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The Radio Technology Leader
January 2000
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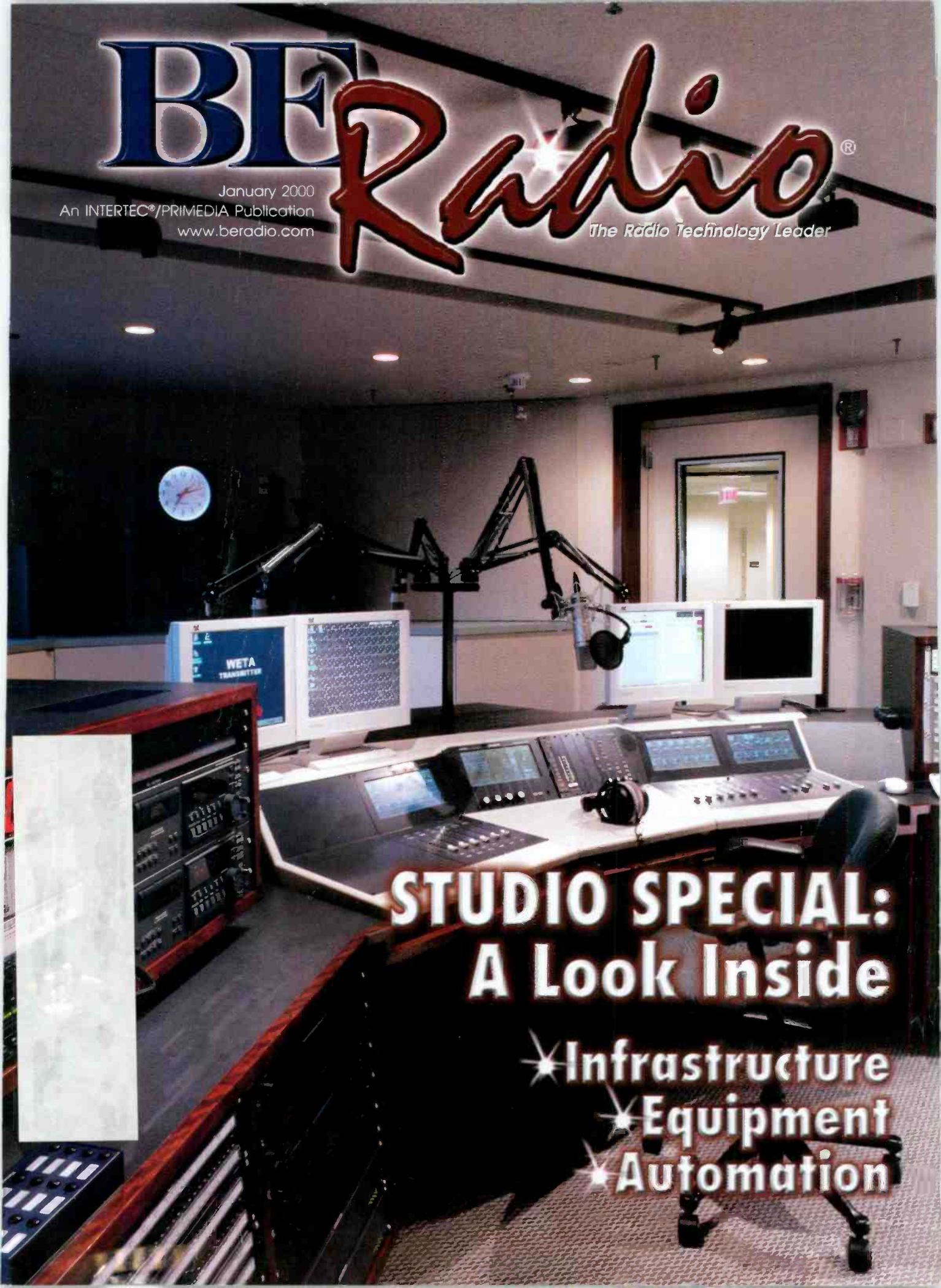

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Placed somewhere on the cover of every 1999 issue of *BE Radio* magazine is a microphone icon similar to the one at the end of all the stories. With a keen eye and a copy of each issue, you can put yourself in the running to win a Neumann TLM103 microphone. Tell us where each image is located and you could qualify for the grand prize drawing. Full contest details are on page 62. **Good luck!**

62

ON THE COVER: Radio's operational home bases are the studios, which must provide a comfortable and practical environment for the equipment and the personnel. Photo of WETA-FM, Washington, D.C., courtesy of Communications Engineering. Cover design by Michael J. Knust.

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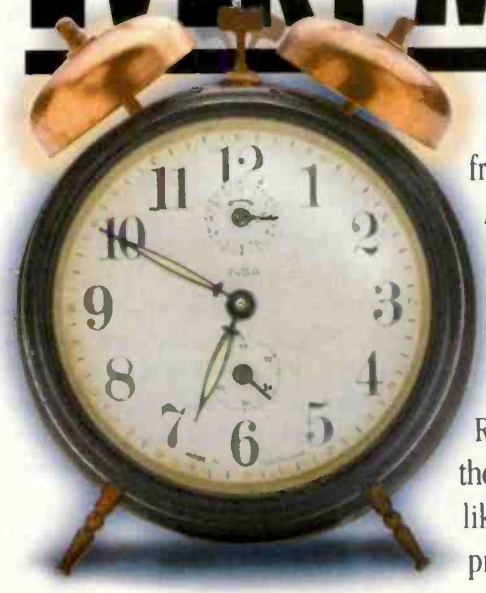

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Viewpoint

The year ahead

How did you survive Y2K? Did you have any problems? I know you're probably tired of hearing these questions now that the big day has come and gone. My guess is you made it through without any serious problems. Now you can prepare for the start of the real new millennium in 2001 and perhaps see the first new steps for radio as well.

This year, we may finally see the start of DAB in the U.S., at least in one form. Both satellite radio licensees are planning to launch their first satellites later this year. These completely new systems will not be ready for subscription until next year, but progress is being made. The marketing campaigns will likely begin to heat up as both providers prepare their commercial service launches.

Meanwhile, on the IBOC side, several twists and turns may play interesting parts in the IBOC launch. The first bit of news was Lucent's decision to not submit test results to the NRSC in December. Lucent cited the FCC NPRM on digital audio radio as the reason for its delayed submission and expects to supply its data to the NRSC by the time a reply is filed with the FCC. Some in the industry naturally feel this decision is simply a delay tactic to allow Lucent additional time for whatever reason.

The Lucent news left USA Digital Radio and Digital Radio Express as the only proponents able to submit their data to the NRSC. Hold on, not so fast. Days before the NRSC deadline, an announcement was made that USADR and DRE have joined forces to collectively work on an IBOC system. Several industry leaders have called for an IBOC grand alliance to be created for some time. Is it possible that this wish will come true?

The USADR/DRE agreement resembles the former alliance held between USADR and Lucent. That alliance was dissolved later when the players encountered differing business methods and ideas. Along this line, there is some history between some of the individuals at USADR and DRE. The two businesses have also demonstrated quite different operational styles: USADR is prominent and vocal, while DRE has worked behind closed doors for most of its existence.

The coalition has advantages for both parties. USADR has strengths in RF and broadcasting. DRE has strengths in subcarrier and data transmission. In many ways, this seems like a perfect arrangement.

I look forward to the findings of the NRSC and the FCC. If all goes well, IBOC may actually be ready in time for the start (the *real* start) of the new millennium.

Chriss Scherer

Chriss Scherer, editor

Win a Neumann TLM103

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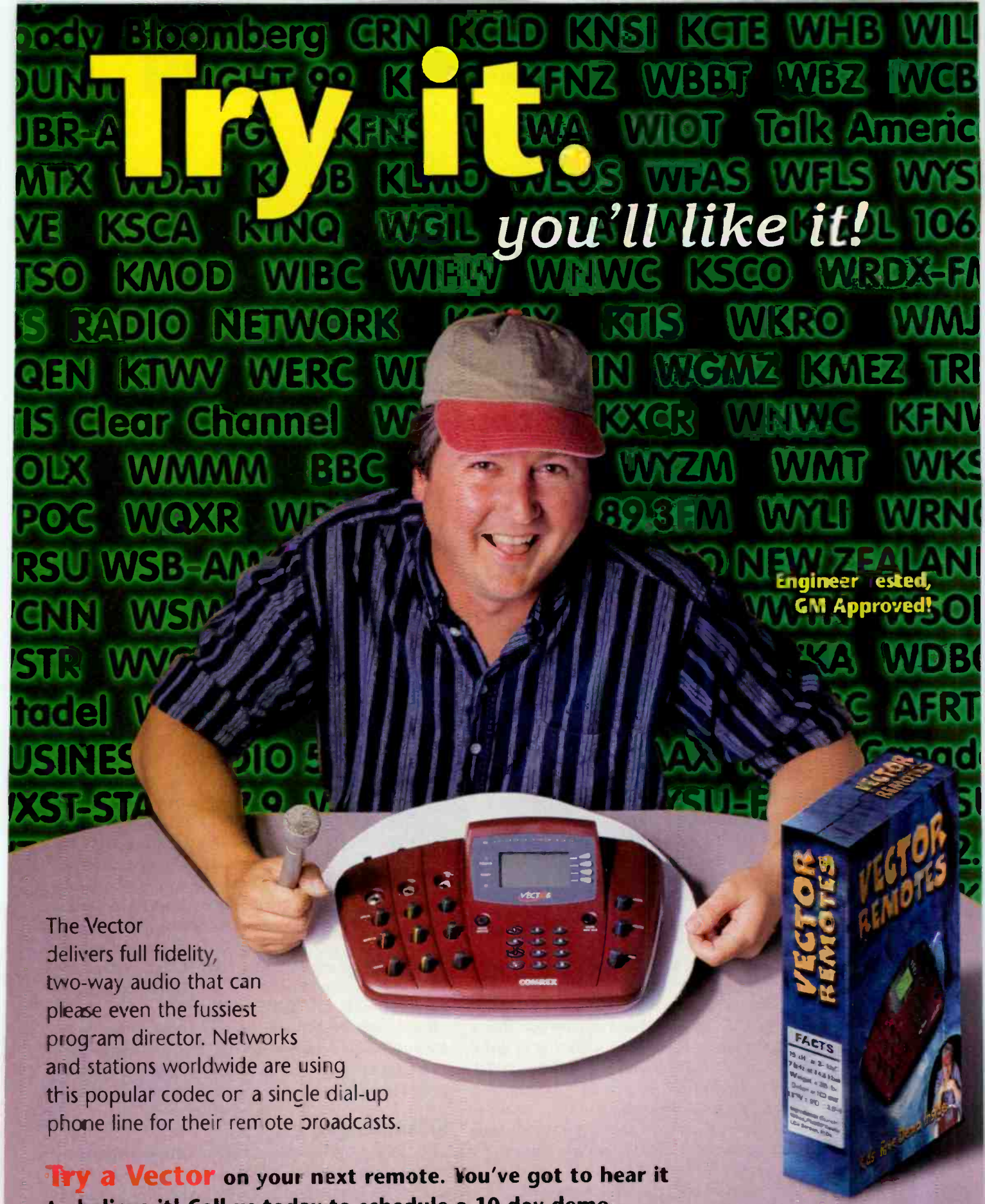

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STL and RPU maintenance

By Kirk Harnack

Outdoor work is either difficult or undesirable during the winter months, so let's examine some indoor tasks. STL and RPU systems are good candidates for indoor winter maintenance. They are often neglected until a problem arises. By then, it is too late to prevent lost airtime.

Proper maintenance can only be done with the proper tools.

The are several options for studio-transmitter links and remote pickup equipment. Many analog RF-based STLs and RPUs are being replaced by spread-spectrum and digital wire-line technologies. In this case, however, *STL* refers to RF-based analog or digital 950MHz radio systems most commonly used in the U.S. *RPU* refers to VHF hi-band or UHF radio systems.

When the work is finished, verify the power levels for both forward and reflected power.

When to maintain

Choosing a time for preventive maintenance on STL equipment depends largely on the availability of a backup system. If a station's sole means of linking the studio and transmitter is one STL transmitter and receiver pair, then a late-night or overnight maintenance session is in order. Having a backup STL system certainly improves scheduling flexibility and convenience.

Keep several goals in mind for an STL preventive maintenance session: Check for existing problems, ensure FCC compliance and make sure the equipment is ready for another year of service.

Here is a checklist to help you meet these goals:

1. Become familiar with the equipment prior to starting;
2. Turn off, disconnect and place equipment in a safe work environment;
3. Open and clean equipment;
4. Examine for wear, overheating and damage;
5. Measure FCC-required parameters;
6. Measure power-supply parameters;
7. Log all parameters possible;
8. Check connectors, coax and pigtail jumpers;
9. Make a list of parts to order for corrective action;
10. Close equipment and reinstall;
11. Check for proper operation.

As part of your maintenence, take a few minutes to skim over the manual. You may discover new capabilities, operating modes or features. Also, work on a clear, well-lighted bench or table. This may necessitate bringing a table to your transmitter site, but the effort is worth it.

Cleaning and examining the equipment are vital to preventive maintenance. Look carefully for overheated components, poor connections, loose hardware, chafed or crimped wires and the like. Don't be surprised if you find dead rodents (or evidence of live ones) or insects. Use a can of compressed air along with a vacuum and a soft brush to get all the dust and debris out of equipment.

If the STL gear uses a cooling fan, pay special attention to cleaning it and any associated filter media. In addition, determine if the fan's rotor is turning smoothly, without vibration or any impairment. This is a great time to note the fan's size and type so that a spare can be ordered quickly. A cooling fan is the most likely component to fail in most equipment, so keeping a spare on hand is prudent.

If any components show evidence of overheating, examine their connections — especially PC board connections — for signs of damage. Intermittent PC board connections caused by overheating can be difficult to track down later.

Follow the rules

FCC Rules Part 74 address the auxiliary services under which broadcasters operate STL and RPU equipment. The text of these Rules is available online from the U.S. Government Printing Office at *www.access.gpo.gov*. Follow links to the Code of Federal Regulations (CFR), Title 47, Part 74. A convenient, indexed website, which accesses the FCC Rules, is available at *www.hallikainen.com*. Part

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74.535 of the Rules addresses emission limitations and occupied bandwidth. Compliance with this section can usually be verified with a spectrum analyzer. Parts 74.465 and 74.562 address frequency tolerance of RPU and STL equipment, respectively.

Another frequent failure point in STL equipment is the power supply. Operating for years on end, the large electrolytic filter capacitors tend to dry out and lose their capacity. The result is excessive power supply ripple, which can cause a myriad of problems in audio, AFC and PA circuits.

Use an AC voltmeter or, preferably, an oscilloscope to read power supply ripple. In conventional power supplies, be sure to examine ripple before and after the regulator. Typical conventional supplies should exhibit no more than 2V of AC component prior to the regulator circuit and less than 50mV after regulation. Also, look for signs of power supply oscillation and correct with bypass capacitors around the regulators.

When the equipment is open on the workbench, make as many measurements as practical while operating into a dry load. Check the power supplies while operating, and check the calibration of any front-panel voltmeters or current meters. Use a spectrum analyzer or service monitor to check for proper carrier deviation and calibration of front-panel VU or modulation meters. If the manual indicates other internal test points, make note of their values. Measurements of numerous parameters can greatly expedite troubleshooting. The few minutes required to gather this information could pay off quickly when the station is off the air.

Before closing the equipment, check the condition of the input and output connectors. Some RF connectors are damaged when fitted with poorly made coax connectors. Check their connection with internal circuit boards or coax jumpers inside. Flexing of cables outside can cause PC board cracks and poor connections inside.

Finish the job

When your lists of items to order or other corrective actions to be taken are complete, close and replace the equipment in its operating location. Be especially careful when attaching N connectors; it is easy to misthread these and damage the center conductor.

Recheck all the operating parameters including forward and reflected power on transmitters and observe proper deviation. On STL receivers, log the received signal strength under operating conditions.

Most of this discussion has centered on STL and RPU transmitters, but maintenance of their receivers is just as vital. Power supplies, local oscillators and internal connections are all important points to examine.

It is often difficult to set time aside for preventive maintenance. Day-to-day emergencies often keep us from tasks we know will save us trouble in the future. Consider the importance of your STL and RPU systems and their reliability in your stations' operation. You may decide to schedule that maintenance sooner rather then later.

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

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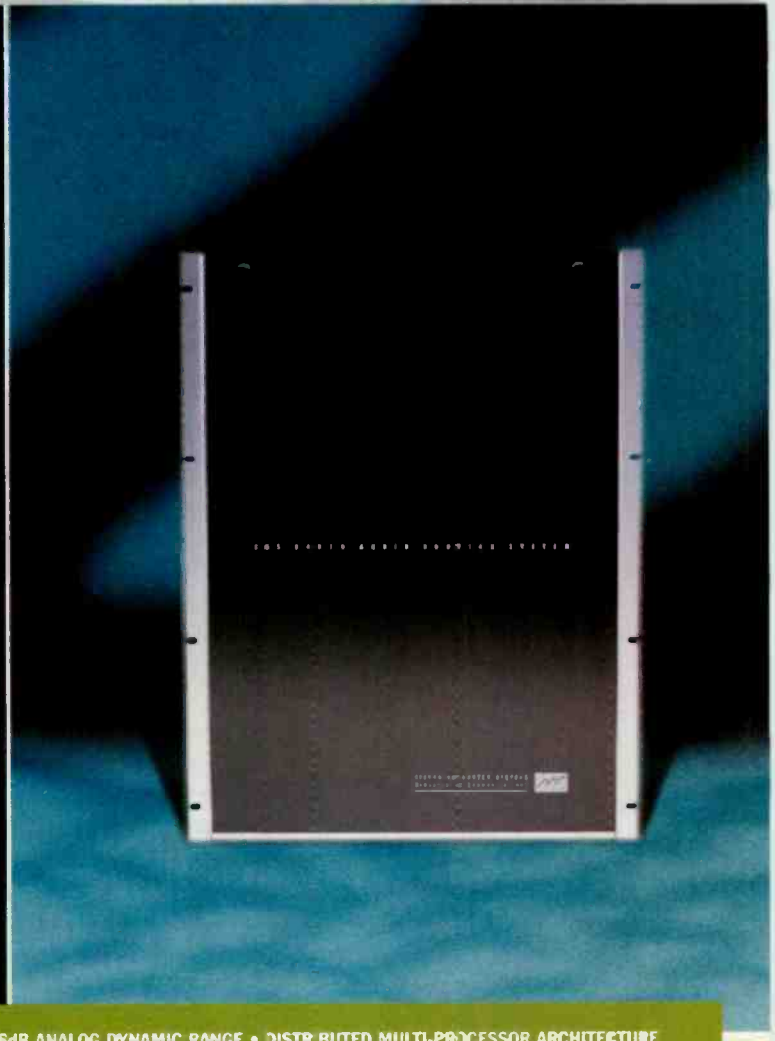

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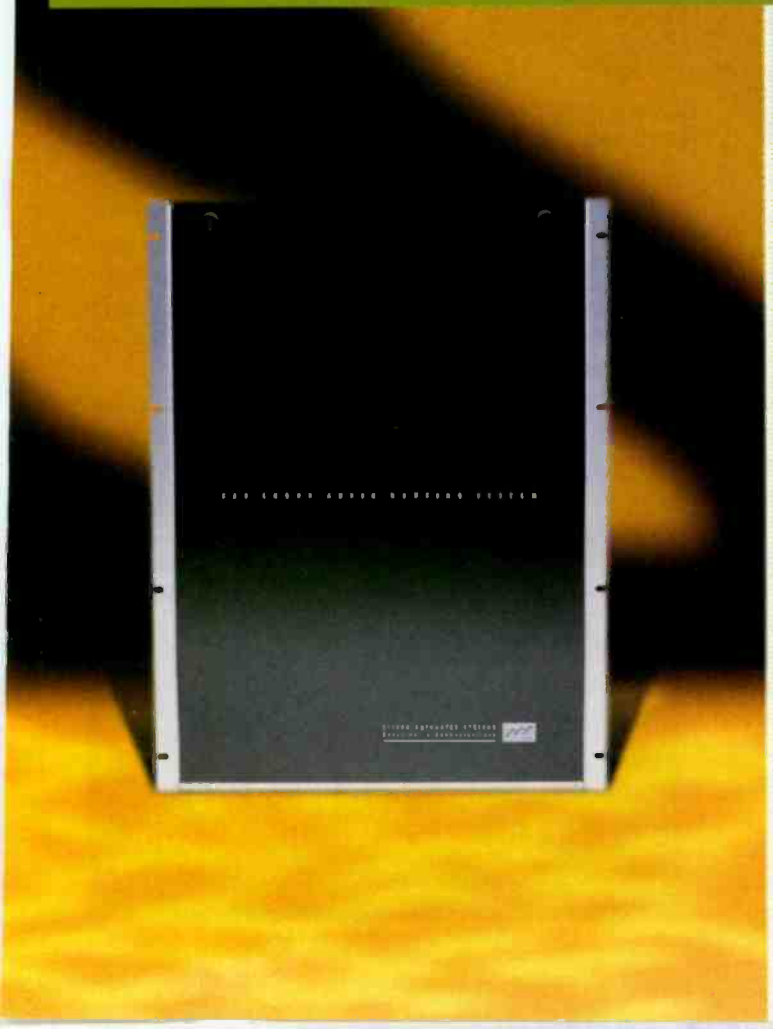

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S-DARS update

By Chriss Scherer, editor

Change is inevitable. This year, we should witness significant changes in the radio industry. One of those changes is the launch (literally) of a new radio service. *Satellite Digital Audio Radio Service* (S-DARS) is scheduled to begin later this year. The two licensees, Sirius Satellite Radio and XM Satellite Radio, are moving forward with their plans to provide a nationwide audio service to subscribers.

To review, the two companies were awarded their licenses in April 1997 through an FCC auction for spectrum. The two licensees each paid more than $80 million for their licenses to establish their satellite-delivered services, operating in the S-band frequency range. Both had initially set launch dates in 1998. Then they moved the dates back to 1999. Now they plan to have their satellites in the sky later this year. Each provider is planning for up to 100 program channels, for a subscription fee of less than $10 per month.

Current progress

Sirius and XM have changed their names since their inceptions. XM, formerly American Mobile Radio Corporation, changed its name just over one year ago. Sirius recently changed its name from CD Radio. In both cases, marketing plans prompted the name changes. Because subscribers will support both services, an appealing and marketable name is essential.

Both licensees have pursued and signed agreements with equipment manufacturers for consumer hardware. Most of the major receiver manufacturers have agreements in place with one or both of the satellite companies. When service begins, the primary audience will comprise those with mobile reception in automobiles. The reason for this is that the S-band signal will not penetrate most buildings and it will be adversely affected by the urban canyons in downtown areas. A stationary listener base will develop as a network of terrestrial repeaters is set up to supplement coverage.

Availability of consumer equipment is vital to making the S-DARS systems work. Some of the agreements outline aftermarket equipment, and some are looking ahead to OEM-installed receivers. Receivers for either service are expected to have analog AM and FM reception capability, but there are currently no announcements to have receivers capable of receiving signals from both licensees.

XM and another DAB player, Lucent Digital Radio, recently reached an agreement. LDR, a division of Lucent Technologies, has licensed its *Perceptual Audio Coder* (PAC) technology to XM. LDR already uses PAC in its own IBOC DAB system. This agreement also opens the door for XM's technology partners to manufacture PAC-capable equipment. The deal seals PAC as the audio coding technology for S-DARS because Sirius Satellite Radio also uses PAC in its system.

Both service providers expect to launch satellites this year.

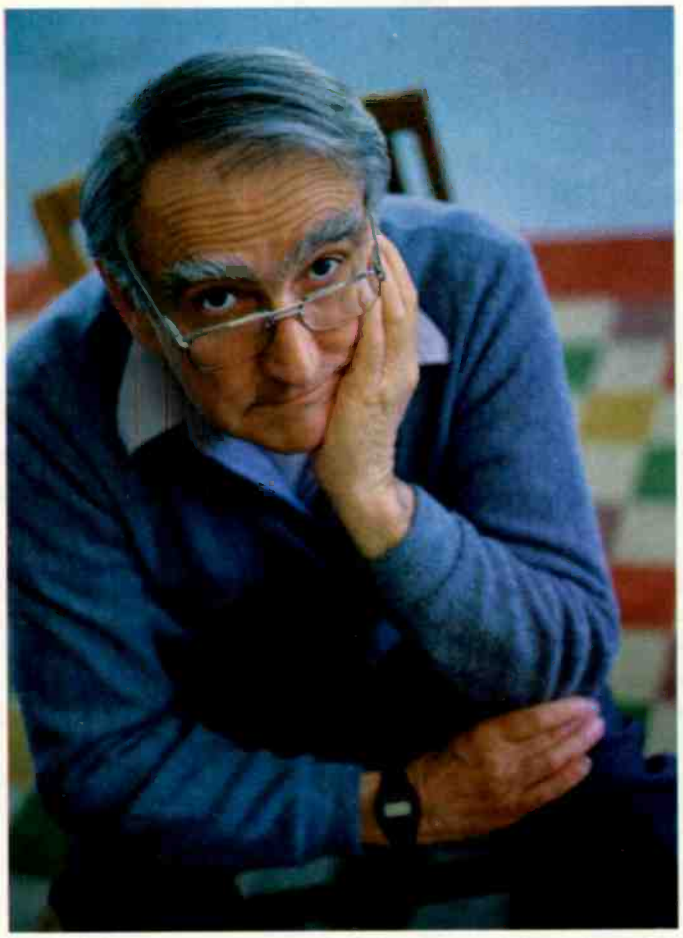
Launch dates

XM plans to launch the first of its two satellites at the end of this year and the second early next year. This plan will allow XM to begin commercial program distribution in the second quarter of 2001. Sirius' dates are much earlier. It plans to launch the first satellite on January 17. The second will be launched in March, and the third will be launched in May. Following some system tests, Sirius plans to begin service delivery at the end of this year.

Both providers have been active in securing audio programming partners to occupy their services. Prominent networks and program providers have entered agreements with both companies.

On the studio side, Sirius recently completed its studio facility in New York. These facilities are all-digital, from audio playback to the uplink. A unique feature of this facility is its satellite control center, where the routine satellite operations can be monitored.

The studios for XM will be built in Washington, D.C. The company recently selected building space for the facility.



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Ground systems

By John Battison, technical editor, RF

Two hurdles lie between the transmitter and the listener: the antenna and the ground system. The latter is usually buried under several inches of soil and forgotten. This month, the ground system is our focus. First, we'll discuss AM grounding, followed by a discussion of FM grounding.

The AM ground system

It used to be that the FCC required a drawing of the ground system. With time, variations in the approved FCC ground appeared, which the commission accepted. The rule requiring 120 radials the same length as the antenna, typically at least ¼ wavelength long, is not as rigidly enforced as it once was.

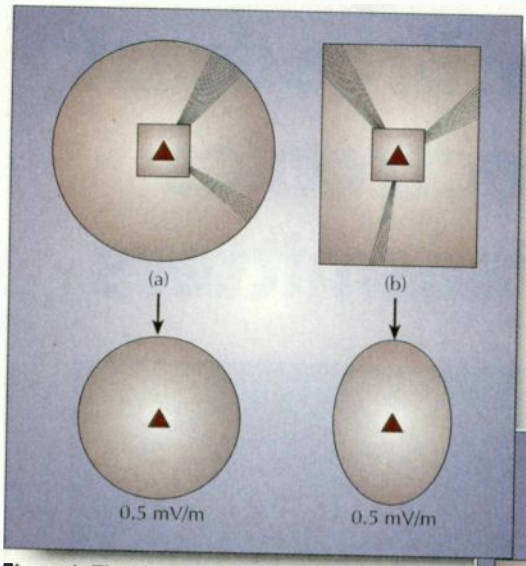

Figure 1. The shape of the ground system (top) can influence the radiation pattern (bottom).

Today, the ground system is scarcely mentioned. Instead, paragraph 73.188 of the Rules specifies the required RF performance of an AM antenna system; the ground system enters as a part of the overall radiating system. The actual size of the ground system has a small effect on the station's coverage, as shown in Figure 1.

Minimizing ground losses

The purpose of the ground system is to return the space conduction currents as directly as possible, with minimum I^2R ground resistance losses, to the base of the antenna. The all-important radiation resistance does not include ground resistance. Unfortunately, the measured base operating resistance that we use to calculate the radiated power includes the ground losses. The higher the ground resistance, the lower the radiated signal because some RF is being wasted in heating the ground. It follows that, as the ground system is more efficient and has lower loss, the radiated signal will be greater. For application purposes, the FCC requires an assumed ground loss value that depends on the actual ground system used.

It is evident that the highest currents will appear in the immediate vicinity of the antenna. It is therefore logical to provide the lowest resistance path in this area. See Figure 2 for radials around a building. If the soil conductivity is high, such as in marshy or moist river-bottom ground, 120 ¼-wavelength radials will work well. You might think a tower surrounded by sea or fresh water would be desirable. Such installations can be extremely efficient. However, potential concerns must be considered, such as the possibility of flooding, corrosion of the ground wires and changes in water levels.

It is common to surround the tower base with a 24-foot square, expanded copper screen. Before going any further, make sure all transmission lines, AC, monitor, phone and other lines are installed in a plastic conduit below the screen.

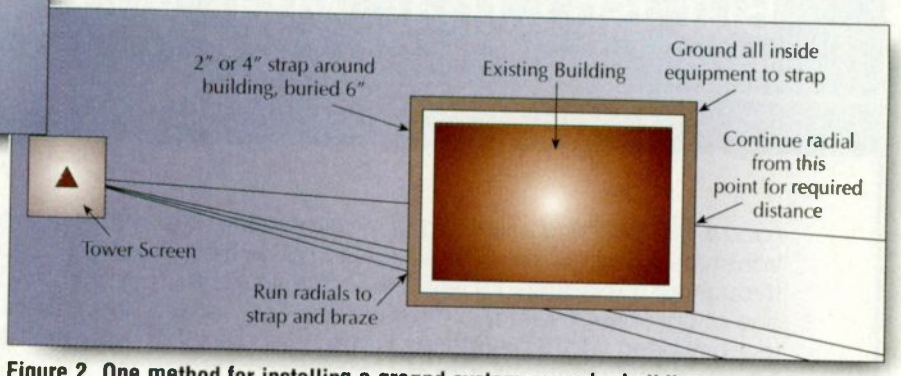

Figure 2. One method for installing a ground system around a building.

The directional array

If a directional antenna is being installed, a 4-inch copper strap must connect each tower base and the transmitter building.

Commonly, ground radials are buried to protect them from damage and theft. A ground system laid *on* the ground is slightly more efficient. Today, the FCC seems to be more open-minded and will consider unusual systems, provided these systems include adequate engineering detail. Tim Cutforth, P.E., designer of a number of stations using variations of aboveground systems, has published several papers on this subject in IEEE BTS publications.

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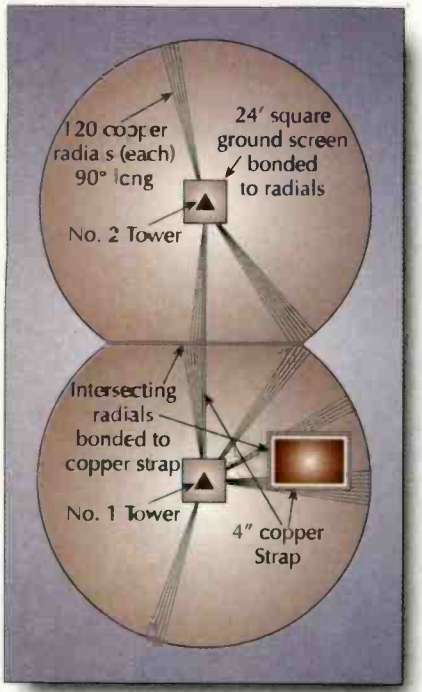

Figure 3. Each tower's ground screen must be securely and properly connected.

Figure 3 shows a DA ground system. The 4-inch copper strip between the towers and the transmitter is important in maintaining an equipotential ground level. Often, this strip is omitted, which can lead to instability with drastic moisture changes. Where the radials from adjacent towers overlap, a 4-inch copper strip is placed at right angles to the strip between the tower, and the otherwise overlapping radials are brazed to it.

Do not allow random ground elements to touch, such as loose wires. Corrosion may turn these light contacts into semiconductor rectifiers, especially in high-current areas. Such random rectifiers can produce spurious off-frequency signals and interference. Many engineers have discovered this when installing new antenna systems on old parking areas.

FM ground systems

FM antennas do not require such an elaborate ground system. Nevertheless, grounding FM transmitters is important for a more practical reason: lightning protection. Although they are grounded, FM antennas still suffer from direct lightning strikes, and the unwanted static charges can wreak untold havoc on audio equipment.

Many FM towers are inadequately grounded by means of three or four ground rods connected by a piece of number 4 or 6 copper cable to the tower. Not only are the grounding rods inadequate, but the round copper cable also has relatively high impedance to an instantaneous rise electric current, and tremendously high voltages develop across these cables. Instead of going to ground, these charges go into the building equipment.

At the very least, four ground rods should be used at each tower leg, chemical grounding-material should be used to lower resistance, and copper strap should be used to connect the rods. In areas of sandy soil and excessive wind-generated static, it is advisable to use grounding methods similar to those used for AM.

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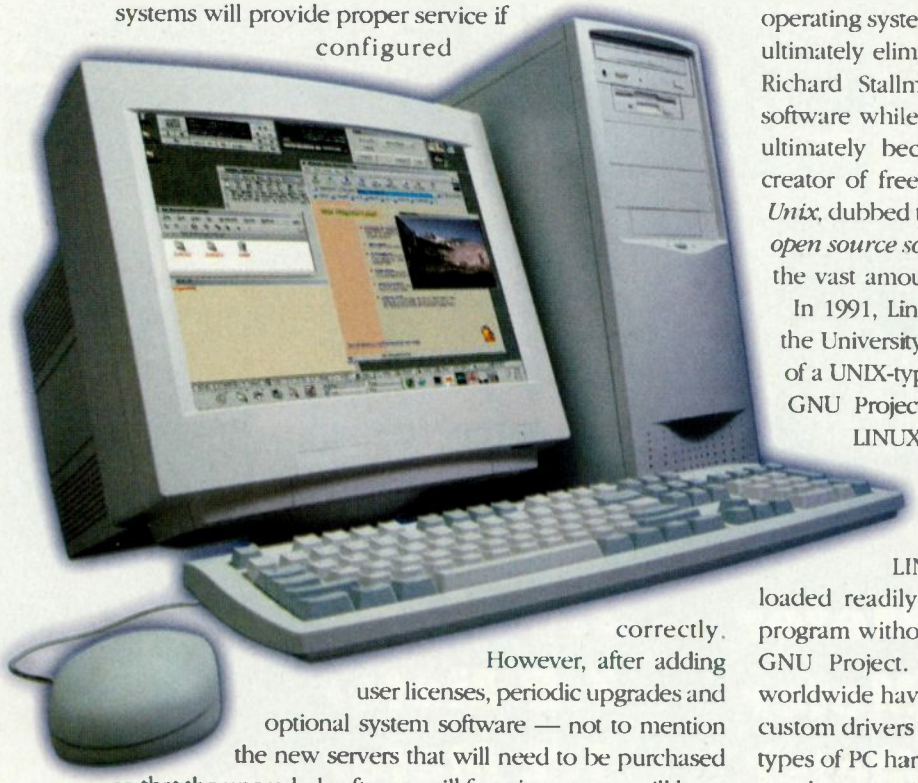
LINUX around the station (part 1 of 2)

By Kevin McNamara, CNE

By now, most of you have some knowledge (or at least an awareness) of LINUX. A few of you may even have an operational LINUX server at your facility. The majority of broadcast facilities have installed some form of PC-based networking that, in most cases, has dramatically improved communication between employees within the company, both locally and nationally. Chances are your network uses a version of Novell or Windows NT as an operating system. Either of these systems will provide proper service if configured correctly. However, after adding user licenses, periodic upgrades and optional system software — not to mention the new servers that will need to be purchased so that the upgraded software will function — you will have spent most of your general manager's bonus!



What if you could have an operating system that provides at least as much performance as Novell or Windows NT, operates sufficiently on a 386-based PC (or higher) and could be obtained free or nearly free? LINUX provides all this and more. LINUX is also considered one of the most stable operating systems on the market, and it has some practical applications. In this two-part series, we will look at what LINUX is, how to get it, and what hardware it requires.

History

To fully understand LINUX, it is helpful to understand its roots. In the early 1970s, AT&T developed the UNIX operating system to run on minicomputers and mainframes to handle the increased demand for computing power. AT&T chose to make UNIX an *open architecture* by making its *source-code* readily available to developers. The IEEE later defined a set of system calls and library routines known as *Portable Operating System Environment Standard* (POSIX), which permits UNIX to have a clearly defined means by which it can communicate with different hardware platforms.

With the introduction of the 80XXX personal computer system, other companies began introducing proprietary operating systems and software (think Microsoft, IBM) that ultimately eliminated cooperation between programmers. Richard Stallman developed a dislike for proprietary software while working at MIT during the early '70s. He ultimately became the world's leading advocate and creator of free software. In 1984, he created *Gnu's Not Unix*, dubbed the GNU Project, to maintain the concept of *open source software*. The GNU Project is responsible for the vast amount of free software available today.

In 1991, Linus Torvalds, a student in Finland attending the University of Helsinki, started to create a free version of a UNIX-type of operating system made possible by the GNU Project. That system is now known as LINUX. LINUX currently has a user base of more than 10 million worldwide and growing rapidly.

How to get LINUX

LINUX is a free program that can be downloaded readily over the Internet. What good is a free program without software? Herein lies the beauty of the GNU Project. Thousands of programmers and users worldwide have contributed every type of software, from custom drivers that permit LINUX to operate with specific types of PC hardware to full-featured applications such as word processing, spreadsheets and databases. All of these can be downloaded free over the Internet.

The easiest way to get started is to purchase a copy of a *distribution set*, which packages the basic LINUX program with the most popular LINUX programs. Caldera and Red Hat produce commercial distribution sets that

Citadel Selects Scott Studios as "the Best" Digital System

Larry Wilson (at right), CEO of Citadel Communications Corp., shakes hands with Dave Scott as Citadel standardizes on Scott Systems for its 124 stations and future aquisitions.

Citadel Communications Corp., one of America's top 10 radio groups in 1998 revenues, selects Scott Studios Corp. as its sole supplier of on-air digital audio delivery systems for its 124 radio stations and future acquisitions.

"We thoroughly investigated all of the competitive digital air studio systems and decided upon the best one," says Larry Wilson, CEO of Citadel Communications. "Our regional Presidents and Vice Presidents of engineering and programming spent nearly a year analyzing different options. While no system or manufacturer is 100% flawless, it became obvious to us that Scott Studios is the very best. Their long history of excellent service commitment, the quality of their digital studio products and competitive pricing were our primary reasons for selecting Scott Studios."

Dave Scott, CEO of Scott Studios Corp. says, "It's an honor to be Citadel's sole digital audio vendor and take their other brands as trade-ins on our new equipment. Our systems are designed by announcers, for announcers.

"Of Scott's 61 employees, 43 are former jocks and PDs with 700 years collective radio experience. Competitors work more from the engineer's perspective, although we have 20 former chief engineers on staff also. Scott Studios' digital fits DJs like a glove."

After adding five Oklahoma City stations and other pending transactions, Citadel will own or operate 124 radio stations in 23 mid-sized markets such as Providence, Salt Lake City and Albuquerque.

Citadel is well known across the country for attaining topnotch competitive programming success, and the addition of Scott Studios announcer friendly technology will help Citadel announcers deliver superior information, entertainment and service to their 8,000,000+ weekly listeners.

Citadel's stations are not the only ones who choose Scott: *More* U.S. radio stations use Scott Studios' than *any other* digital system, with 5,046 Scott digital workstations in 2,202 U.S. stations. Nine of the ten *top-billing groups have Scott Systems*.

Scott Systems are the ***easiest to use!*** They're intuitive, straightforward, simple, yet the *most* powerful!

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 of phone calls and graphic waveform editing, all in one computer!

Scott Studios is famous for our *uncompressed* digital systems at a compressed price, (but we work equally well in MPEG and MP3). Scott Studios' audio quality is the *very best* and plays on laptops or PCs with ordinary sound cards. We pre-dub your startup music library free. Your PD can auto-transfer songs digitally in *seconds* with a CD-ROM deck in his or her office.

Scott gives you industrial quality 19" rack computers, but *nothing* is proprietary: functional equivalents are available at computer stores. You also get 24 hour *toll-free* tech support! Scott also lets you choose your operating system: Linux, Novell, NT, Windows, DOS or any combination. You also choose from *three* systems: Good, Better, Best. One's right for *you!*

The Scott System 32 (pictured at the upper right) is radio's most powerful digital system. Your log is on the left side of the LCD touch screen. Instant access Hot Keys or spur-of-the-moment "Cart Walls" are on the right with lightning-quick access to *any* recording. Phone calls record automatically and can be edited to air quickly. You can also record and edit spots or voice tracks in the air studio or go on the air from production.

Options include seamless redundancy, self-healing fail-safes, newsrooms, 16-track editors, time and temperature announce, and auto-transfer of spots and voicers to distant stations over WAN or Internet. Check our web site and call us toll-free.

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can be purchased at any computer store for about $50. Both sets include a setup program that automates the installation process, which is similar to that found in most software packages, as well as ample documentation. In some cases, limited technical support is even provided. This support alone justifies the modest price of the package. These companies also produce a deluxe version that, for just a few dollars more, contains software tools that allow you create a Web server.

Basic hardware requirements

If you are looking for something to do with an old 386 PC, look no further. LINUX will run on virtually any PC, 386 or higher, with as little as 4MB of RAM and 40MB of hard-disk space. As with all things in the PC world, however, more is always better. I recommend using a Pentium-class machine with at least 64MB of RAM and sufficient hard-drive space for application-intense processing that supports multiple simultaneous users.

LINUX uses only extended RAM memory. If your system supports both extended and expanded memory allocations, you will need to set it for minimal expanded memory usage while maximizing the extended memory. Besides a 3½" floppy drive for booting the machine, you should also have a CD-ROM drive because most of the commercial distribution sets are produced on CD.

LINUX currently supports most of the hardware in use. Chances are, if you run into a particular piece of hardware that is not supported with your current distribution set, you can probably find it by searching any of the popular GNU websites.

Other hardware considerations

Though most of the available hardware is supported, you should be aware of two problems that may arise:

1. Some manufacturers maintain proprietary control over their products, which means the GNU public domain would most likely not have the needed drivers required.

2. New Windows-specific hardware on the market uses a custom Windows driver, while the PC's CPU does the work normally done by a processor on the particular hardware device. The obvious advantage here is that the cost of the hardware is reduced. These devices, however, usually will not operate with LINUX because of the proprietary nature of the drivers. Since LINUX makes full use of the PC's CPU, adding the additional load of controlling another hardware device would likely slow the system down.

You can make sure a particular piece of hardware will work by checking a LINUX hardware-compatibility list found in your distribution package. For the most up-to-date list, consult one of the LINUX websites.

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

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FCC Update

Digital audio rollout begins

By Harry Martin

The FCC has released a notice of proposed rule making that takes the initial steps toward establishing digital broadcasting as the standard for FM and AM service. In its NPRM, the agency states that the transition to an all-digital radio service is a public policy goal and seeks comment on numerous items related to the transition.

In 1998, equipment manufacturers asked the FCC to proceed with terrestrial digital radio service, citing progress in the development of the needed technologies. Noting that there is more than one technical format for digital radio, the FCC believes the time is right to consider development of the service. The FCC proceeding does not contain many specific proposals, but rather seeks comment from the industry and the public to assist in developing the foundation upon which digital radio will operate.

Two frequency allocation schemes are under consideration. The first, in-band on-channel (IBOC), requires no new frequency allotments. IBOC would be transmitted simultaneously with a station's existing analog signal. The second proposal involves allocating digital frequencies in a dedicated portion of the spectrum. In this connection, the FCC points out that European and Canadian digital radio systems broadcast on frequencies outside of the AM and FM bands. The FCC specifically notes that TV channel 6, which uses 82MHz to 88MHz, is not widely assigned for DTV and may be of use in the transition of FM to digital.

The FCC is considering how to coordinate the digital radio proposal with its currently pending low-power FM proposal. The FCC previously considered placing low-power FM stations on TV channel 6, but seeks comment on the concern that digital radio on the same frequencies may produce interference. In addition, the FCC points out that an IBOC system may create interference to low-power FM stations that have been proposed for operation on previously unused adjacent channels. The two proceedings are interdependent and will continue to affect one another as the FCC moves forward on low-power FM and digital radio.

The current implementation process for digital television (DTV) is cited frequently by the FCC in its digital radio proposal. As with DTV, the FCC states that current radio licensees are the best-suited parties to introduce digital radio to the public, and they should bear the cost of digital implementation. The FCC also draws an analogy between DTV and digital radio, stating that the FCC must be involved in any development of digital radio transmission standards. Numerous other issues, including a timetable for converting to digital radio, are raised in the NPRM.

BAPS replaced/online filing

The commission has replaced its old Broadcast Application Processing System (BAPS) with a new computerized record-keeping system known as the Consolidated Database System (CDBS) for mass media applications. The new CDBS contains application data for AM, FM, FM translator, TV, DTV, LPTV and TV translator stations.

The benefits of the new system include the fact that it will provide information about existing stations and electronic representations of granted construction permits, licenses and authorizations of license assignments and transfers of control. In addition, CDBS will provide information as to the status of pending applications for new stations, modifications and assignment and transfer of control applications, as BAPS did previously. CDBS will not be available online until the first quarter of 2000.

The commission also has announced that it is making changes to its Universal Licensing System (ULS), which is used for applications in the Wireless Telecommunications Bureau. This bureau handles all microwave auxiliary applications and tower registrations. Owing to the many complaints received concerning its current dial-up system, the commission has decided that it will move to what promises to be an easier Internet-based system. The staff hopes that this system will be available in the first quarter.

The commission's staff also is anticipating that electronic filing for broadcast applications will be an option by the end of January 2000. The commission's staff has stated that use of the electronic filing system will significantly reduce processing times for modification applications. Once the electronic filing system is in place, its use will be optional for a period of six months. After the six-month period, electronic filing will become mandatory.

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

Dateline

TV stations in the following states must file their biennial ownership reports on or before February 1, 2000: Arkansas, Kansas, Louisiana, Mississippi, Nebraska, New Jersey, New York and Oklahoma. Commercial stations must use the new Form 323, which seeks gender and race information on persons with attributable interests.

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STUDIO INFRASTRUCTURE

By Ron Bartlebaugh

Rebuilding or remodeling? Infrastructure goes beyond choosing the right equipment.

Broadcast engineers often place so much emphasis on the equipment choices for a particular facility that they minimize the importance of the infrastructure required for each studio. Infrastructure is defined as the basic facilities, equipment, services and installations needed for the growth and functioning of a facility. Ergonomics, cable management, HVAC and equipment support are important considerations for successfully building or remodeling studios.

Designed for workers

Ergonomics is the science of equipment design in order to reduce operator fatigue and discomfort. In other words, ergonomics means designing and arranging things people use in such a way that the two interact efficiently and safely. As we all transition into the 21st century, the days of pushing buttons to activate tape machines and turntables has gone by the wayside. Now, the norm is operating a computer mouse and keyboard and reading a myriad of information from a computer monitor. Engineers face the challenge of how to install computerized equipment in a studio, yet enable the operator to see and reach all other necessary equipment control surfaces.

Hand position while working is a fundamental part of ergonomics. Operators should not have to rest their wrists on a hard surface or edge while typing or using a mouse. To reduce the operator's risk of developing hand and wrist pain, make sure computers are set up so that keying or using a mouse can be done in a neutral arm-, wrist- and hand position. Eliminate sharp edges and use a keyboard and mouse wrist rest. Place the mouse in a position where it can be operated without stretching the arm or otherwise putting the body in an awkward position. Also, make sure there is sufficient room on the keyboard tray for a mouse. Too often, the mouse is located where it is difficult to reach.

Computer monitor positions are another critical area of ergonomic design. The following are some general rules of thumb. The topmost line

of the screen should be slightly below eye level. Monitors should be directly in line with keyboards and with operators, whether they are seated or standing. The viewing distance between the operator and the computer monitor should a minimum of 20 inches. Copyholders should also be positioned at the same height and distance as the computer monitor. Often, glare from windows and overhead lighting decreases operator efficiency and production. Moving into awkward positions in an attempt to avoid glare may lead to neck, back and arm discomfort or injury. Eyestrain, dizziness, blurred vision, headache and fatigue can all result from improperly placed equipment. Consider using antiglare shields or screen filters in brightly lit environments. Also, consider reducing background lighting or relocating overhead lighting as much as possible to further minimize glare on computer monitors and other reflective surfaces.

Proper seating is essential to creating an ergonomic studio. A chair's seat and backrest should support a comfortable posture while permitting occasional variations in the sitting position. The seat height needs to be adjustable so that the entire sole of the foot can rest on the floor or footrest with the back of the knee slightly higher than the seat of the chair. All chair adjustments should be user-friendly. Remember that people come in all shapes and sizes; provide seating that is appropriate for the user. Each task requires its own set of movements and postures, called *range of motion*. The movement of an ergonomic chair should accommodate the operator's range of motion during the workday. Adjustable-height armrests help relieve tension in the upper back, neck and shoulders, thus reducing the incidence of repetitive-strain injuries.

When it comes to ergonomic design, always check local building codes. Many municipalities have special requirements for those with neck, cervical spine or upper extremity limitations as well as for the visually impaired. OSHA has also been working on proposed ergonomic standards for the workplace; these regulations will affect the broadcast industry.

Support furniture for other studio equipment, such as mixing consoles, CD players and DAT tape decks, must be designed with ergonomics and other considerations in mind. Modular designs enable the studio engineer to reconfigure the furniture setup as equipment changes. Many companies now offer conductive laminate countertops that should be a strong consideration for use in the studio. These countertops connect to the facility grounding system and greatly assist in eliminating dangerous static-electricity buildup. All laminate surfaces should be laminated on both sides to prevent warping and moisture absorption. Make sure sufficient cable chases are available within the furniture and that there is room for ancillary devices (e.g., punch blocks and those infamous black boxes that seem to somehow end up in every studio). Separate cable chases for electrical and audio should be mandatory. Plan for the proper placement of studio furniture in relation to cable entry and exit ports, including all electrical power service terminations. Proper access panels or slide-out racks for easy technical access to all cable and equipment are mandatory. In addition, when it comes to designing studio furniture, be sure it will fit through the studio door.

Wire and cable installation

Cable management is a primary concern in any studio facility design. With the advent of digital audio, broadcast engineers may not need as much cabling in a studio design as would have been required in the past. There are two basic cable options for the distribution of the AES digital audio signal. One is using 110Ω balanced twisted-pair cable. The other, of course, is the use of 75Ω coaxial cable. The 75Ω cable is typically used for longer distances rather than the 110Ω cable. Because the AES digital audio format is capable of transmitting two channels of coded digital audio, which may be stereo or two independent mono channels, cable requirements for stereo audio pathing are then reduced by half. Other benefits of using digital audio in the studio are the avoidance of hum, noise, level shifts and other effects

of analog distribution systems.

The use of analog to digital and digital to analog converters should be kept as minimal as possible. Thus, the engineer would be wise to purchase equipment that has AES digital audio inputs and outputs. Many manufacturers make passive devices that will convert 110Ω AES audio (XLR connectors) to BNC (75Ω) adapters. When using 75Ω cable, regular video distribution amplifiers, routers and patching devices can be used. Special distribution amplifiers are required when using 110Ω systems. Analog audio distribution amplifiers should not be used for the distribution of the AES digital audio format. Proper operation of all AES sources

Computers and monitors should be placed for comfort and practical use.

requires the synchronization of both sampling and phase. A variety of methods is available for time-locking the AES signal, including DARS, a TTL level world clock or an analog video reference. The studio design engineer, when intending to use digital audio, should take great care in planning the location of all equipment, including routers.

Installing cabling, regardless of type, requires careful planning and documentation. Cable routes must be well-planned, especially when using analog audio, to ensure minimal signal crosstalk as well as to minimize other potential noise sources that could cause hum and other unwanted interference. Cabling may be expensive to install and, in some cases, a bit costly to maintain, but remember that the facility relies heavily on its cabling infrastructure. Thus, corners should never be cut in this area. Cable documentation often comes in one of three

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modes: 1. It may reside in the mind of someone who has left the company; 2. A paper-based system may exist, but it may be unwieldy or incomplete if the records have not been updated; 3. The facility may use a homegrown system in a program such as MS Excel or Access. None of these scenarios is an effective way to maintain cable documentation. Many sophisticated cable management software programs on the market include the ability to store and display graphics, import cable test results, and drag-and-drop functionality for easy moves, adds and changes. In addition, many programs provide the ability to document multiple sites, which is beneficial for engineers responsible for group-ownership operations. Most of the programs are capable of automatically creating cable labels as well. A little time invested in researching and implementing a good-quality cable documentation system will save time and grief in tracking the ever-increasing number of cables in any facility.

Studio furniture must not only support the equipment installed in it but also serve as a cable raceway and termination point.

In addition to cable documentation systems, many products on the market enable the engineer to properly and neatly route the various cables required for any facility. Products of this type can usually be purchased from cable and hardware distributors. More and more facilities are using raised-floor systems. Although they provide wonderful possibilities for routing cables, these systems require a bit of ongoing maintenance. Cleaning the floor and subfloor surfaces increases the operating efficiency and reliability of equipment, and extends the life of the floor system. The entire floor system needs to be properly grounded to prevent loss of conductivity and therefore possible damage to equipment. Cables need to be neatly routed, color-coded cables for various signals should be used whenever possible, and all documentation should be kept up-to-date. The proper installation and documentation of cables will provide predictable performance and pay huge dividends.

Electrical power distribution is a concern in any studio facility. Because digital equipment is so susceptible to power problems, proper power-line filtering and protection should always be used. The use of *uninterruptible power supplies* (UPS) is mandatory for

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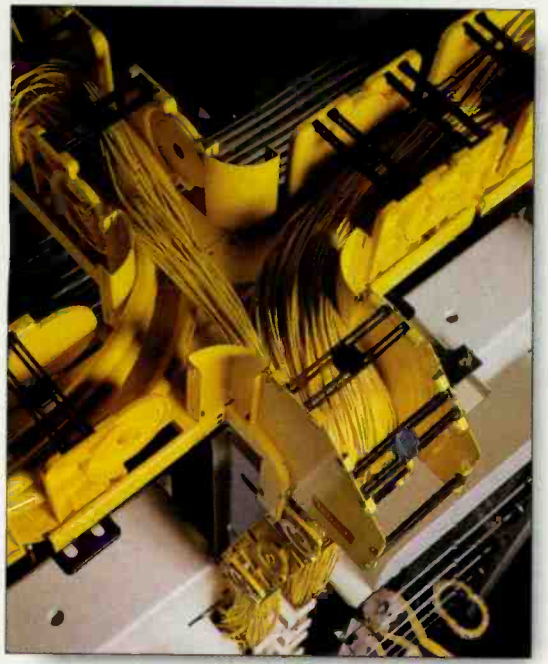

Physical cable routing is critical in any installation. Digital audio and data cables require proper routing and handling.

all computer-based equipment, even in facilities equipped with emergency power generators. The UPS units will ensure continuous power to the equipment during the time it takes for the emergency generator to start and transfer. UPS units also protect equipment from momentary power outages, which can cause a loss of all data not saved onto disc. Engineers should consider operating their audio consoles on a UPS unit as well, especially if operating an automated facility. The logic circuits in many modern consoles will revert to their normal state when a power glitch occurs. Make sure, though, that the UPS unit in use is capable of providing pure sine-wave power; many do not. Plan the facility electrical design in two phases: one is technical equipment power; the other is regular power. Provide plenty of tech power for your existing equipment and for future growth. Each room should have electrical receptacles that are not connected to the tech power. These may be used for vacuum cleaners and other utilitarian devices. Every electrical system design should include a high-quality facility-wide grounding system. Digital equipment requires a much different type of grounding system from that which many engineers are used to in that the bandwidth of the ground system is now an issue. For a ground system to be effective, it must maintain a low impedance over a bandwidth from DC to 30MHz. Signal reference grounds (SRG) should be employed in every new facility or facility renovation.

HVAC system installation

HVAC (heating, ventilating and air conditioning) systems are frequently overlooked by engineers. Every facility, depending upon local climate of course, must have a properly designed heating and air-conditioning system in place. Nevertheless, noise that HVAC systems may generate often destroys on-air or recorded sound quality.

Air handlers should be located a sufficient distance from any open microphone environments. They should be mounted on the proper noise-isolation pads. Noise silencers must be used in all supply and return air ducts, and the ducts should be lined with the proper sound-absorbing material. The size of air diffusers must be properly chosen to minimize noise as well. Airflow rates in and out of a room are critical for the effective heating and cooling of a room as well as in relation to noise generation. The engineer responsible for any facility remodel project, or one who is building a new facility, should work with a qualified mechanical engineer when designing the facility's HVAC system.

As you can see, a studio is much more than just equipment. Intense thought needs to go into the infrastructure to ensure a well-prepared, lasting facility. Before beginning any studio project, make a list, check it twice, then check it again. Remember, once it's built, it's built.

Ron Bartlebaugh is director of engineering for the WKSU Stations, Kent, OH and president of Audio and Broadcast Specialists, Akron, OH.

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MP-3-5	5	3,000W	4.1	$2,270
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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

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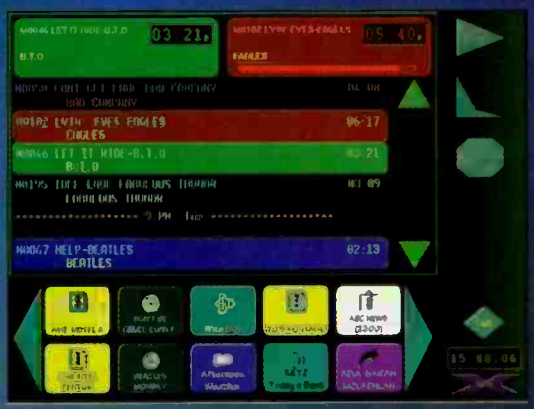

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SMARTS
Broadcast Systems

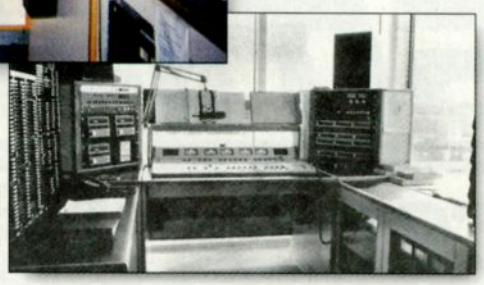
STUDIO EQUIPMENT for the NEW millennium

Advances in digital technology and the computer age have changed today's radio studio.

By Steve Fluker

As we approach the new millenium, we have already entered a new era when it comes to radio studio equipment. The days of cart machines, open reels, turntables and distribution amplifiers are almost gone. Even CD players are getting scarce in some facilities. Just ask a production director for a razor blade or splicing tape and see what happens.

Today's studio differs from those of the recent past. When looking to design a new studio, particularly a multistation consolidation project, there are many choices to make and directions to consider. The new heart of a radio station operation is the method of delivering audio. Computer-based hard-drive storage is becoming the norm in today's studio. (See "Automation and Digital Audio Delivery Systems," p. 48.) A network of computer servers and workstations can now link production rooms, newsrooms, control rooms and even remote studios. With the availability of increased capacity hard drives at bargain prices, it has become economical not only to use the system for commercials, but also for music. The complete library, which used to take up valuable wall and storage area, now easily fits in as little as 6 inches of rack space. Audio recorded in a production room is instantly available to play on the air.



Studio appearances have changed with the addition of computer-based equipment.

Streamlining automation

After deciding on a system for your facility, you may choose from a variety of options available as add-ons to customize your needs. Automation can now be easily achieved using voice-tracking software, which allows an announcer to record a typical four-hour air shift in 30 minutes or less. Voice-track automation sounds clean on the air. In many cases, it sounds better than a live announcer does, since the announcer can correct any mistakes before they air. On-screen commands allow you to hit the post of a song perfectly every time. A program director can even have an air-check session before the fact. With this time-saving tool, your top announcers can voice-track weekend shifts and even stay on the air while on vacation.

Hard-drive systems can make complex morning shows much smoother. Music and spots can load and segue

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STUDIO EQUIPMENT

automatically, freeing up the DJ to do work that is more creative. On-screen arrays put the morning team's favorite sound effects, liners and bits right at their fingertips. Manufacturers make these arrays in separate tabletop packages for easier access. With these, each announcer can access 50 or more sounders instantly.

Other options available on most delivery systems can help eliminate paper in the control rooms. On-screen text for live commercial reads, promos or liners can come up automatically on the main screen or on a separate monitor. Text can also be programmed to give the announcer artist information. Links to websites can be incorporated to give up-to-the-minute local weather information or access to local news or events such as art festivals, concerts and sporting events. Even news capture is available on many systems, giving the news staff the chance to edit or write their own stories. News bytes can be recorded and inserted as part of the news copy.

Voice-tracking is an automation feature that has gained wide acceptance.

Choices, choices

For production rooms, many choices of digital editing systems exist to complement the on-air delivery system. For budget-conscious facilities, there are inexpensive software packages designed to work on standard off-the-shelf PCs. These economical packages can deliver powerful editing and effects functions. Basic software packages start at less than $100, while others offer more features and flexibility for prices ranging from $500 to $1,000. These programs run well on the standard consumer sound cards, but better audio performance can be achieved with the addition of a professional sound card. Most of these software packages will have several, if not unlimited, audio tracks on screen, but they will have only two hard-wired input and output channels to connect to the console.

When the demands on the editing systems are higher, consider professional turnkey systems. These systems are still PC-based but have high-quality audio cards and SCSI controllers and drives. Some of these systems also provide the ability to expand the number of actual inputs and outputs. Eight or more channels are common, with breakout panels available for XLR or ¼-inch balanced connections

to the computer. Final production works can be transferred to CD burners or digitally sent directly to the on-air storage/delivery system. Archiving of the final production as well as all of the unedited audio and edit information is available via mass storage systems such as 4mm or 8mm tape drives.

Other all-in-one editing systems are on the market as well. These editors typically have a built-in LCD waveform display and may even have their own built-in mixing board and speakers, making each a production studio in a box. Even the price is amazing. Systems complete with mixing console, display, digital inputs and outputs, hard drive, CD recorder and even onboard effects such as reverb, EQ, time delay and chorus start for less than $3,000. These systems are great for small studios, home studios, news edit rooms or dub stations.

The next studio evolution is in the recorders. Digital recorders are readily available in several formats. DAT (digital audio tape) recorders were among the earliest of these machines. They still use a tape, but they have the advantage of recording up to two hours of linear audio at up to 48kHz sampling rate. They are also standardized and readily available in most radio and recording studios. Inexpensive portable units are available for field and news recording. If you want to eliminate tape altogether, look to mini-disk recorders. The mini-disk offers an optical solution on a disk that resembles a floppy disk. Up to 70 minutes can be recorded on one disk. Audio can be recorded, erased and rerecorded on a disk. Some minimal cut-and-paste editing can even be accomplished, adding to the format's flexibility. The down side to the mini-disk is the use of data compression to provide increased storage time. If this is a problem and you want linear audio or a more universally compatible format, look to the wide selection of available CD recorders. These recorders come in several flavors, from rackmount to stand-alone units, to internal software driven drives for your PC. Software is widely available to record audio to the CD. The down side is the limitation of reusing a disk later.

Telephones

With increased demands from talk shows, high audience participation top 40 radio shows and remote broadcasting, telephones are becoming high-tech. For the studio, new telephone systems, which can interface to digital lines, are finally being introduced. New systems on the market can connect directly to ISDN/BRI telephone lines and split them out to 12 lines. With the complementing digital hybrids, new quality standards for telephone callers on the air can be achieved. Desktop telephones can be programmed and reprogrammed to meet the demands of the radio show on the air. Computer software can also integrate with some of the sophisticated telephone systems. Software can work with caller ID, alerting screeners to frequent callers, to callers who are good, and to those who should be put in an indefinite holding pattern.

New technology allows telephone lines to replace the old RPU UHF

transmitters and receivers. With the use of digital codecs, analog audio can be converted to digital, high-quality audio that can be delivered on a standard, dial-up telephone line. Even bandwidths of 15kHz can be achieved in either direction, making remote talk shows and long-distance remotes easy. These codecs are best-suited for voice-only. For music and stereo broadcasting, the use of a different codec and an ISDN line will provide good results.

Audio routing

The next consideration in the studio is how to distribute the audio throughout your facility. In the past, the use of distribution amplifiers (DAs) was the most common method. The DA takes a single audio input and offers four- to 16 isolated audio outputs to feed studios, tape machines, monitors and more. With the number of sources increasing and the demands higher with multiple radio stations sharing one building, DAs are sometimes hard-pressed to handle the needed capacity. For this reason, the use of routing switchers in a studio is rapidly growing. Routing switchers have been widely used in TV studios for years; they are typically custom-configured for each facility. The switcher has input cards for audio sources and output cards to feed consoles, recorders and other items. The switcher can route each input to any number of available outputs. The routing is accomplished through front-panel controls or by the use of an external PC. Routers are so flexible that they eliminate the need for patch bays and reduce the amount of cabling needed to interconnect studios. The larger switchers now have the ability to mix digital and analog sources. In the control room, the line selector module on the audio console can now be replaced with a remote controller for the routing switcher. Instead of a choice of eight to 10 audio sources, each individually and permanently hard-wired, the module can select any of hundreds of sources in the building, all carried on a single stereo or digital audio pair. Even sources used rarely in a particular room can now be accessed easily when needed.

An important item to discuss is the control board. Although digital editors and automation can eliminate it, including the control board is advisable. Consoles are evolving rapidly to accommodate digital sources. Evaluate your needs before selecting a console. Most likely, you will find that not all of your audio equipment will have digital inputs and outputs. Thus, a board that can handle either digital or analog may be desirable. Most of the major manufacturers now have this flexibility. Methods of accomplishing this, however, vary greatly. Some boards look and feel just like the old analog boards with plug-in modules. Choose from either analog or digital modules, which are easily interchangeable. Another console on the market uses one input module, with a small plug-in circuit board to select digital or analog. This method will be less expensive to change in the future, since most of the module will still be used. Another concept in the control board is almost completely removing audio from the board. This method requires the integration of a routing switcher, and the console becomes nothing more than a fancy computer

Much of the current technology has reduced the amount of equipment needed in the studio.

controlling the switcher (see "Getting from Here to There," November/December 1999, p.28). All of your audio is inputted to a central router, which can mix your sources and output them directly out of the router. This approach can simplify your audio chain and give you more flexibility. You will no longer find yourself short on mix-minus buses or other console outputs, because you can simply assign another of the router's outputs for any purpose. These consoles are typically interconnected to the router and other consoles in other rooms via a computer network. This makes it easy to put a production room on the air in an emergency. At the touch of a button, that board will duplicate all of the functions, including remote controls, of the control-room board. The remote start and stop logic is now wired into the routing switcher instead of the console. Any room in your facility that selects a machine will automatically have the control of the logic.

When examining today's new technology, do your research carefully. Be sure you don't forget about redundancy. Remember, in the past you would not have relied on only one cart machine or one CD player. Installing only one computer workstation or server to handle all of your audio in your station can be an easy oversight. If that computer crashes or needs to be rebooted — and it will — you can be in serious trouble unless you have planned and designed ahead. Also, be sure that you have mirrored drives or some means of duplicating your audio on multiple drives. All drives will eventually fail. Redundancy can be easily achieved, and the manufacturers can help you with your plans. It's also a good idea to incorporate a PC and software in your studio. These powerful tools can allow engineers and programmers the ability to work from home or remote locations in emergencies. This ability can greatly speed up repairs, and make the engineer happy.

Steve Fluker is the director of engineering for Cox Radio's seven Orlando radio stations.

All photos are by the author except page 47, which is by S. Parks Hall.

FOR MORE INFORMATION
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Automation and digital audio delivery systems

By Chriss Scherer, editor

Computer-based audio delivery and storage systems have made their way into most facilities.

Finding a place to install a new piece of studio equipment used to be a problem for many stations. For the most part, that problem has been replaced by wondering where to put the next computer monitor.

Computer-based audio storage and delivery are used in most radio facilities today. Selecting the right system can be a daunting task, given the number of available choices. Deciding which system fits your needs may take some time but, as with any equipment purchase decision, you can find the right solution by following a carefully articulated plan that considers all of your needs.

The transition to a computer-based system should provide a smoother on-air operation.

Getting started

Whether you are replacing an existing system or starting from scratch, you must take into consideration all of the departments and personnel that will influence and be influenced by the final decision. Naturally, engineering will maintain and install the system, and programming will operate the system. The system must also suit the needs of production, traffic, accounting and sales.

Gather information from each of these departments. If a system is already installed, you may have an advantage, in that you are accustomed to working with a computer-based audio delivery system. Your experience with this existing system, however, can get in the way. The system may be too small or it simply may not fit your needs. Other systems may have completely different ways of performing tasks and manipulating data. Do not impede the information-gathering stage by repeatedly referring to the existing system. Focus instead on what is needed in the new system. Department heads involved in the information-gathering stage should be urged to consult their staffs as well. If possible, let the entire department, rather than one person, state its desires.

Once the final list of requirements is assembled, begin reviewing the available systems. Be sure to provide as much information as you can to each manufacturer with whom you are dealing. In return, ask for a list of users whom you can contact for feedback. Ask for a complete client list, not just a preferred customer list. Your goal is not to discredit anyone. Rather, it is to get a fair assessment of the system

being considered. Find out what features these users like and dislike. Look at areas where the system exceeds expectations or falls short of them. Find installations that are a similar size and application to yours.

Each system has strengths and weaknesses. Many systems can be purchased as a complete turnkey or simply as a software package to be installed on your existing computers. The latter usually offers some cost savings. The drawback is that some unforeseen difficulties may arise later.

The use of proprietary hardware is a topic of major concern in some circles. Hardware supplied by one source has the advantage of being a matched system. For example, the audio cards are designed to work with the software on the system. Purchasing hardware from the local computer store provides some flexibility when a problem comes up. You may be able to get the system running again with a quick trip down the street.

File-storage arrangements

The configuration of the servers and hard drives is the one area that will likely be unique to your facility. Most systems can be configured in countless ways. The two basic approaches are *central* and *distributed* storage. Each approach has it's own set of advantages and disadvantages.

Centralized storage keeps all the files in one location. Whether the files are stored on mirrored drives or use a RAID array, there is one primary place to find them all. There are several advantages to this approach:

- Audio files are accessible immediately after they are finished (or even while they are still recording);
- Audio-file management is simplified (no need to worry about having two different copies of a song with the same name;
- Backups are simplified because everything is one place; and
- Audio wiring is simplified because the servers are usually located near the audio-distribution backbone.

There are, however, two drawbacks to this approach:

- Workstations rely on the server and the network connection; and
- High-performance (higher cost) drives are typically found in servers to handle read-and-write requests from multiple users.

A distributed storage system places the audio files where they are needed. A file may initially be placed on a server and then sent to the individual workstation where it is needed. The advantages to this approach include the following:

- Network problems usually do not affect the workstation. In cases where they do, the workstation can be disconnected from the network; and
- Hard-drive demands are reduced.

Some of the disadvantages include the following:

- File synchronization can be difficult, and multiple versions of the same file name may exist; and
- File backups can be complicated.

Planners of some installations

choose a combination of the two methods so they can benefit from the advantages of both systems. Though you can never eliminate the chance of a failure, you can build in layers of redundancy. RAID arrays have become a popular choice; mirroring of servers and workstations also helps. Some stations perform automatic system backups, either through a *wide area network* (WAN) or through other means. One possibility is to use some extra bandwidth on a T1 STL to store the backup at the transmitter site. This method not only provides an off-site backup, but also puts the backup in a location where it may be most advantageous in case of a studio crisis.

By locating the servers in a common space, the noise and heat are contained, and service and maintenance are simplified.

Audio data compression is a hot topic. Many types of audio encoding exist, and these types of compression are used in various applications. All of the available systems support at least one type of compression. Most will also support linear audio storage. Again, there are advantages and disadvantages to either approach.

Linear data audio files usually use the WAV or BWF format. The biggest advantage to linear storage is that no distortion or additional artifacts are introduced. While perceptual encoding algorithms are designed to minimize the audible effects of their actions, there will always be some kind of distortion present. In most cases, you can vary the amount of data compression to suit your needs.

The drawback to linear file storage is that file sizes can become quite large. At 44.1kHz sampling rate and 16-bit resolution, 1 stereo minute of audio will occupy about 10MB of disk space. Hard-drive costs have certainly decreased over the years, and it may be easy to justify the additional storage requirements.

Many systems will allow you to use more than one compression algorithm and even let you use varying sampling rates and compression ratios. Thus, stations can record music in a low compression or linear format and commercials and promos in a higher compression format. This approach allows you to reduce the storage space needed for commercials but lets you keep the music sounding its best.

If you are considering the mixed compression approach, be sure the system you select can play files of varying formats simultaneously. A system may support several formats but may only be able to play and record files of one format at any given time.

Audio compression also has an advantage in systems that are connected over a WAN. Smaller file size means faster transfer times across a network. Some radio groups are sharing more of the resources across a WAN. This network may only be across town or it may be across the country. Either way, moving files between two locations can take some time if the file size is very large.

Spreading out

Ideally, the WAN should allow users in one location to access the files in another location with minimal effort. It may be as seamless as making the remote files appear as they are stored locally to the user. The technical prowess of your operations staff will determine the simplicity of the interface.

One feature that is seeing increased use and popularity is voice-tracking. Voice-tracking allows the air talent to prerecord their breaks into the system. This can be done moments before or several days before it is played. The air talent can then work from the same building or from a different city. Many systems have made voice-tracking a new art unto itself.

In the most basic voice-tracking, the talent simply records the breaks themselves. This approach usually results in uninteresting breaks in which the mood of the air talent does not match the mood of the music. Now, the talent can hear one song end and the other begin, making the break sound much more natural. Advanced features allow cross-fade points to be set and changed; the timing may even be altered to make the break tighter. Remote voice-tracking requires some of the music to be accessed by the remote talent, but the level of control is still as high as having talent in house.

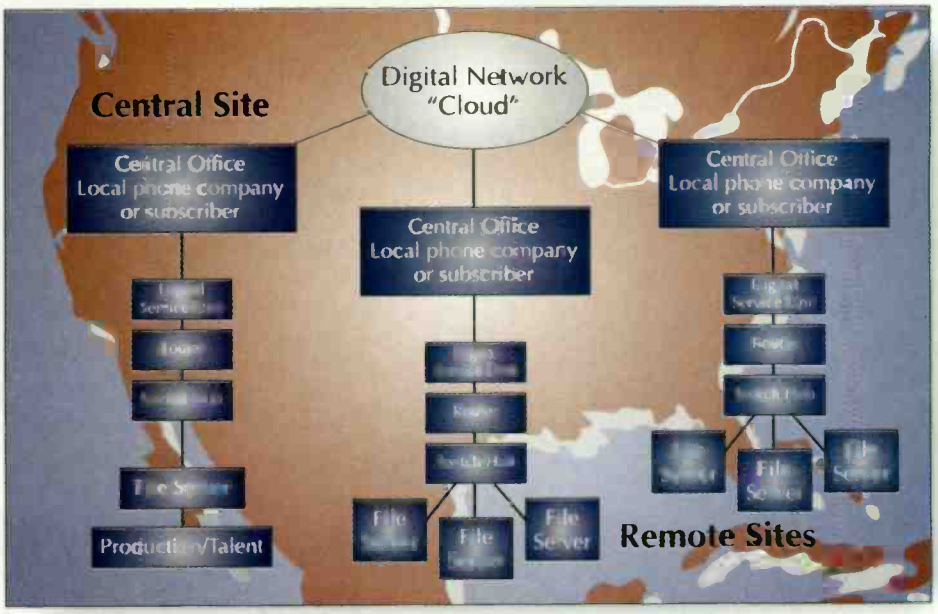
Another item to consider is the integration of the playback system with other equipment. Interfacing to a satellite receiver is one example. Another is the use of a CD jukebox.

Most systems have some means of controlling or accepting commands from these devices.

Many stations record audio feeds during the day. These may be a few minutes long for news actualities or up to an hour for full programs. Most systems offer the ability to automatically capture and store audio files like this for later use. In some cases, the new file may be available within seconds of the recording start.

The list of available features could go on and on. More features seem to be developed every day. Whether your system is being used in a live-assist or fully automated mode, periodic attention will be necessary to ensure that files are not being fragmented. Further, you will need to make sure individual users are not loading unnecessary programs or files (especially games) onto the system. It is also wise to check for old audio files that are simply taking up space.

Any system selection process should include room for growth or modifications in the future. You may need to add workstations or file servers, or integrate one station's system with a WAN or a new traffic and accounting system. Recognize the limits of the system's original design. There will be a point where it is not practical to continue adding on to it. At that time, the entire system will need to be reviewed and a new set of operating goals and parameters established.



System integration over a WAN can increase system flexibility and allow for sharing of resources.

Graphic p. 51 courtesy of Prophet Systems Innovations.

New Products

CD burner
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CD-R624W: Hardware includes an Adaptec PCI SCSI card (2903 bus master) plus a TEAC CD-R56S/614 6×24 external drive. Software includes SEK'D Red Roadster 24 v5.20, Adaptec EZ CD creator v3.5b and Xing AudioCatalyst v2.0. Accessories include SCSI and power cables, SCSI terminator, two blank CD-R media, and a CD-labeling kit. Includes MP3 audio compression encoding and playback capabilities. Windows and Mac compatible.

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◀ **12 Series:** Two dual-channel models currently comprise the line: the 2RU 1215, featuring 15²/₃-octave bands per side, and the 3RU 1231, featuring 31¹/₃-octave bands per side. Both provide standard features like dual channels, ISO frequency centers, ±12dB input gain range and switchable 18dB per octave 40Hz Bessel low-cut filters. Other features include 45mm faders, barrier strip and ¼-inch connectors for installation ease, balanced inputs and outputs for quiet operation, chassis/signal ground lift capabilities for quick hum isolation, and an internal power supply transformer to eliminate the wall wart.

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Audio Precision

▶ **System Two Cascade**: Features both 96kHz and 192k digital sampling rate capability. A companion model System Two+DSP, with the new platform improvements but without digital I/O, is also available as well as a cascade digital-only model, SYS-2500A. Harmonic analyzer is capable of individual and group harmonic distortion measurements. The company also has introduced APWIN 2.0.

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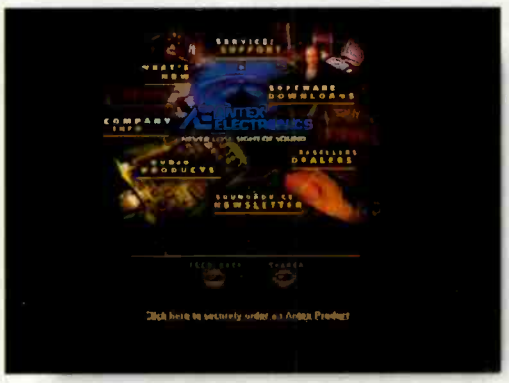

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Entries must be received by February 15, 2000. One entry per person. Intertec Publishing ("Sponsor") is not responsible for late, lost or misdirected mail, faxes or e-mail. Entries will be reviewed by the *BE Radio* contest committee for accuracy. Be as specific as possible in describing the location of the mic icon on each 1999 issue of *BE Radio*. All decisions are final. In the case of more than one entry with all 10 correct answers a single entry will be drawn at random on or around February 17, 2000. If there

BE Radio®

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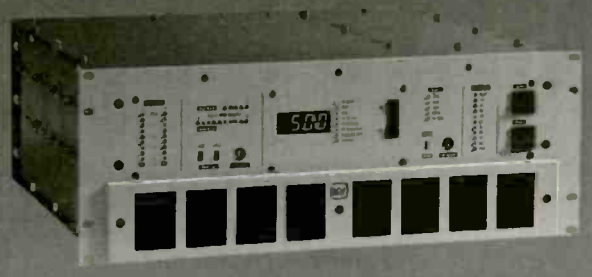

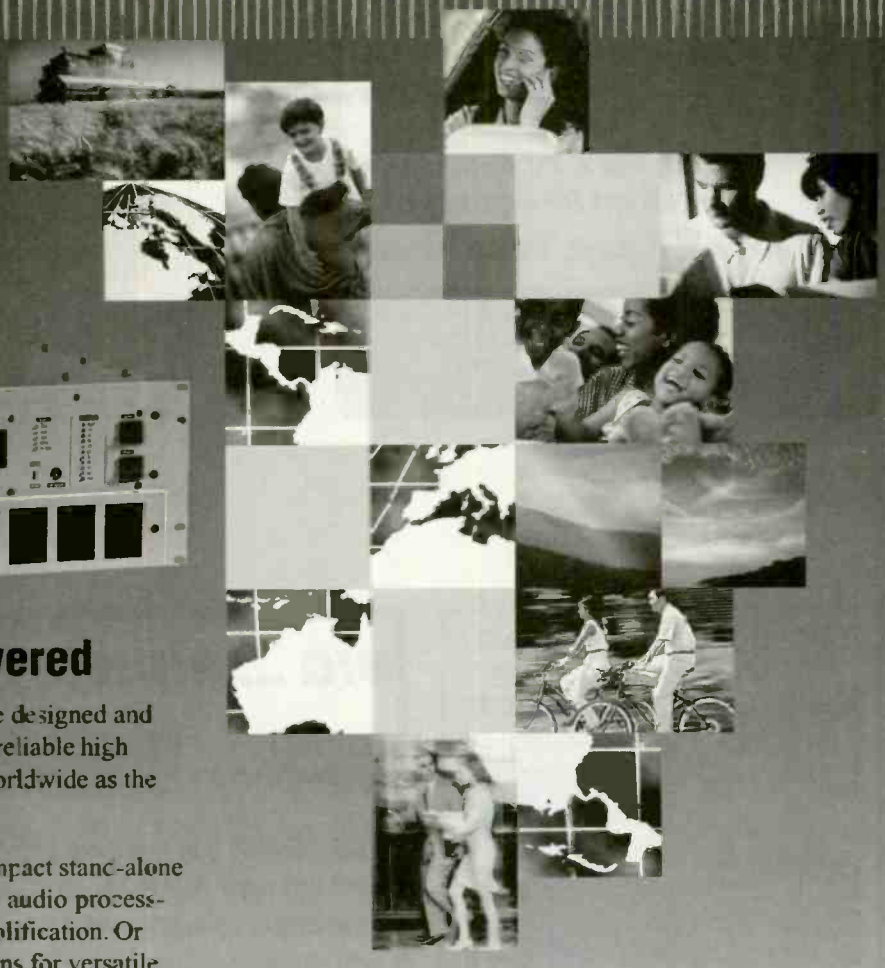

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BE RADIO (ISSN 1081-3357) is published monthly (except bimonthly in May/June and November/December) and mailed free to qualified recipients by INTERTEC, 9800 Metcalf, Overland Park, KS 66212-2215. Non-qualified persons may subscribe at the following rates: USA and Canada, one year, $45.00; all other countries, one year, $60.00 (surface mail), $100.00 (air mail). Single copy price, $10.00. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canada Post International Publications Mail (Canadian Distribution) Sales Agreement No. 0956244. POSTMASTER: Send address changes to *BE Radio*, P.O. Box 12937, Overland Park, KS 66282-2937.

BE Radio is edited for corporate management, technical management/engineering and operations and station management at radio stations and recording studios. Qualified persons also include consultants, contract engineers and dealer/distributors of radio broadcast equipment.

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Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2215. Phone: 913-341-1300; Edit. Fax: 913-967-1905, Advt. Fax: 913-967-1904.

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The well-tempered browser

By Skip Pizzi, executive editor

Back in the '90s (i.e., a few months ago), I was a guest on an NPR talk show about the future of radio. A fellow guest kept pointing to MP3 downloads and the like as a primary indicator of where things were heading. I commented at the time that such downloading technologies really represented the future more for the *record business* than for radio. In the intervening months, however, I have come to realize that downloading will have an important effect on the future of radio, but not in the way either of us was thinking at the time. There's much more to the business of downloading than codecs and players.

Consider how the downloading process works: Users go to a content-downloading website, which they are attracted to by the prospect of free access to popular content — typically individual songs. These sites give away the music to their users; this is the primary reason for the MP3 movement's popularity — the content is *free*. Free content works, almost to the exclusion of any other business model. This lesson has already been learned many times over in the Internet environment.

Dueling businesses

So how do these sites survive? There's advertising income (from banners or short audio clips), but most revenue is derived from *data mining* — selling usage reports about downloading behavior to record companies and other marketers. Although this may seem nefarious, it's no different from Arbitron diaries — except that the user doesn't have to fill out the diary. In fact, users may not even be aware that the data is being collected, although they should be. Just as highway drivers should realize they are subject to observation by police at any time, Internet users should always assume that someone may be monitoring their surfing patterns, particularly when such patterns indicates personal preferences.

In this respect, the download sites, like radio, attract music listeners who stay for a while to sample the programming. While they are there, a banner ad may catch their eye for a click-through, or an audio clip may influence some future behavior. The site in essence rents its listeners to advertisers, just like a radio station.

However, the download site goes a step further. It can report to marketers the exact behavior of its users — not what the user voluntarily offers in a ratings diary or a trade magazine's reader-service card, but actual, measured preferences. This direct-response data provides increased appeal to some marketers, and it represents a chink in radio advertising's armor. The future of marketing, at least for some products, may lean more toward such sites and less toward traditional broadcast media.

Free content works, almost to the exclusion of any other business model.

Early returns

There is also much to learn from the reported experience of these websites. First, it's important to note the powerful appeal these sites have for many musical artists. The current culture of "star or starve" in today's music business has practically eliminated the middle-class career artist — an essential component of human musical culture, and one that has never been under such severe threat. The prospect of direct access to a mass market of musical consumers is attractive to musicians, even those who have already tasted success in that traditional environment (e.g., www.davidbowie.com). Today's artists don't want to navigate the narrow straits of recording contracts and even narrower radio airplay opportunities. The difficulty in gaining radio airplay has also led some record labels to embrace the Web for similar reasons.

Today, both labels and artists use the Web for sampling or downloads of singles, hoping to stimulate sales of CDs and cassettes through traditional retail or mail order. In a broadband future, however, the entire sale could take place via the Web, and this is on the mind of many early adopters. While MP3 has no intrinsic rights management features to protect the intellectual property of such downloads, other emerging downloading formats do, and standards are now under development for such protection.

Download sites also report that the typical user samples across many different musical genres. Contrast this with radio station programming, in which a single musical genre is the norm for a programming format and, within that style, a narrow selection makes up the typical playlist. It seems that variety is still the spice of life for most music listeners.

How deeply this affects the radio business remains to be seen. As the millennium dawns, however, this is one area of new technology that broadcasters should watch.

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