24/7 live support via toll-free cell phones.

Scott Studios' unequaled money-saving features mean more U.S. stations use Scott than *any* other digital air studio systems (5,500 workstations in 2,250 U.S. Stations and nine of the top ten groups). See our web site and toll-free phone at the right.

Scott Studios

13375 Stemmons Freeway, Suite 400
Dallas, Texas 75234 USA
Internet: www.scottstudios.com
(972) 620-2211 FAX: (972) 620-8811

(800) SCOTT-77

NABExtra!

Eight-track recorder/player
TASCAM/Teac Professional
Booth L12944

▶ **DA-78HR:** A 24-bit format DTRS recorder, the unit can record eight tracks, up to one hour and 48 minutes, on a standard Hi-8 tape. Fully compatible with all existing DTRS machines. Can be locked with other generations of DTRS machines. Able to play 16- or 24-bit tapes. I/O for word clock, SMPTE and MIDI. A read-before-write method allows for internal mix-down. Mix can also be routed to S/PDIF outputs.

323-726-0303; fax 323-727-7635; www.tascam.com; tascamlit@tascam.com
Circle (283) on Free Info Card

Digital console upgrades
Logitek
Booth R3170

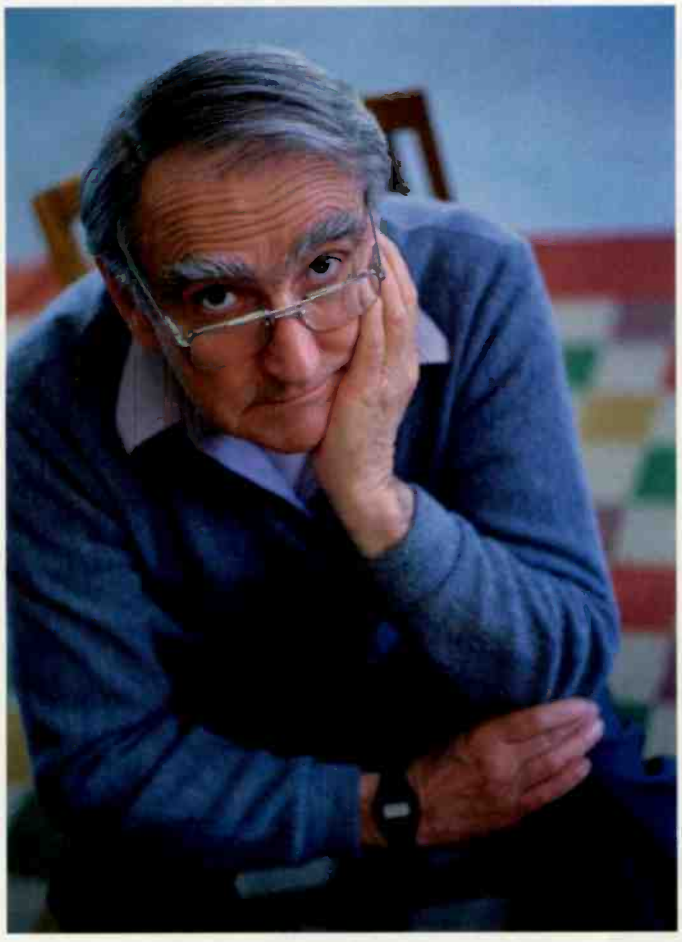
Audio Engine Enhancements: Several new options are available for the Logitek Audio Engine, the heart of the NuMix and ROC series audio consoles. The IO8D is a digital I/O that doubles the number of inputs and outputs on each digital card. The sample rate converter resolution has been increased from 20 to 24 bits, and the maximum sample rate is now 96kHz. IONet is a network card that allows 64 audio channels to be shared between audio engines with a fiber optic cable. The RCH2 is a router control head that can select two router crosspoints for distribution to any destination in a facility.

800-231-5870; fax 713-782-7597; www.logitekaudio.com; info@logitekaudio.com
Circle (267) on Free Info Card

Vocal microphone
Neumann
Booth L7530

▶ **KMS 105:** A supercardioid, live-performance vocal microphone. 145dB maximum SPL, reduced handling noise due to a triple process involving capsule tensioning, mounting and microphone electronics. Reduced sensitivity to plosives, owing to a sophisticated inner-basket structure. 127dB of dynamic range and a 20Hz to 20kHz frequency response.

860-434-5220; fax 860-434-3148
www.neumannusa.com
neumlit@neumannusa.com
Circle (250) on Free Info Card



This is a really boring ad for Broadcast Electronics Transmitters

But isn't that what you want from a transmitter?

Face it. The last thing you need from a transmitter is excitement. In fact, what you're looking for are transmitters and exciters that work. No fuss, No muss. Broadcast Electronics Transmitters are known throughout the industry for reliability, stability, and serviceability. And in that rare occasion when one of our units go bump in the night, our 24x7 service department is legendary. Or, if you have recently been visited by Andrew, El Nino or some other nasty mother nature type event, in most emergency situations we can get you a transmitter, on site, the very next day. Just ask the 30 or so customers we rescued last year.

Spectacular audio performance, a wide range of products and services - why don't you call and find out just how boring a BE transmitter really can be.

BE TRANSMITTERS

www.bdcast.com
or 888.232.3268

60 YEARS BE OF RADIO

Broadcast Electronics
Quincy, Illinois

NABExtra!

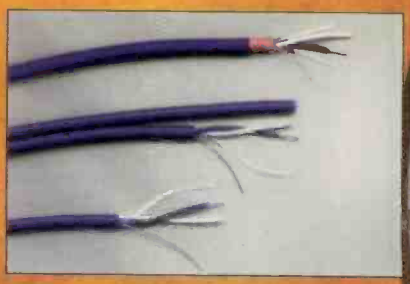
Two-channel mic pre-amp
Sound Devices
Booth R3661

▼ **MixPre:** A studio-quality two-channel, portable, stereo microphone preamplifier/mixer. Each input has pan switches and level control. Also includes a built-in slate microphone, 1kHz tone oscillator and headphone monitoring. Each input can provide up to 66dB of gain and uses Lundahl input transformers. Phantom power is selectable between 48V and 15V. Audio bandwidth is 10Hz to 50kHz. Levels are shown with seven-segment LED output meters that have a three-position brightness switch. Two-color LEDs per input channel indicate clipping and limiter activity. Powered by two AA batteries or external, chassis-isolated 5VDC to 14VDC. Power LED indicates low battery power.

608-524-0625; fax 608-524-0655; www.sounddevices.com
info@sounddevices.com
Circle (263) on Free Info Card

AES3 cable
Gepco International
Booth L5660

▶ **5596 series:** This AES3 digital audio cable is designed for extended physical distances and increased data rates. Precision manufactured for 100Ω impedance, it is optimal for 96kHz bandwidth requirements. The low attenuation and jitter specifications work well for applications requiring long cable runs at lower sampling frequencies. Available in two versions, the 5596EZ is intended for punchdowns, mass termination and permanent installations, and the 5596M is designed for studio wiring and cable harnesses. Both feature stranded, 24-gauge conductors.



800-966-0069; fax 347-795-8770; www.gepco.com; gepco@gepco.com
Circle (261) on Free Info Card

Audio tester
TerraSonde
Booth R1494

▲ **The Audio Toolbox Rackmount:** Based on the original Audio Toolbox, this multifunction audio test and acoustic analysis device combines more than 30 functions in one 2RU unit. Includes timecode generator/analyzer, RTA, SPL, signal generator, sample scope, impedance meter, THD, sweeps, memories, speaker/mic polarity tester, MIDI, and more. Power is selectable for 90V to 120V or 220V to 240V. All connections are on the front panel. Includes PC and Mac interface cables. Optional rechargeable battery system. Software version 2.16 supports uploading of up to 40 data memories.

888-433-2821; fax 303-545-6066 www.terrasonde.com
info@terrasonde.com
Circle (264) on Free Info Card

Make your way through the show floor with BE Radio's exhibitor listings.

NAB FASTTRACK 2000

Your time at NAB is limited and it's impossible to see everything. Use the BE Radio FASTtrack to plot your course around the show floor. The following listings are arranged in product categories, then in booth order to help you see the exhibitors without wasting any time. For an alphabetical exhibitor listing, see the NAB show-floor map in this issue.

BE Radio FASTtrack Directory

Audio Accessories

Soundscape I6939
International Cellulose L1749
Benchmark L2046
beyerdynamic L5207
ATI L5211
Switchcraft L5213
Acoustics First L5215
Datatek L5610
Acoustic Systems L5654
Lectrosonics L5812
Lemo L6333
Harris L6524
Wohler L6761
Gefen L7038
Acoustical Solutions L7338
Whirlwind L7433
Sennheiser Electronic L7530
Panasonic L8236
Beck L8470
DNF Controls L8683
Multidyne L9144
Leitch L9328
Telex Communications L9366
Dorrough Electronic L9769
Opamp Labs L10073
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K&H Products L10376
Clear-Com Systems L10776
ADC Telecommunications L10982
Clark Wire & Cable L10986
Horita L11350
Mohawk/CDT L11933
Sony L12107
Neutrik L12139
Ross L12326
Dolby Laboratories L12335
Bogen L12342
Techflex L12550
Rip-Tie L12572
Boland Communications L12680
AVP Manufacturing & Supply L12929
TASCAM/Teac Professional L12944
Avocet Instruments L12955
Bittree L13114
Avitel L13242
Link Electronics L13255
JBL Professional M8632
Hafler Professional M8669
Mackie Designs M9373
Audemat R577
Martinsound R582
TGI North America R683
Tannoy R683
Signal Transport R686
AudioScience R795
TC Electronic R1059
Genelec Oy R1393, M7672
AKG R1396
Digigram R1456

Issue advertisers indicated in gold

Gentner R1581
Telos R2057
Solid State Logic R2074
Sonifex Ltd R2296
JOEMEEK R2299
HHB Communications R2360
LPB R2370
Euphonix R2388
Audio Processing Technology R2390
Broadcast Richmond R2393
QEI R2678
MUSICAM USA R2685
RDL (Radio Design Labs) R2954, L12510
Audio-Technica R2970
Logitek R3170
TFT R3252
Gorman-Redlich R3388
Henry Engineering R3389
Audio Toys R3496
Symetrix R3663, M9727
Ward-Beck R3763
Industrial Acoustics R4060
AEQ R4066
Studer R4073
Walters-Storyk S4017
Miller & Kreisel S4175
Ensemble Designs S4737
WhisperRoom S5359
SD Tech/Div. GVC S5373

Audio Mixers — On Air

Harris L6524
TASCAM/Teac L12944
IDT Image Developpement R571
TC Electronic R1059
Arrakis R1574
Telos R2057
Wheatstone R2081
AEV R2087
Tiesseci R2097
Aphex Systems R2368
LPB R2370
Autogram R2577
Fidelipac R2674
Inovonics R2976
Logitek R3170
Circuit Research Labs R3197
Audio Toys R3496
Broadcast Electronics R3682
Orban R3686
Ward-Beck R3763
AEQ R4066
Studer R4073

Audio Mixers — Portable

TeleCast Group AS L1823
ATI L5211
Shure L5617
Zaxcom L13231
Mackie Designs M9373
Calrec Audio R491
Roland R2063
Audio Developments R2354
AETA Audio R2680
Audio Toys R3496
JK Audio R3659
Studer R4073

Audio Mixers — Studio, Recording

TeleCast Group AS L1823
Graham-Patten L2010
ATI L5211
Shure L5617
Harris L6524
Whirlwind L7433
Panasonic L8236
Telex Communications L9366
Sony L12107
TASCAM/Teac Professional L12944
Zaxcom L13231
AMS Neve L21637
Klotz Digital M7173, R3798
Mackie Designs M9373
Calrec Audio R491
Martinsound R582
Soundtracs R669
TC Electronic R1059
AMEK US R1562
Harrison by GLW R1569
Arrakis R1574
Solid State Logic R2074
Wheatstone R2081
Audio Developments R2354
LPB R2370
Euphonix R2388
Radio Systems R2663
Fidelipac R2674
Audio-Technica R2970
Logitek R3170
Ward-Beck R3763
AEQ R4066
Studer R4073

Audio Processing

NVISION L543
Axon Digital Design L2006
Shure L5617
FM Systems L5833
Gefen L7038
Prime Image L10186
Dolby Laboratories L12335
Link Electronics L13255
TC Electronic R1059
Telos R2057
Roland R2063
Audi-Cord R2273
JOEMEEK R2299
HHB Communications R2360
Aphex Systems R2368
Circuit Research Labs R3197
Audio Toys R3496
Symetrix R3663, M9727
Broadcast Electronics R3682
Orban R3686
Dan Dugan Sound Design R3761
Eventide R4069
DigiDesign R4086

Audio Recording, Storage & Playback

Doremi Labs L517
Nagra L5603
Harris L6524
DRS Ahead Technology L9619
Otari L9741
Sony L12107
TASCAM/Teac Professional L12944
Zaxcom L13231
Alcorn McBride M9440
TeraTek Software R586
Digigram R1456
Arrakis R1574
Roland R2063
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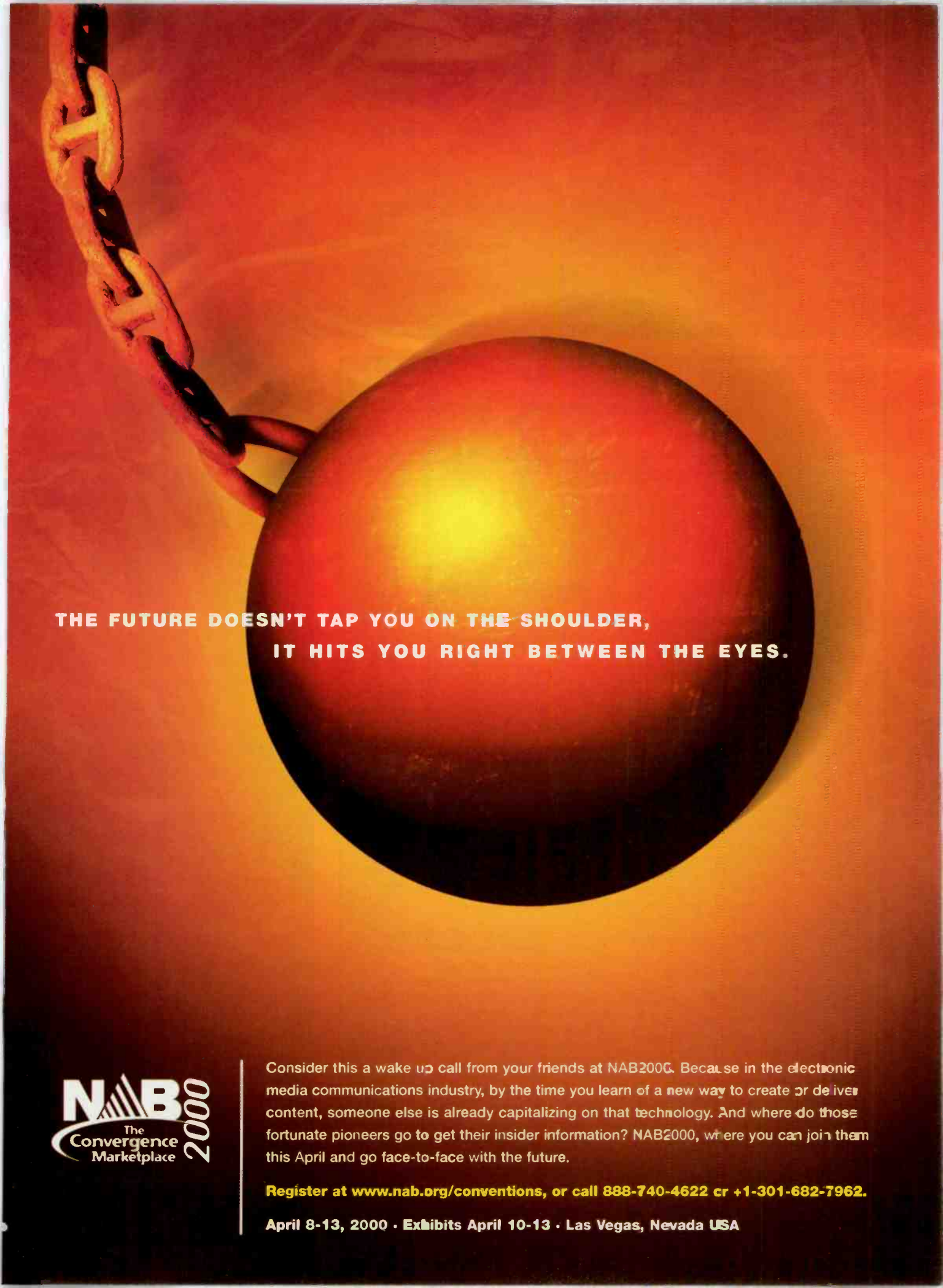

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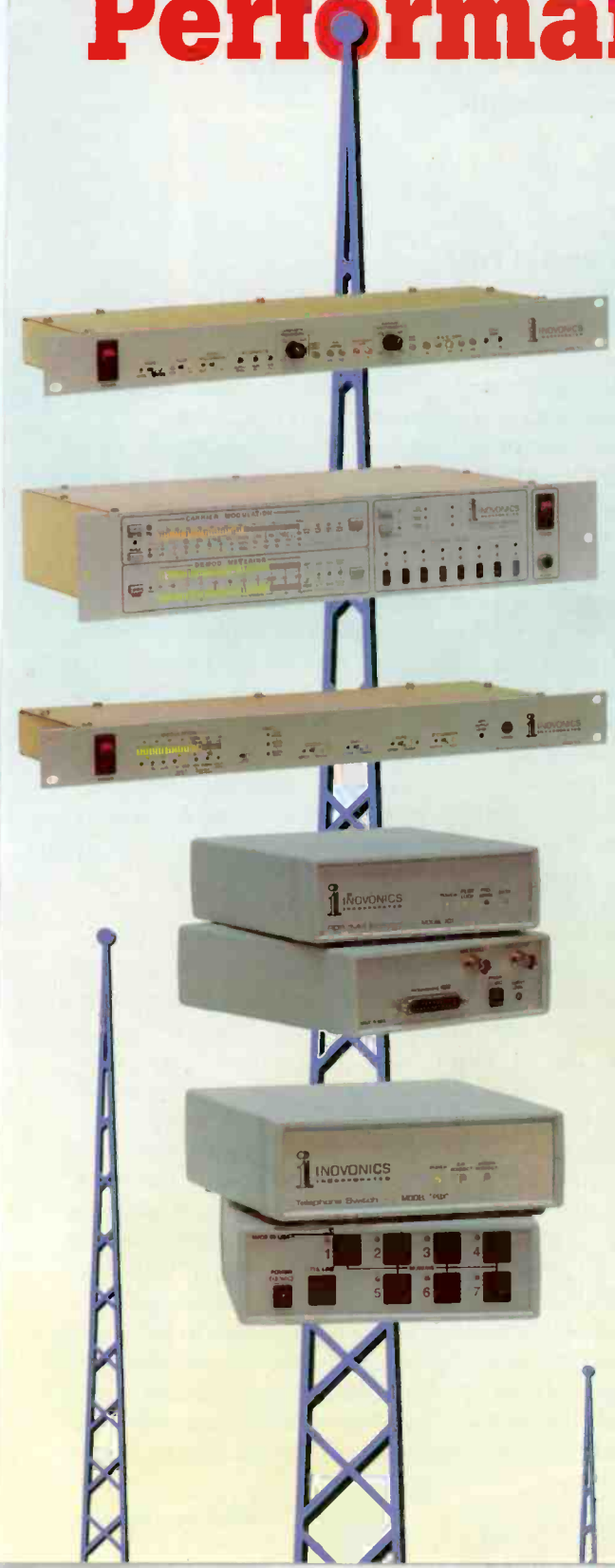

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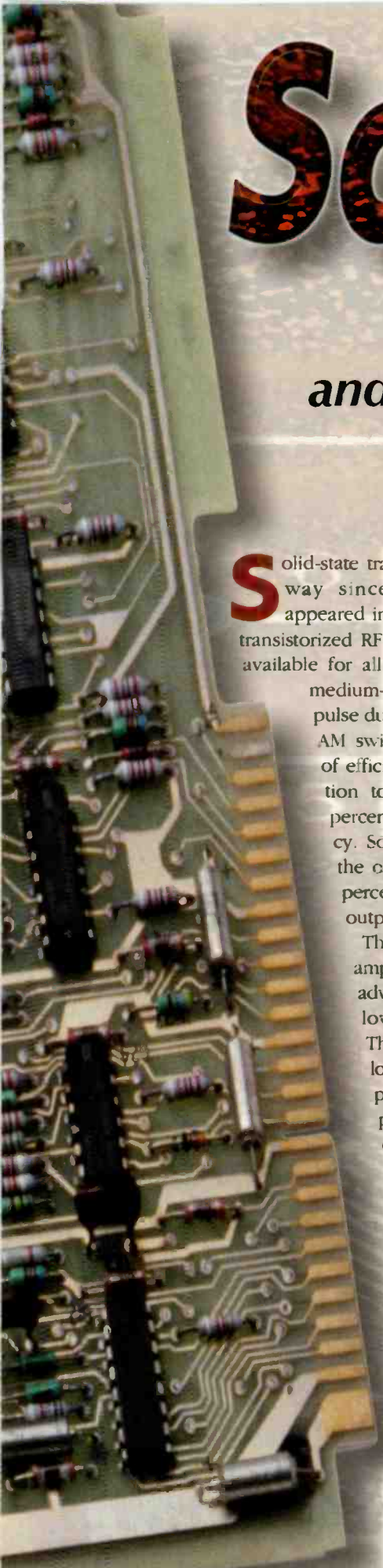


Solid-State

Efficiency, reliability and an investment for the future.

By Russ Mundschenk

Solid-state transmitters have come a long way since the Harris MW-1 first appeared in the mid-'70s. Cost-effective, transistorized RF power amplification is now available for all classes of AM and low- to medium-power FM stations. Modern pulse duration and digital modulation AM switching techniques make use of efficient class D and E amplification to provide in excess of 80-percent overall transmitter efficiency. Solid-state FM transmitters, on the other hand, are limited to 65-percent power line to RF power output efficiency.

The state-of-the-art in VHF power amplifier device design has not advanced as rapidly as that of lower-frequency components. The availability of inexpensive low-frequency FETs was made possible by the proliferation of pulse width modulation power blocks of all types, from switching power supplies to DC motor controls. Unfortunately for broadcasters, there is no widespread marketplace need for solid-state VHF RF power amplification. Presently, this translates to a "bang for your buck" breakpoint of about 10kW for transistorized FM transmitters. Nevertheless, the positives of high-power, solid-state VHF amplification may outweigh the negatives in your facility.

The start of PDM

In the late 1960s, Hilmer Swanson of Harris adapted pulse width modulation techniques to AM carrier modulation. By using highly efficient switching techniques, pulse duration modulation made it possible to design air-cooled, high-power amplifiers and modulators.

Early AM PDMs suffered from unpredictable field-related problems. Because AM bandwidth is equal to twice the highest modulating frequency, the antenna system load impedance had to be relatively flat over the 20kHz spectrum. This is especially problematic for facilities using directional arrays. The complex swept impedances produced by matching and phasing systems in conjunction with array element interaction often results in a resistive/reactive plot that looks more like a mountain than a plain. Impedance mismatches cause standing wave reflections that ultimately end up at the power amplifier and modulator. The high-impedance nature of tube output circuitry is much more forgiving of mismatches than some solid-state designs.

Lightning and even a highly charged atmosphere easily wiped out early solid-state components, and manufacturers had to install better lightning suppression. Bipolar devices were subject to *thermal runaway damage*, and transmitter engineers found themselves replacing transistors more often than they would tubes.

The use of *metal oxide semiconductor field effect transistors* (MOSFETS) reduced component failure due to load mismatch. At last, transmitters were staying on the air, but transistor output stages and modulators (especially) performed poorly into a mismatched system. This translated into poor sideband performance and subsequent audio distortion. The power of an RF amplifier block is directly proportional to the FET drain voltage. To amplitude modulate a carrier wave, that voltage must be instantaneously varied in direct proportion to the intensity of the modulating waveform. This is usually done by using a 60kHz to 70kHz pulse train to interrupt the primary DC voltage. The duty cycle of these pulses are varied in direct proportion to the amplitude of the

Transmitters

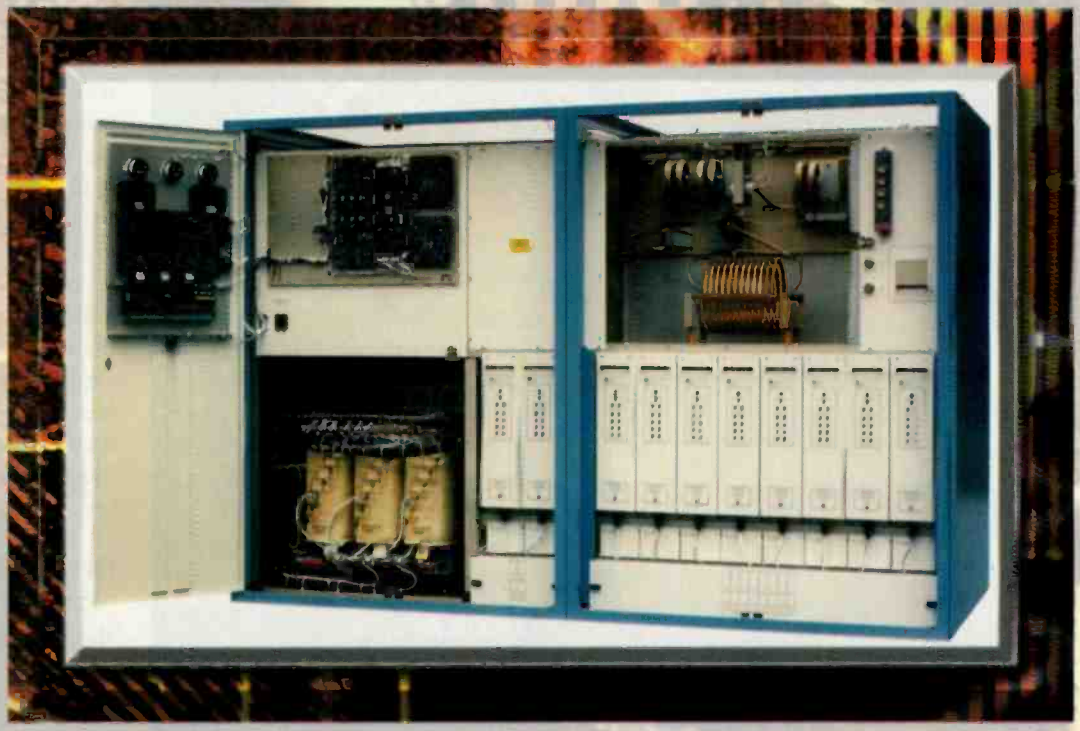
modulating waveform. The bottom of the wave, or 100-percent negative modulation, corresponds to an "off" condition. Fifty-percent modulation causes the on/off switching times to be approximately equal. Maximum modulation corresponds to a full duty cycle.

In order to remove the PDM frequency from the PA supply voltage, the latter is audio low-pass filtered. The design of this filter is critical to transmitter performance. Any antenna system reflections appearing here will result in audible distortion due to incidental modulation of the supply. To minimize the effect of these reflections, some manufacturers resort to a multiphase modulation system that uses either two or four individual pulse trains, 180 degrees or 90 degrees out of phase. These pulse trains then run through individual PDM filters, which can be optimized for a gentler roll-off slope with a higher cutoff frequency. This method results in fewer group delay variations and a lower source impedance to drive the PAs. PDM transmitters consist of two elements, the modulator and the power amplifier. Because of the number of devices necessary, and for redundancy, there are often multiple modulators driving multiple PAs. The loss of any one module then results in a corresponding power cutback, but not total system failure. Some of the larger transmitters' automatic power controls are even able to drive the good modules harder and maintain full power.

In 1987, Harris introduced digital modulation in its DX series of AM transmitters. The DX series directly synthesizes the RF waveform using a number of binary weighted amplifier power blocks. When the audio signal enters the system, it is sampled and converted to a 12-bit digital word immediately. A modulation encoder then determines which sets of modules are to be turned on and off to produce the exact power level. It should be noted that the transmitter's logic calculates the exact instantaneous amplitude for both the carrier and the modulating waveform's effect on it. Because of the lack of a lowpass filter and the inherent load-independent output module design, changes in load impedance have a minimal effect on a digital transmitter. Continental Electronics will introduce its digital transmitter series at NAB2000 in Las Vegas.

Ready to buy

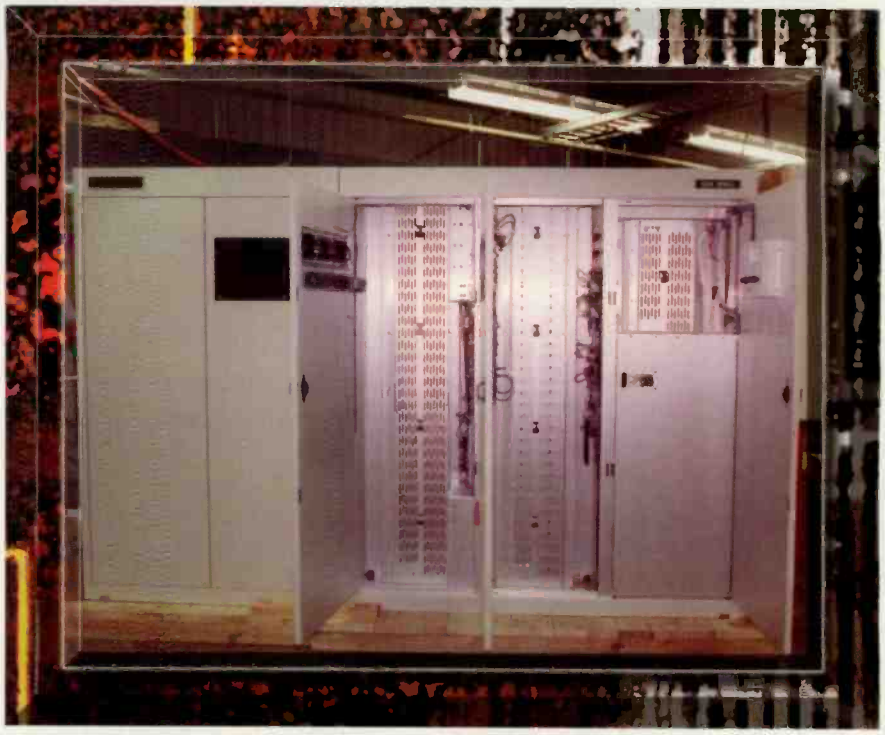
When buying a solid-state AM transmitter, it is wise to consider its acceptability for In-Band On-Channel digital audio broadcasting (IBOC DAB). There are two different systems currently in development from USA Digital Radio and Lucent Digital Radio. Both use multicarrier *orthogonal frequency-division multiplexing* (OFDM) that inserts multiple (more



One major advantage to most solid-state transmitters is power modules can be removed and installed while the transmitter is operating.

Solid-State Transmitters

than 160) individual carriers at an amplitude 30dB below carrier. In general, this method of modulation requires linear amplification or highly accurate envelope detection and restoration techniques to eliminate intermodulation components. Single-phase PDM transmitters are, in general, bandwidth-limited and can cause overshoots on negative peaks. OFDM carriers need at least 50kHz of bandwidth to operate properly. Multiphase PDM systems extend the frequency response by an amount approximately equal to the number of phases times 20kHz. The goal is to start with an amplifier that is as linear as possible and then introduce a type of pre-distortion to further attenuate undesirable signals.



This transmitter has access to the RF power modules from the front. The serial combiner is accessible from the back.

Digital transmitters, on the other hand, use no modulator or PDM filter. As a result, two-tone IMD tests of digital versus multiphase PDM transmitters may yield 20dB or better improvement in production of spurious artifacts. This is not to say that digital AM transmitters are the definitive answer to your IBOC worries. What is really important is determining whether a transmitter manufacturer has entered into a development agreement with one of the IBOC proponents. The hope is that the manufacturer will work with the DAB vendor to ensure the system meets the standard.

Over to FM

FM solid-state transmitters started showing up at trade shows about 10 years ago. The biggest problem back then was the need for efficient heatsinking of nonefficient FET devices. One manufacturer even resorted to

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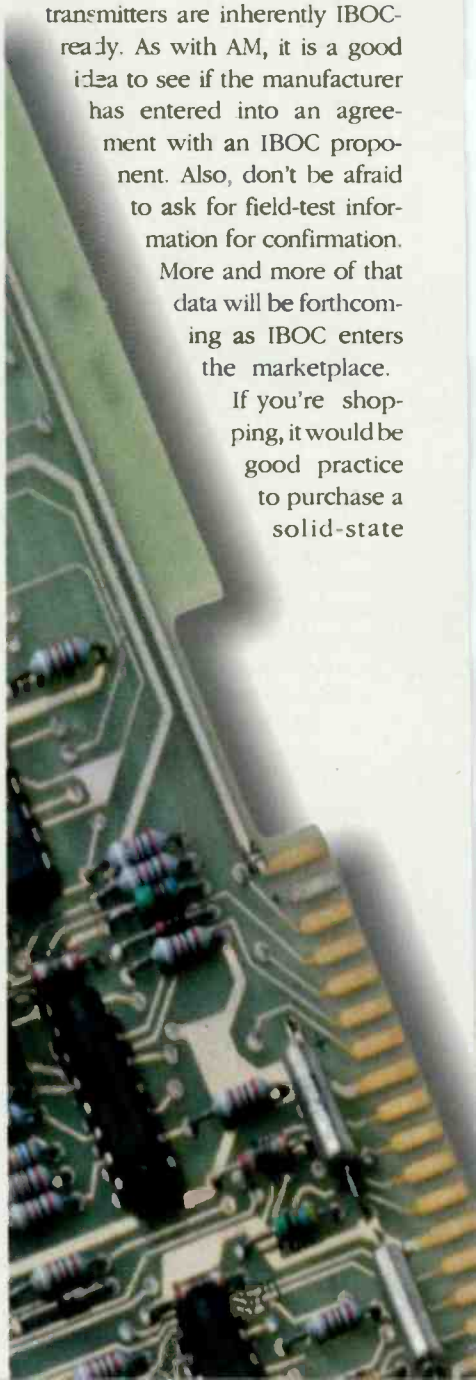
a circulating liquid coolant system for a class A series transmitter. All solid-state radio transmitters today are cooled by air — large volumes of it. Cabinets are designed by mechanical engineers, with the goal of removing as much heat as possible from a number of little hot spots. Most power blocks operate in the 500W range and use devices such as Motorola's MRF-151 MOSFET. The good (and bad) thing about solid-state FM transmitters is their inherent broadband design. Most systems are at least partially frequency agile and can be used as a backup transmitter for multiple co-located stations on different frequencies (with lots of attendant RF plumbing, of course). The bad side of broadband FM transmitters is that the PA can generate intermodulation products. It may be wise in a multiple-transmitter installation that does not feed a common antenna through a multiplexer to incorporate a bandpass filter or trap to prevent IMD. New RF combining techniques have greatly improved IMD suppression.

The bad side of broadband FM transmitters is that the PA can generate intermodulation products.

Most broadband solid-state FM transmitters are inherently IBOC-ready. As with AM, it is a good idea to see if the manufacturer has entered into an agreement with an IBOC proponent. Also, don't be afraid to ask for field-test information for confirmation. More and more of that data will be forthcoming as IBOC enters the marketplace. If you're shopping, it would be good practice to purchase a solid-state



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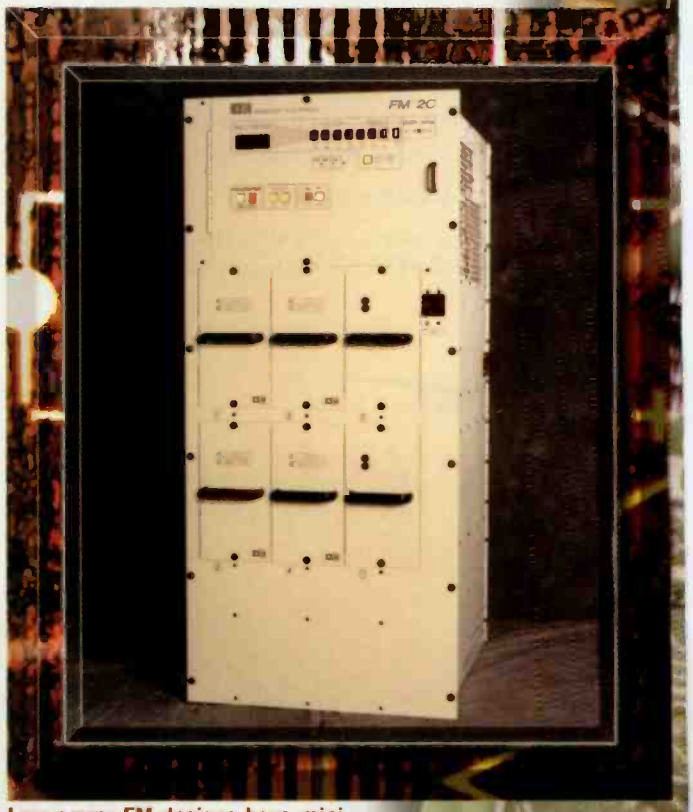
Solid-State Transmitters

FM transmitter in the 10W to 10kW range. The initial cost versus long-term maintenance and primary power consumption easily warrants its purchase. 10kW has been a breakpoint for some time, however, and to make the 20kW necessary to power a class B or C FM, two transmitters have to be combined. Yet that does not have to be a bad thing.

Combined 10kW FM transmitters are internally redundant, even though a total failure of one cabinet might temporarily reduce the total output power to 25 percent until you can patch around the hybrid combiner. Unlike tube transmitters, combined solid states do not suffer from the "tube is aging and my AM noise is rising" blues. Combined solid-state transmitters also can be placed in remotely



Low-power FM designs have minimal space requirements and are ideal for backup use.

located antenna sites that are only reachable in winter by dog sled or helicopter.

Combined setups are the ideal N+1 backup transmitter (with both 10kWs available in the event of a two-transmitter failure). Also, there is no warm-up time necessary which results in an instant transfer without

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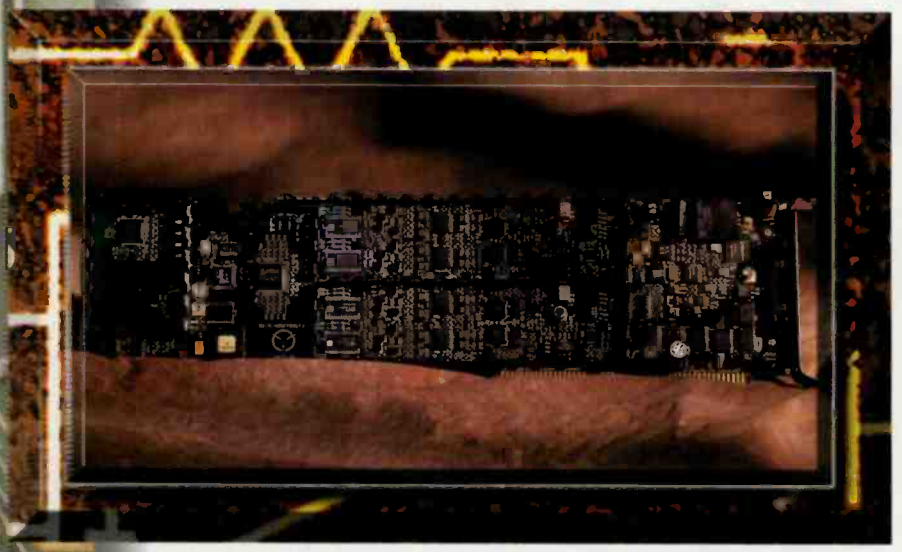
having to keep tubes "hot." One further advantage is that two of anything provides a great 3D schematic, complete with voltages.

When choosing a solid-state transmitter, consider the items important to you:

- *Remote control.* To save the cost of an external R/C, some transmitters come with built-in serial interfaces. That's fine, if all you are going to control is the transmitter, like in an unattended FM site with no RF switch or AM with one stick.
- *Modularity.* Lots of modules (within reason) are good; it means redundancy. That usually means several modulators are tied to several PAs. One thing to be wary of is any transmitter with just one module (such as some 1kW AMs).
- *Hot pluggability.* If one of the aforementioned modules goes south, it would be ideal to be able to replace it with the transmitter still on (having to turn off a breaker first is not too much work).
- *RF combiner type.* All those modules have to come together somewhere. It is wise to determine the type of combiner and what happens to the transmitter output (and match) when one of them fails.
- *Frequency agility.* With the co-ownership of so many FMs and AMs at one site, it makes sense to have the ability to use just one aux transmitter on many frequencies.
- *Primary power requirements.* There are probably more options for single-phase powering of solid-state transmitters (with bigger capacitors, of course). This can be advantageous when considering a site at the summit of Mount Stratosphere.



Solid-state technology has also been applied to the modulator stages. This digital FM upconverter card eliminates the analog heterodyne process.

When installing any solid-state transmitter, whether AM or FM, you should keep in mind all the caveats of operating anything that uses transistors instead of tubes. In other words, treat it like a computer — short of a placard with the initials HAL. Ground it to a common ground without any daisy chains. Install lightning protection. Plug strips labeled surge arrestor will not work. The primary feeder to the building should be shunted with some serious surge protection.

Keep it clean. Have your high-pressure air hose ready at all times. The spacing between the heat dissipation fins, especially in FMs, is very close. Don't expect the external filters (which also require regular cleaning) to do all the work.

Finally, keep some spare modules handy. Modules don't act funny; they just stop working. The nice thing is that your transmitter is still on the air!

Cost-effective AM transmitters of all power levels and FMs up to 10kW are available to broadcasters. Check with your prospective vendor to determine IBOC capability.

Photos courtesy of Nautel, Harris, Broadcast Electronics and Continental Electronics.

Russ Mundschenk is chief engineer at WBEB-FM, Philadelphia.

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MP-2	2	800W	0	$680
MP-3	3	800W	1.4	$980
MP-4	4	800W	3.3	$1,280
MP-2-4	4	2,000W	3.3	$1,820
MP-3-5	5	3,000W	4.1	$2,270
MP-3-6	6	3,000W	5.2	$2,740

LOW POWER CIRCULAR SERIES

Model	Bays	Power	Gain	Price
GP-1	1	2,000W	-3.1	$350
GP-2	2	4,000W	0	$1,350
GP-3	3	6,000W	1.5	$1,900
GP-4	4	6,000W	3.4	$2,600
GP-5	5	6,000W	4.3	$3,150
GP-6	6	6,000W	5.5	$3,700

MEDIUM POWER CIRCULAR SERIES

Model	Bays	Power	Gain	Price
SGP-1	1	4,000W	-3.3	$690
SGP-2	2	8,000W	0	$2,690
SGP-3	3	10,000W	1.4	$3,595
SGP-4	4	10,000W	3.3	$4,500
SGP-5	5	10,000W	4.1	$5,300
SGP-6	6	10,000W	5.2	$6,100

The antenna gain may vary with the frequency. For powers up to 20KW please, make the request to provide the specific configuration.

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Telos Zephyr Express

By Ted Tait

Simplicity and flexibility wage a constant battle in the realm of technology. The more options you have, the more complex using a piece of hardware or software becomes. Just look at the pulldown menus on your computer programs, and you'll know what I mean. Ultimately, a wealth of choices can lead to greater flexibility, but they can also be daunting for the new user.

Performance at a glance

- Combined mixer, HP amp, TA and codec
- Lightweight
- G.722, Layer II, Layer III and ISDN voice supported
- Flexible operation modes
- Safe mode for inexperienced operators
- Well-written documentation in plain English
- External power supply
- Internal or external NT-1

At a remote broadcast, the last thing you need is a piece of equipment with so many options your staff cannot figure it out. The Telos Zephyr Express addresses this issue. It is a powerful device for the person who knows how to use it, yet those with less experience will find it simple and user-friendly.

We all hate lugging crates of gear to and from remote locations. The Zephyr Express provides almost everything you need for a remote broadcast in one box. It combines an ISDN terminal adapter, a codec, a mixer and a headphone amp in one lightweight unit that includes a carrying handle and an external power supply. The ISDN portion of the unit is just like the Telos Zephyr, which may already be familiar to you. The Zephyr Express offers an integral NT-1 if needed or it can be hooked to a circuit that already has the NT-1 provided. The codec handles Layer II, Layer III and the ubiquitous G.722 formats. It is also possible to place regular voice calls over the ISDN circuit using the mic and headphones.

Audio flow

The mixer handles two mic inputs, two line-level inputs and two line-level outputs, with flexible monitoring. At this point, the unit can seem confusing, but it can be set up as simply as you like. The Express can use one or both of the two ISDN bearer channels for increased audio performance on mono or stereo feeds. It can also separate the channels to send two different mono feeds to different destinations. This feature has come in handy when feeding various news outlets on a breaking story.

Each of the two mic inputs can feed either or both of the codec channels. The two line inputs can feed each codec channel individually, or they can be combined and fed to both. There is only one volume control for both line feeds, which is a drawback. (Apparently, the designers figured the unit was most likely to be used for a single stereo input rather than two independent mono inputs.) The line input connectors are interesting in that they accept either an XLR or ¼" plug on the same connector.

Monitoring is flexible as well. There are two separate monitor circuits, each of which can listen to either (or both) send channels as well as either (or both) returns. In addition to a headphone jack, monitor one feeds XLR connectors on the back for a PA system feed if needed (such as for a live audience). The other monitor circuit appears only as two isolated ¼" headphone jacks. Since you can select which monitor gets which audio, it is easy to set up your monitoring the way you want.

The Zephyr Express comes with an external power supply that plugs into the back of the unit. The unit was designed this way because of concerns related to heat if an internal power supply were used. Even so, the unit has a cooling fan and vents on the side. The unit produces a fair amount of heat, even without the power supply inside, so the cooling fan performs an important function.

When my Express was delivered, I had only one problem with it: The cooling fan was rather noisy. The Telos folks responded quickly to my call; they promptly sent a replacement fan. They offered to replace the part themselves, but I decided to do it. When I opened the

unit, I was able to replace the fan quickly and painlessly. Once I changed the part, noise was no longer a problem. As an aside, Telos is good about allowing you to open their gear when necessary without voiding the warrantee.

All of the settings for ISDN and codec configuration, mic and line sensitivity, mixer panning, and auto-dial numbers are configurable using the controls on the front. The large knob is the main interface with which you dial up or down to a selection. You then press briefly to enter the selection. Holding the knob down makes it function as an Escape key, exiting you out of a menu. Just about anything you can think of is configurable, which makes the unit confusing at first. It takes an engineer a little time to get the hang of the menu layout.

Playing it safe

The Safe mode makes the unit simple to operate. If the unit will be used by less experienced personnel, all the proper settings can be made in advance, then the unit can be placed in Safe mode. In this mode, you can lock a user out of any of the menus. At its most restrictive, you can prevent a user from changing anything other than the levels on the pots. Yet you can allow or block each feature as you see fit, so you can customize the Safe mode to the technical ability of the user. You can prevent staff from changing vital settings like the SPIDS and switch type or you can restrict access to everything but your preprogrammed auto-dial numbers. As with each of the setups, you can create a Safe mode configuration, give it a name and recall it for use as needed.

I have sent our Zephyr Express out with journalists on various trips with minimal instructions. As long as the programming is right before it goes out the door, it is easy to use. Journalists who have use it have been pleased with its simplicity. What makes the unit even more flexible is the fact that Safe mode does not lock the unit. If you need to talk a user through a setting change in the field, all they have to do is move a DIP switch on the back to revert to full access of all menus. Safe mode does not lock the unit from intentional tampering. Rather, it simply stops the inexperienced user from changing settings accidentally. In our case, that is exactly what we needed.

Ted Tait is an engineer with the BBC News and is based in Washington, D.C.

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The power behind the St. Louis Powerhouse

By Dana Martin, associate editor

Two stations move to the heart of the city.

How many radio stations can claim that they once were the site of a discotheque? Or that their building, now a registered historic landmark, was the powerhouse of the city's railroads?

St. Louis stations KIX (106.5) and Extreme Radio (104.1) boast all this in addition to their consistently high ratings. The stations are housed in the Powerhouse building, a name that hearkens back to its early days, when the building served an integral role in the city's railroad industry. Today, the area, known as the Union Station complex, has been revamped as a focal point for the St. Louis tourist industry.

The original Powerhouse building was demolished, but the building's original smokestack was left standing. In 1988, a replica of the building was erected, and the first floor opened as the Powerhouse Disco. Later, the space became the KSHE Real Rock Café. KSHE, a legendary St. Louis rock-and-roll station, is housed in an annex building next to the Powerhouse. When this restaurant closed, the building was unoccupied for about a year. That's when Emmis, which owns KSHE, acquired KIX and Extreme Radio.

New ownership, new location

Because Emmis wanted its St. Louis stations to be co-located, the choices were clear: either move KSHE to the Westport area, where the newly purchased stations were located, or move the other stations to KSHE. The staff for KIX and Extreme were asked for their input, and they overwhelmingly decided to move to the downtown Union Station complex. Besides being practical, the move had a symbolic meaning. The stations represent St. Louis. Thus, it made sense for them to move into the heart of the city.

Visitors enter the station through a corridor that looks into both control rooms.

was an Alice format and thus did not require a huge studio. Alice in turn began operating out of a production room. Because space was tight during this interim period, KTRS rented an area in another part of the building for its sales and administrative offices.

A rigid timeline

The time frame for completion of the move was accelerated. Like KTRS, Kix and Extreme were under lease constraints, and they had to move out of the Westport location quickly. Renovation on the Smokestack began in September of 1998; the move was completed by February 15, 1999. This was the stations' drop-dead date, and they came through without a hitch. To keep up with this aggressive schedule, the stations used a local builder, ICS. They also assembled a team of engineers, who were primarily local,

The logistics of the move took form early in the process. Another station in town, KTRS, a news/talk format on AM 550, had just been purchased by an investor group and was looking for new facilities. KIX and Extreme struck a deal with KTRS: The latter would not only move into the Westport location but also purchase almost all of KIX and Extreme's equipment. Therefore, instead of simply vacating the facilities, KIX and Extreme were afforded the rare opportunity of leaving behind almost all of the hardware in the facility as well. All KIX and Extreme packed up was its Scott Studio audio platform and equipment that applied only to FM. Besides simplifying the process of leaving the Westport location, the deal with KTRS gave KIX and Extreme enough capital to finance their new building.

During the move, the two companies coexisted for about six months at the Westport location. KTRS was under a tight deadline to vacate its former facility, so it took over the studio for 104.1, which at the time

St. Louis Powerhouse

The control room for KIX. The stations' control rooms are set up to mirror one another. Each provides enough room for several guests at one time.

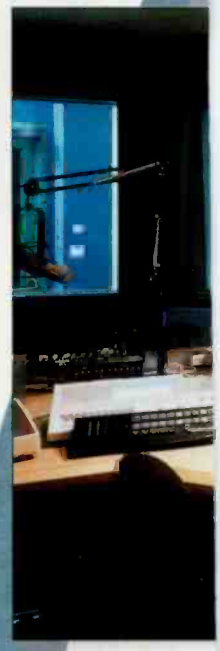
to buttress the stations' full-time engineering staff.

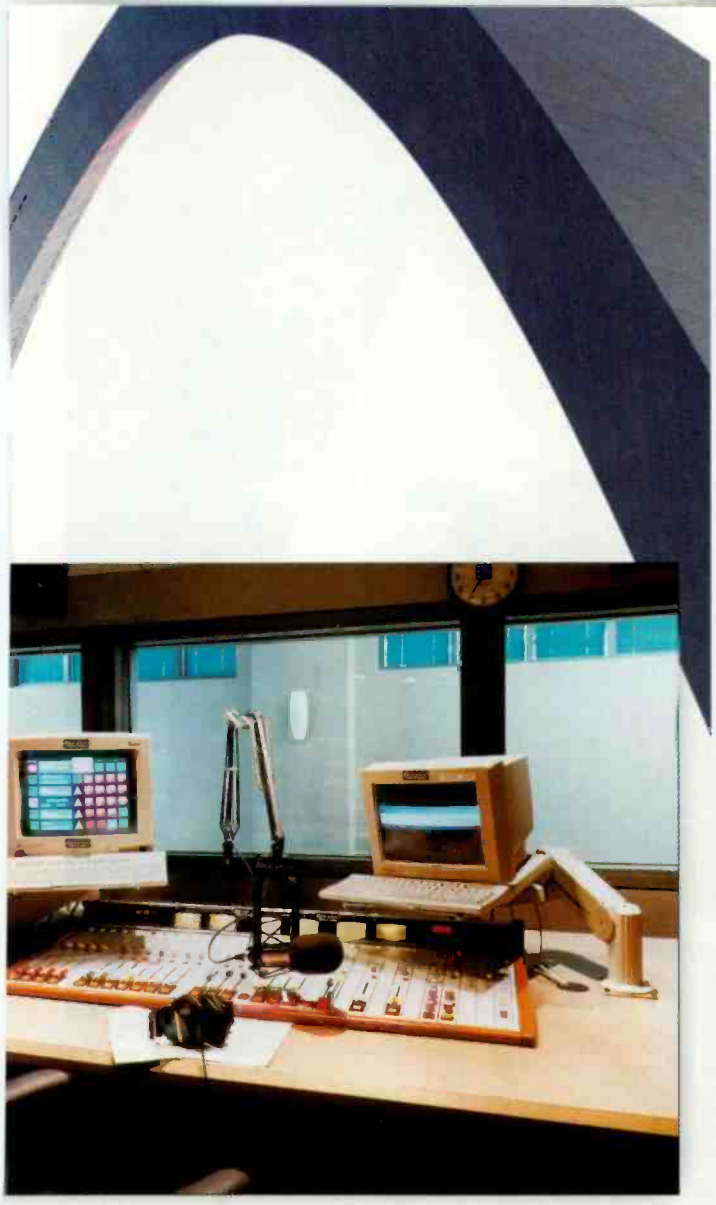
The Lawrence Group was hired as the project architect. The design team decided to play up many of the building's unusual architectural details. To this end, the sales area lies on the building's disco dance floor. Likewise, the disco's DJ booth is now a balcony conference room. Another conference room is located directly under the smokestack; its circular shape mirrors that of the stack itself. To give the space the feel of a radio station, the architects employed design elements that play on the industry, including a sine wave-shaped hall and a bright orange mast-type cable housing that runs from the ceiling to a ledge in the kitchen area.

The two stations' main studios are located across from the reception desk. When they enter the station, visitors can view both of these studios as well as the equipment in the rack room, which is on display behind glass panels. This layout is similar to that used at the Westport building.

On the air

Each station has its own air studio, and the two rooms are mirror images of one another. Equipment in the rooms is identical. The furniture in both rooms was custom-built by Classic Woodworking, a St. Louis-based company. Each air studio uses a Wheatstone A-6000 console and the Scott Studios digital audio system for music and commercials. Ceiling-mounted Acoustic Research monitors with a subwoofer were chosen for the rooms to warm up the sound. Four shock-mounted Rode broadcaster condenser mics are used. Denon CD players are used for request cuts and special shows, like the *Top Five at Five*, and Extreme Rock's ret-





The Extreme control room. The station changed from an Alice format after moving into the new facility.

ro rock segment on the show *Hairspray Café*.

For the telephones, Telos hybrid and switching equipment is used; this equipment comes into play during the *Steve and DC Show*, the phone-intensive morning show on KIX. Instant Replays are also critical to this show. There are two in each room. A 360 Systems Short Cut is used for phone replays. A Telos call screener system allows for call-ins. There is a separate PC on the office network that is linked to Emmis' WAN for Internet access as well as Internet communication with listeners. This PC also runs Promo Suite software, which tracks listeners, prizewinners, promos and announcements.

Connection to the KSHE studios is achieved through an underground conduit to the Annex building. This link between the two buildings is used for the phone system, computer network and audio signal routing.

In production

In addition to the production rooms, the imaging director for each station has an imaging suite for production all of the stations' creative and marketing promos and liners. The rooms serve as two rooms in one: half

St. Louis Powerhouse

One of the two full production rooms. The studios have identical layouts and equipment.

In the racks

Rack 1. ESE master clock, Orban 8100A processor for backup use, link control terminal for uplink control and monitoring, SierraCom 2600 VSAT controller for Ku-Band uplink, two Comstream CM-701 modulators for Ku-band uplink (main and backup), Comstream DAC-700 digital audio codec for Ku-Band uplink, Best Fortress 1.4 KVa UPS.

Rack 2 (for Extreme). Carver TX-2 FM tuner, TFT 844 FM stereo modulation monitor, Dolby 740 spectral processor, Orban 222A spatial enhancer RE-533 RBDS coder, Orban 8200 Digital Optimod, two Moseley PCL-606 composite STLs (main and backup), Moseley TPT-2 STL transfer panel, dbx 166 audio compressor/limiter for uplink audio limiting, Comstream DAC-700 digital audio codec for Ku-band uplink (backup), SierraCom 2322 VSAT controller for Ku-band uplink (backup), Best Fortress 1.4 Kva UPS.

Rack 3 (for KIX). Carver TX-11 FM tuner, the TFT 763 modulation monitor, Aphex compeller AGC, the Dolby 740 spectral processor, Orban 222A spatial enhancer, RE-533 RBDS coder, Orban 8200 Digital Optimod, two Moseley PCL 6010 composite STLs (main and backup), Comstream ABR-200 digital satellite receiver for uplink monitoring.

Rack 4. Symetrix 528E voice processor for satellite talk-show level control, two S/A Encore DSR-3610 satellite receivers, RAM SR-10M audio monitor, a SAS 16000 routing switcher, Telos Zephyr and a Comrex Vector, two dbx 160X compressor/limiters for IFB and audio control, Moseley RPL-4020 RPU receiver, Gentner EFT-3000 three-line extender, StarGuide II digital receiver, Best Fortress 1.4 KVA UPS.

Rack 5. CRT terminal for the network server and administration of the voice-mail system, a Lucent terminal for phone system switch administration, an ATI Quad distribution amp for EAS audio distribution, and TFT/Gorman Redlich/Yahama receivers for EAS audio reception.

Rack 6. Cisco router/Paradyne CSU-DSU for T1 WAN routing, an H/P ShurStor tape backup for the LAN server, two Precision Electronics Axiom 125 power amps for office PA/paging, a Pentium PC for phone switch call accounting, a Pentium Pro/RAID array LAN server (Novell 4.11), and a Pentium Novell server for the Scott Studios digital audio platform.

The imaging suites serve as an office and a production studio for each station's imaging director. Though small in size, the rooms house a wealth of production tools.

office and half studio. Each suite has a Mackie console (one room has a 1604, the other an SR24•4), Yamaha NS-10M near-field monitors, a SAW editor running on a Windows NT workstation and Rode NT-2 mics. The rooms used to have a rack of external processing equipment, but now most of this equipment is in the form of PC plug-ins. The studios recently incorporated Sonic Forge software, a plug-in package from Sonic Foundry. The idea for these space-saving, dual-purpose rooms came from a makeshift room that was incorporated in the Westport facility in the sales area. Everyone liked the concept so well it was replicated in the new facility's design.

Equipment for the two full production rooms includes the following: Harrison Pro 950 consoles, SAW digital production workstations, Scott Studios terminals, Acoustic Research monitors and subwoofers, Yamaha power amps, Tascam DAT machines, and Plextor CD burners.

Each of the rooms has a control head for an SAS routing switcher. All of the studios are backed up by UPS. The stations' surge suppression equipment is by Innovative Technologies; Tripp Lite isobars are also used for this purpose.

Other rooms include a post-production/producer booth for the *Steve and DC Show*. This room can serve as

St. Louis Powerhouse

The news preparation booth provides a quiet workplace and allows for better isolation during the morning news.

a screener room, a multifunction room and a backup air studio. There's also a small news preparation booth with a Mackie 1402 mixer. To allow for growth, a future studio was also built. This studio is currently used for off-air monitoring and as a green room for guests.

With the kind of growth these Emmis stations have experienced lately, don't expect that extra studio to function as a green room for long. And when the time comes to install a third studio, you can bet this seasoned technical staff will be poised to carry out a quick and seamless job.

Thanks to Sam Caputa, director of engineering, and the Lawrence Group for their help in preparing this article. Facility photos courtesy of the Lawrence Group.

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BD003

2 Please check the ONE type of facility or operation that best describes your primary business classification:

- A ☐ Radio Station & Network (including education, government and religious)
- C ☐ Recording Studio (including education, government, religious, production and research)
- D ☐ Consultant
- E ☐ Contract Engineer (including maintenance, technical support)
- G ☐ Dealer or Distributor
- F ☐ Other (please specify) _____

3 Which of the following best describes your title? (Check only ONE box.)

A. Company Management:
- 01 ☐ Chairman of the Board
- 02 ☐ President
- 03 ☐ Owner
- 04 ☐ Partner
- 05 ☐ Director
- 06 ☐ Vice President
- 07 ☐ General Manager
- 08 ☐ Other Corporate/Financial Official (including corporate sales)

B. Technical Management & Engineering:
- 19 ☐ Vice President Engineering
- 09 ☐ Technical Director/Manager
- 10 ☐ Chief Engineer
- 11 ☐ Other Engineering or Technical Title

C. Operations & Station Management/ Production & Programming:
- 12 ☐ Vice President Operations
- 13 ☐ Operations Manager/Director
- 14 ☐ Station Manager
- 15 ☐ Production Manager
- 16 ☐ Program Manager
- 17 ☐ News Director
- 18 ☐ Other Operations Title

D. Other (please specify) _____

4 Which statement best describes your role in the purchase of equipment, components and accessories? (Check only ONE box.)

- A ☐ Make **final decision** to buy specific makes, models, services or programs
- B ☐ **Specify** or **make recommendations** on makes, models, services or programs
- C ☐ Have **no part** in specifying or buying

5 Which of the following types of equipment will you be evaluating for purchase in the next 12 months? (Check ALL that apply.)

- 01 ☐ Audio distribution services
- 02 ☐ Audio mixers
- 03 ☐ Audio monitoring
- 04 ☐ Audio processing
- 05 ☐ Audio recorders/players
- 06 ☐ Automation equipment
- 07 ☐ Consulting, contracting & design services
- 08 ☐ Data compression codecs
- 09 ☐ Digital audio workstations
- 10 ☐ Information services
- 11 ☐ Microphones and accessories
- 12 ☐ Racks, studio furniture and cases
- 13 ☐ RDS/RBDS & subcarrier equipment
- 14 ☐ Routing/switching
- 15 ☐ Satellite equipment
- 16 ☐ STL, RPU, & remote site control
- 17 ☐ Tape/optical storage
- 18 ☐ Telephone interfacing/POTS and ISDN
- 19 ☐ Test & measurement equipment
- 20 ☐ Transmitters/antenna systems/towers
- 21 ☐ Wire and cable
- 22 ☐ Internet/streaming audio equipment & software
- 25 ☐ None of the above

6 What is the budget for equipment and services you are evaluating for purchase in the next 12 months? (Check only ONE box.)

- 1 ☐ Less than $10,000
- 2 ☐ $10,000 - $24,999
- 3 ☐ $25,000 - $49,999
- 4 ☐ $50,000 - $99,999
- 5 ☐ $100,000 - $299,999
- 6 ☐ $300,000 - $499,999
- 7 ☐ $500,000 and up

7 If you checked A on question #2, what is the MSA rank of your market? (Check only ONE box.)

- A ☐ Top 20
- B ☐ 21 to 50
- C ☐ 51 to 100
- D ☐ Over 100

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www.systemstore.com

SystemsStore.com: Doing your own studio systems project? This site has everything you need, including advice! Assembled by the experienced staff at RDA Systems, the site has over 1200 items including racks, cable, connectors, cable ties, D-rings and punchblocks, all from well-known names like Belden, Gepco, StudioHub, Panduit, and Neutrik, and much, much more. New items are added daily and everything is available for ordering on-line!

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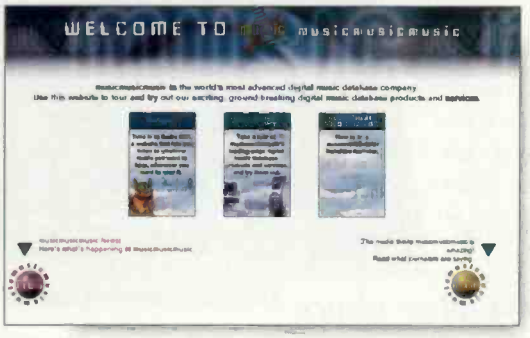

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Logitek ROC digital console

By S. Parks Hall, CPBE

Stations large and small have been slow to install or replace analog consoles with new digital devices. Yet a growing number of station decision makers are taking a serious look at the rapidly expanding number of digital consoles and are choosing to go digital. If you tune into the buzz at professional gatherings and on Web chat groups, you know few are expressing sorrow about having made the move to digital.

When it came time to choose either analog or digital consoles for Brewer Broadcasting's new facilities in Chattanooga, TN, I decided to go with digital boards. I selected the Logitek ROC series, specifically two fully loaded Audio Engines and four ROC-10, ten-fader control surfaces.

Performance at a glance

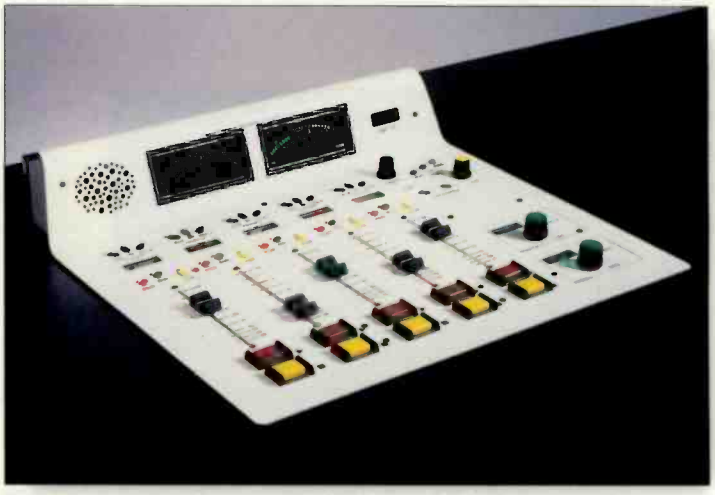
- Compact audio engine
- Centrally located electronics
- Five- or 10-channel controllers
- Router and console combined
- Fully programmable

There seem to be two divergent visions of just what the digital console should be. The majority of product offerings at this time follow the traditional radio model, that is, a piece of equipment that looks, feels and installs like the familiar analog console — except its inner workings are digital. The other approach has its origins in television and is an extension of the central router concept.

A router platform

Logitek's radio consoles employ the router concept. At the heart of this approach is the Logitek audio engine. The audio engine is not only the nucleus of the company's two digital console offerings; it *is* the console. The engine occupies seven rack spaces. Considering the power of this box, its small size is a wonder. What these consoles offer is computerlike routing and a digital signal processing system. Data communication takes place over a single bus running at a speed of 33MHz and uses *time division multipath* technology. Everything except the backplane is modular. The brain of the box is the AEC-2 card, a 16-bit microprocessor-controller. Up to two DSP cards can be installed, depending on how many I/O cards and control surfaces will be used. Each engine will support up to eight analog and/or digital I/O cards. The housing accepts two power-supply modules to offer redundancy. Each analog I/O module accepts eight inputs and eight outputs. The digital modules support four stereo AES I/Os, 110Ω balanced or 75Ω unbalanced. New digital modules soon to be available will provide eight stereo I/Os.

The engine contains a communications controller *general-purpose interface* (GPI) that provides 15 dry-contact output closures and 15 TTL input channels. All can be programmed within the setup software to interface with automation systems, provide tallies or provide other outside-world interfacing. Each analog I/O has its own A/D converter. The digital inputs will match any sample rate from 25kHz to 50kHz. The sample rate of output may be locked to an external source as well as 32kHz, 44.1kHz or 48kHz internally.

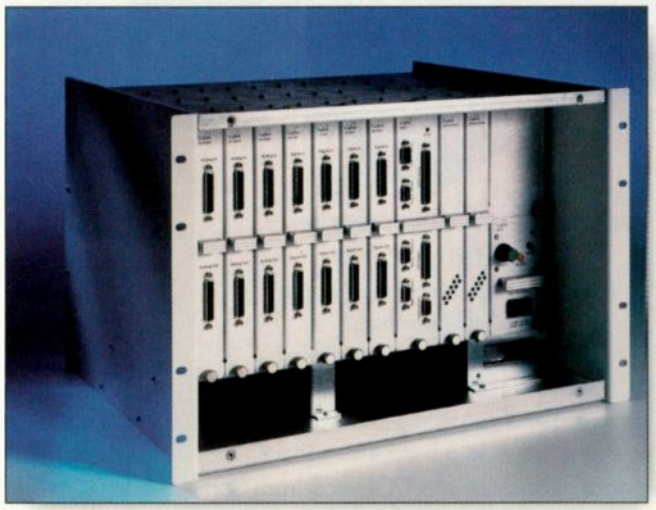


The ROC control surface is available in 5- and 10-channel versions.

All connections are made to the audio engine via DB

connectors. However, Logitek offers several wiring interface options that should be considered to avoid time-consuming and error-prone direct connection to the engine. The XLR interface is highly recommended; it provides 16 rear-facing XLR connectors in a single rack space, with any length of cable specified. At the Brewer installation, there are two engines and 16 interface panels mounted in one 44-rack space cabinet. From the front, nothing is visible except nicely finished ivory panels.

The consoles themselves are remarkable. Each engine will support three control surfaces, two 10-fader units and one five-fader unit. The base ROC series is attractive, especially with optional maple trim. Other than an AC cord, the only attachment is a single CAT-5 cable connecting it to a serial port on the audio engine. This feature certainly makes for clean operational room installations. Any input can be any source you want it to be with the punch of a button and turn of a knob. Air talent can arrange the board according to their preferences within the parameters allowed in the setup. This flexibility is achieved with the setup software. The channel source at any given time is displayed above the fader in an LCD window along with other information. Four segmented digital meters read VU and peak audio levels.



The audio engine is the real workhorse of the system.

A software package called V Mix can run on a PC and is a virtual console alternative to the control surface. This tool is being used in several production situations as well as in smaller studios and newsrooms.

Test drive

The company provides demo versions of the setup software for potential customers. The software runs on Windows 95 or 98. If there is a key to a satisfactory experience with this equipment, it is gaining a thorough understanding of how this software works. It isn't difficult to use, but it is a totally new way to approach an audio console installation. A traditional console comes to you preprogrammed. You may make only a few simple

decisions, usually using jumpers or DIP switches. The Logitek comes to you completely unprogrammed unless you have asked for a starting setup to be downloaded.

I found it was better to program the Brewer consoles myself. Sitting down at the computer weeks ahead of the actual installation offered a terrific opportunity to design the entire studio installation and configure the console system ahead of time. Building the console system is an exciting experience: You realize how much control you have over the finished configuration. Once the installation is complete, you can fine-tune the setup to your heart's content and have as many different setups as you wish. Downloading into the engine is done from any computer with a spare serial port. A new download can be done on the fly in seconds with only a momentary audio dropout if the system is one the air.

The software provides several screens from which to work. The primary screens are hardware setup, input and output settings and surface settings. The hardware window lets you tell the engine how many audio, DSP and power-supply modules you have installed as well as how many and what type of control surfaces you are using. The I/O windows and subwindows give you a vast number of options, which include choosing connection pin numbers, level settings, mode, digital sample rate and mute bus assignments. This is also where you make labels that will appear above the console fader and describe the nature of the source or output. Additional links from these windows provide GPI setup and configuration of submixers and routers built into the software. The control surface window allows you to tell the control surfaces what inputs can appear on each fader of each control surface and each of the three monitor inputs.

At the Chattanooga stations, 110Ω digital cable was used for all inputs and outputs to the audio engine, regardless of whether or not it was digital. This makes changing from an analog source or destination to digital simply a matter of changing

Also available is the Nu-Mix control surface, which uses the same audio engine as the ROC series.

the I/O module. Good engineering practice will yield a functional and visually appealing installation in spite of the many cables going to and from the engine interfaces.

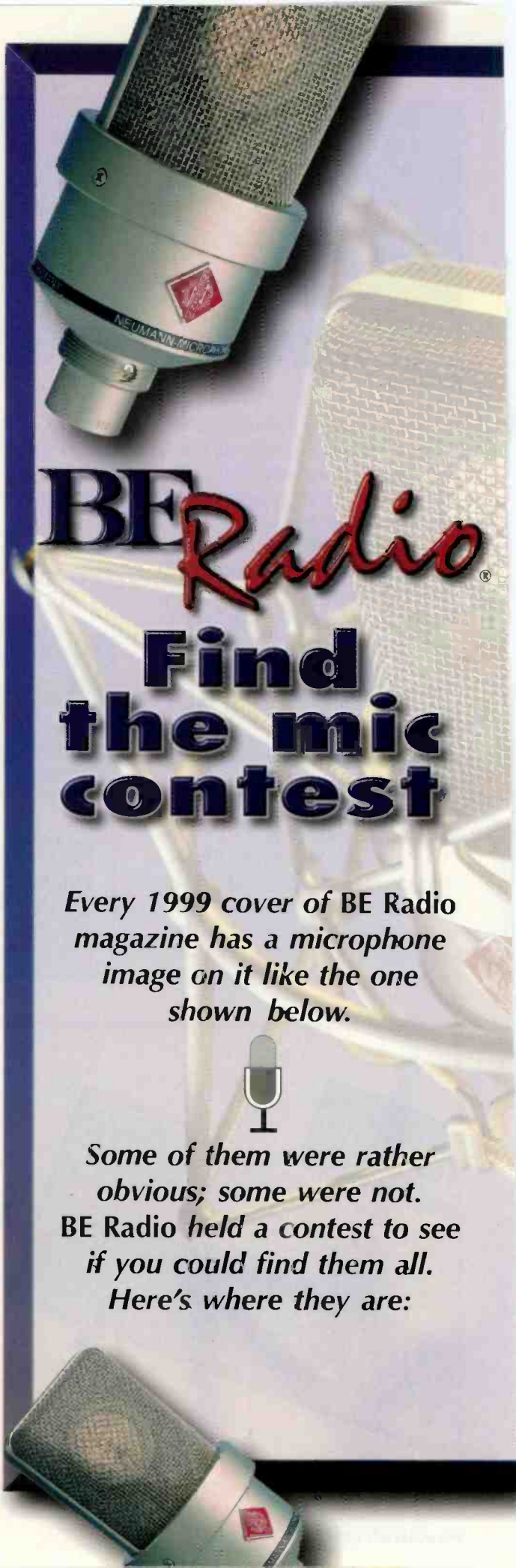
Taking the central router concept further, the computer workstations and servers for the facility digital audio delivery system, STL, processing, satellite and other major equipment are all located in the same equipment room with the Logitek system. This allows short, direct digital paths between the computer audio cards and the Logitek digital inputs. This design also allows for the pampering of all vital equipment in its own controlled and secure environment.

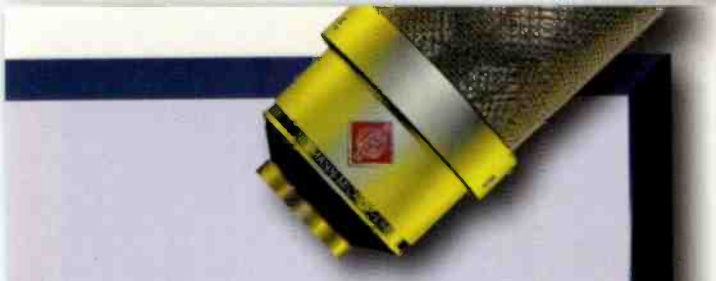
The digital consoles at Brewer Broadcasting have been online since July of 1999. Everyone from management to air staff feels positive about the sound quality, versatility and reliability of the equipment. During and after the installation process, the level of field support has been superb. Logitek has done it their way, and their way works for Brewer.

Parks Hall operates Broadcast Engineering Services in Chattanooga, TN.

See the complete Brewer Broadcasting facilities in the Studio Spotlight at www.beradio.com. Go to the Studio Spotlight index and select WMPZ/WJTT, Chattanooga.

Editor's note: *Field Reports are an exclusive* BE Radio *feature for radio broadcasters. Each report is prepared by well-qualified staff at a radio station, production facility of consulting company. These reports are performed by the industry, for the industry. Manufacturer support is limited to providing loan equipment and to aiding the author if requested. It is the responsibility of* BE Radio *to publish the results of any device tested, positive or negative. No report should be considered an endorsement or disapproval by* BE Radio.





- ***January***: On the corner of the rolled-up blueprint
- ***February***: In the coat-of-arms above the stage
- ***March***: In the circuit board points above the man with the hat
- ***April***: In place of the top right eyelet of the spring-mounted mic
- ***May/June***: As a shadow on the ground under the words "Part 5"
- ***July***: Next to the word "July" below the *BE Radio* logo
- ***August***: On the telephone next to the console
- ***September***: On the girder to the left of the words. There are six of them.
- ***October***: In place of the beacon on the right-most pylon
- ***November/December***: Above the N in the word "integration"

Several entries had the correct location for all 10 covers. A random drawing was held from these entries, and the winner of the *BE Radio* ski shirt and Neumann TLM103 microphone is:

Ross Pierce
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Wichita, KS

Congratulations!

Be sure to keep all of your issues of *BE Radio* for the year 2000, because the mic image will also appear on them. Look in the December 2000 issue for details on the next contest.

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Plowing new ground

By Skip Pizzi, executive editor

You've surely heard about the imperative for broadcasters to develop alternate delivery technologies for continued viability in the new-media world. Less adequately discussed, however, are workable business models for these new services. Naturally, the latter is critical to any new strategy, particularly when substantial up-front investments are required.

There are no easy answers here, and there never have been. Remember that broadcasting itself became established as a desirable medium before the business model of commercial announcements was hatched. This almost accidental discovery turned radio into a wildly successful business decades after its initial development, which helped fuel the growth and improvement of the service from that point forward.

Today, we all recognize the unique values of new-media technologies from the consumer's perspective, but we have not yet stumbled upon the key to fueling this effort with new revenues. It is likely just a matter of time before this happens. In the meanwhile, some potentially dangerous trends are emerging.

We all recognize the unique values of new-media technologies from the consumer's perspective.

Killing the golden goose

With the onset of new competition, one might think radio stations would be anxious to keep their existing customers as happy as possible and do whatever they could to expand their audiences. But it seems just the opposite is true. Driven by a robust advertising market, many radio stations are now saturating their listeners with commercials.

Some major-market stations have approached or even broken the previously unimaginable 30-minute per hour benchmark with their commercial loads. The elasticity of listeners' tolerance to commercials is not infinite. When a station is playing more commercials than content, alarms should sound. Such a station is clearly at risk of losing significant portions of its audience as soon as a reasonable alternative becomes available. Other stations have resorted to time compression of network programs to squeeze in a few more local spots.

Supply and demand rules all economics. When advertising customers abound, it's hard to turn them away because of sold-out conditions if those circumstances can be altered by a policy change or the addition of clever hardware. But there can be unintended and undesirable results.

By any measure, the radio-advertising business is booming. Revenues in 1999 were up by double-digit percentages across the board compared with the previous year, with national spot buys increasing by more than 25 percent. It's tempting to want more of the same but, like any good thing, it can be pushed too far. This may already have happened, as evidenced by a drop in the critical metric of time-spent-listening (TSL). Overall TSL to U.S. radio stations exhibited a double-digit decrease across the decade of the 1990s.

Note that this has occurred without much of an alternative for listeners to turn to. If a new medium that provided similar content with fewer or no commercials became available, this downward trickle might become a torrent. That's just what the satellite radio services are counting on: that listeners fatigued by excessive advertising will be primed to accept new services, notwithstanding their use of an unfamiliar and intrinsically alienating subscription model.

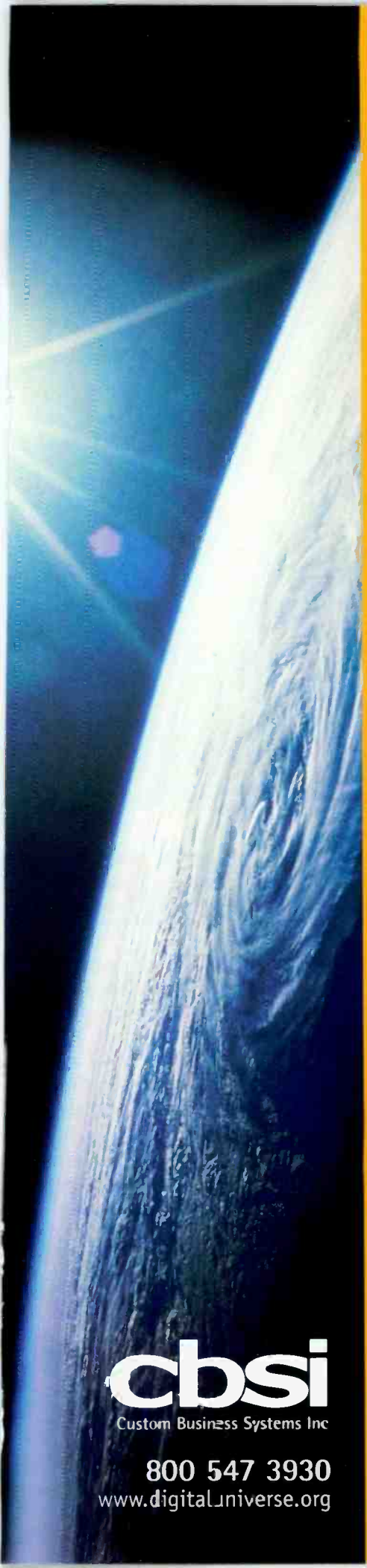
Broadcasters may therefore be advised to "just say no" when it comes to adding more spots to an already heavy advertising load. A far better approach is to raise rates and explore other alternatives.

Taming the wilderness

Broadcasters need to learn how to sell new technologies as soon as they learn how to deliver them. A solid understanding of current web-business practice is essential. Management and sales forces should become familiar with rotating banners, data-mining, usage metrics, click-throughs and e-commerce.

But don't stop there. This new frontier is wide open, and experimentation is the rule of the day. Most of the territory remains uncharted. Remember also that barriers to entry in the online world are low, so there is plenty of nonbroadcast competition out there. One of those players may develop the killer revenue application first, then use it against you.

Broadcasters should focus their efforts on those ideas that exploit the unique synergy of their online plus on-air services. Growing business through careful investment and development of new revenue streams from these areas may be hard work, but it makes far more sense than tilling the same old fields to excess.



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