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The NAB Radio Show preview

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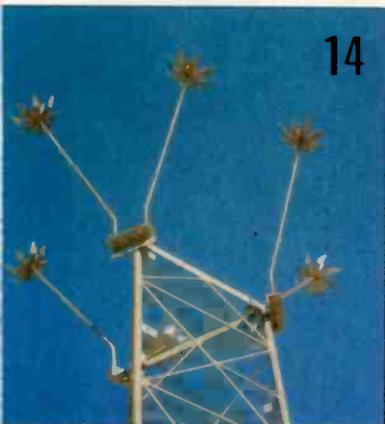
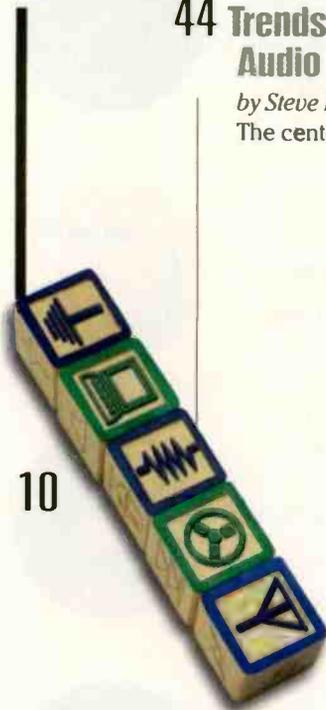
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ON THE COVER:

Radio will shine through as the NAB Radio Show heads to the Northwest.

Cover design by *Michael J. Knust*.



Jeff Gulick
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Services Manager
Clear Channel Radio

Jan Chadwell
AM Chief Engineer
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Currents Online

Highlights of news items from beradio.com from the past month

NAB and Others Appeal Licensing Fees

NAB, Bonneville, Clear Channel, Cox, Emmis, Entercom and Susquehanna file an appeal to the summary judgment for licensing fees.

Telos Releases Updates for 2101 and Twox12 ▶

New software offers several new features and performance enhancements as a direct result of client feedback on earlier versions.

FCC Revises Regulatory Fees for FY2002

The new fees help the Commission raise \$218,757,000 as required by Congress for Fiscal Year 2002.

Comedy Central Film Builds Radio Systems Set ▶

The producers of the cable channel's film, *Porn n' Chicken*, turned to Radio Systems to recreate an authentic college radio station.

Wilson Joins Harris as VP

Haldane Wilson brings 25 years of management experience to his new role.

Burns Joins Klotz Digital

Dave Burns has been named director of broadcast business development for Klotz Digital America.

Orban Now Shipping Opticodecs ▶

Opticodec models 7000 and 7400, which are manufactured in Germany by Orban Europe, are now available.



Site Features

Stolen Equipment Alert

MonsterFM reported a substantial loss in July. A suspect has been captured, but the equipment is still missing.

Vote for the Innovator

Cast your vote for the 2002 Innovator Award from *BE Radio*. Follow the link to the ballot on the home page.

Reader Feedback

Express yourself! Tell us what's on your mind at beradio@primediabusiness.com. You can also read what others are saying as well.

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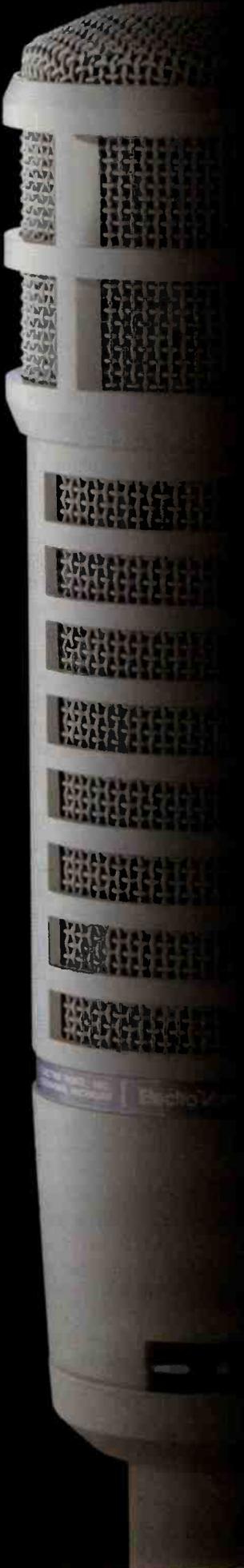
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Road trip

I have had the opportunity to travel some long stretches by car this summer. For the past several years, I have taken summer weekend trips around Kansas and Missouri (*BE Radio* is based near Kansas City), but this year my travels have extended through the Midwest to parts of the South and New England. While this may not seem like a fun way to spend a summer vacation (it wasn't all vacation for me), it afforded me the opportunity to see some landscapes and, more importantly, listen to the radio.

I looked forward to sampling some of the format choices that would be available to me during my drive. Like you, I have my favorites, but this time I put my choices aside and sought selections other than Canadian power trios and ripping solo guitarists.

I listened to talk, country, reggae, news, sports, rock, classical, urban and some other formats that defy naming. I was pleased to hear some newer artists, some of which were new to me but not new to the world, as well as more traditional and established performers. I took note of topics on the talk stations.

I followed the sporting event in my mind as the announcer described the acts and motions.

Throughout my travels, I was pleased with the audio quality of most of the stations. Some choices had a noticeably, shall I say, unusual sound. There were also areas where reception was lacking. Fortunately, these areas of poor reception were brief.

After listening to the same set of terrestrial stations around Kansas City for so long, it was refreshing to discover some alternate voices.

Are you wondering what I was listening to? Are you trying to figure out if it was XM or Sirius? Actually, it was neither. I listened to terrestrial radio the entire time.

During my trip, I heard some of the same

material across the wide regions, but this is the definition of popular music. There were times where the music playlist was limited, but I moved on after giving it a chance. It's easy to become unenthused by the radio choices within our own listening areas, but this time I kept an open mind. I didn't lock onto the next market's "Rock," "Star," "Mix," or "Hot" moniker. I pressed seek and gave the next choice a chance to keep my interest.

This does not rescind my statement of a few months ago, where I stated that I am hopeful that satellite radio will entice terrestrial radio to relax the safe lists and try something new. This still needs to happen. During my drive it was fun to hear about expected crop yields for the area, the swap meet and flea market being held in the next town, the crazy sale prices at the car dealer during the afternoon remote or the 70s rock group that was headlining at the county fair. All of this was mixed in with the local weather and community calendar.

Even the sound quality was acceptable in most cases. Some stations could benefit from a signal-chain inspection, but overall the quality was acceptable if not stellar for most stations—even the AMs.

My experience is a testimonial to the grass-is-always-greener adage, but greener grass is just what is being offered by the rising listening choices. LPFM, Internet radio, satellite radio and other choices are providing the new options that appeal to listeners' ears. While each has had its obstacles in establishing firm roots, the key to success in retaining listeners is not in touting the audio quality and technology that goes into radio, the key is content. If you play it, they will come.



A handwritten signature in cursive script that reads "Chris Scherer". The ink is dark and the signature is fluid and legible.

Chris Scherer, editor
cscherer@primediabusiness.com

Send comments to: E-mail: beradio@primediabusiness.com
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Last-minute remotes?

No stress for John Kennedy of Entercom Boston.

The Patriots win the Superbowl! A major cause for celebration in Boston. And potentially major stress for John Kennedy, Engineering Director for Entercom Boston. With no advance warning, John had less than 24 hours to orchestrate coverage of the festivities on numerous stations — including live remotes along the Patriots' parade route. Fortunately, John knew he could count on Comrex Vatrix to deliver — even last-minute. With Comrex in your toolbox, last-minute remotes are successful, not stressful.

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Contract Engineering



Building your business

By Mark Krieger, CBT

www.beradio.com

For most folks, the desire to own and operate their own business is spurred by a desire for independence. With hard work and a bit of luck that goal may be realized. But then what? With the fulfillment of the main objective come questions of what constitutes success.

A lot has been written about the fundamental role of vision in running a business. This is as true for contract engineers as it is for anyone. Vision can be thought of as a desired or idealized outcome—in short, a future outcome that is exactly as you wish it to be. Now, before you write off the “vision thing” as motivational mumbo-jumbo, consider that it is ultimately necessary as a fixed point to steer toward—without it, you’re lost.

The best it can be

Consider your business for a moment. Is it really what you want it to be? Are you even in touch with what you want it to be?

If the answer to either (or both) of these questions is no, it’s time to start thinking and doing. Vision provides a sense of current reality and ultimate goal. Achieving the goal becomes a matter of mapping the terrain between those two points.

The first thing to consider is just how big you ultimately want to grow your company. Do you aspire to a large

firm with a commensurate number of employees? Or do you

prefer to remain a partnership or one-person operation? Whatever your answer, chances are that you will opt for growth. Expansion comes in two basic forms: Horizontal expansion occurs as a person maintains a range of goods and services offered, while taking a larger share of the

available market for them. Vertical expansion occurs when you extend that range.

Let’s see how this translates for a typical contract-engineering firm in an average radio market. Begin by defining the geographic boundaries of your desired area of operation. Use this information, combined with research on how many potential clients (all those who currently use services like yours) exist within that area, to establish the overall market size. Now, evaluate what percentage of those accounts you are currently servicing. This is your current market share. If you find your market share is below the 50 percent mark, there is clearly an opportunity to expand horizontally.

This touches on a sensitive area among some engineers—competing with local brethren for those existing accounts. The best advice is to remember that you *are* in business, and any good businessperson must compete to succeed. If you do so ethically, emphasizing the value of your services, you will have nothing to feel guilty about. In fact, competition should be embraced, because it provides the impetus to improve service and increase efficiency. In the end, everyone benefits.

If, on the other hand, you find your market share is already close to the top, you may want to consider expanding vertically. For example, you might consider offering remote broadcast rentals and services. You could also become a local distributor for broadcast equipment and supplies, or provide broadcast-specific computer networking services.

These decisions will be based on your own expertise, market holes and strategic partnerships. Such partnerships can be versatile—one entrepreneur I know has seven separate limited partnership agreements with other specialty businesses, allowing him to offer a broad range of services while maintaining low overhead. Tower services, consulting engineers, architects, cabinetmakers and industrial electricians are just a few of the possibilities that come to mind in the contract-engineering context.

Which way to go?

Regardless of the direction in which you decide to expand, you’ll need to evaluate whether your current manpower and capital/equipment resources are sufficient, and, if not, how you will expand them. Don’t overlook the financial revision of your business plan. Of all these fundamental resource issues, manpower is the most perplexing. Adding employees is a major step that adds a considerable overhead burden. Some experts say that an employee’s true total cost is at least double whatever wages you pay them. One way of dealing with this and the other legal encumbrances that come with being an employer is to use subcontractors. This is a flexible arrangement that will allow you to accommodate short-term expansions and contractions in business volume. One cautionary note,



Horizontal and vertical growth can be built on an existing set of tools and expertise.

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however: The reliability of your subcontractors is something your business will live and die by, so choose them as carefully as you would a full-time employee. When you find that you and your subcontractors are working at full capacity for a prolonged period (six months or more) it's probably time to add your first part or full-time employee.

Once a realistic expansion plan is in place,



Additional sources of contract revenue can come from offering remote broadcast services and equipment rentals.

it's time to turn on the marketing campaign. Advertising opportunities include trade publications (*BE Radio* is a prime example), along with trade associations, such as the NAB, SBE and state broadcast associations. Incidentally, many state broadcast associations hold annual conferences and periodic seminars, providing you a unique opportunity to volunteer to hold engineering workshops for radio owners and managers. This can be productive in building name recognition and a personal rapport with potential clients.

A presence on the Web is also important. A website should be well organized and information-driven, with a well maintained links section offering incentives for visiting. Include a list of client referrals and pictures of major projects, such as transmitter installations and studio build-outs. Add value by including radio-oriented shareware and a message board for local broadcasters.

Finally, don't neglect the personal touch. A visit to potential clients leaves a lasting impression that a card, letter or ad cannot. By discussing a manager's or owner's perceptions of their facility's technical strengths and shortcomings, you can lay the groundwork for a successful business relationship.

In sum, building your business is a decision-making process. Allow your vision to set the parameters, make detailed and realistic plans, and follow through with timely action.

Krieger, BE Radio's consultant on contract engineering, is based in Cleveland and can be reached at mkrieger@drfast.net.

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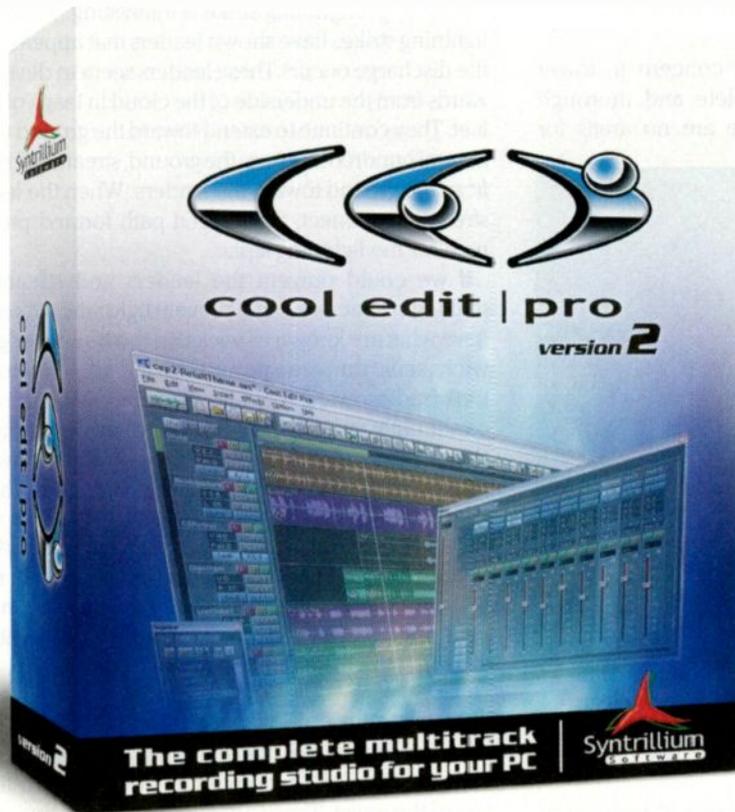
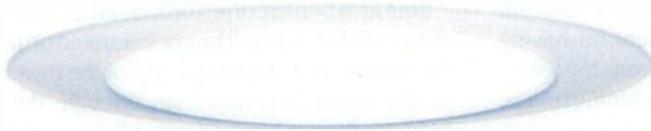
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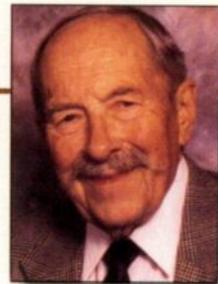
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Lightning protection

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

The radio engineer does his best to prevent its intrusion into his equipment, but having a steel structure extending from 150 feet to 1,000 feet in the air invites lightning strikes. Nevertheless, with proper engineering precautions such structures can survive intense lightning attacks. The Eiffel Tower, which is nothing more than a solid-steel lightning conductor, falls in the same category and it survives.

The most important concern in tower construction is complete and thorough bonding so that there are no areas for

If the area beneath the storm cloud includes a radio tower, the ground charge will be concentrated up the tower. When the difference between the top of the tower and the base of the cloud becomes high enough, the air dielectric between the two breaks down, a lightning strike occurs and the cloud is discharged to ground. If the tower is well grounded and has been properly bonded, no damage will occur to radio equipment.

Watching a lightning strike is interesting. Photographs of lightning strikes have shown leaders that appear just before the discharge occurs. These leaders seem to develop downwards from the underside of the cloud in leaps of about 150 feet. They continue to extend toward the ground until, when several hundred feet from the ground, streamers begin to rise from the ground toward the leaders. When the leaders and streamers connect, the ionized path formed provides the path for the lightning strike.

If we could prevent the leaders and streamers from making contact we might prevent lightning strikes. Aircraft have what are known as wicks on the trailing edges. These wicks serve the same purpose as the lightning rods on the top of radio towers. They allow the aircraft to discharge itself continually as it flies. In the case of the lightning rod, the sharper the point the better the lightning rod works.

As the diameter of a conductor decreases, the voltage gradient increases toward the point. When the voltage at the end of the rod is sufficiently high it will bleed-off some of the induced lightning charge on the ground, streamers will be reduced or eliminated and the likelihood of a lightning strike is reduced. A corona develops at the tip of the rod, which sometimes can be seen.

An ounce of prevention

Several companies offer lightning protection devices that use a series of sharp-pointed electrodes mounted on the top of the tower. These are known as static ground charge dissipation systems and can be effective. It is also common practice to install a static discharge choke from the base of the tower to ground. However, if the standard ball gap is not properly adjusted it can cause more harm than good.

AM towers, with their large and low-resistance ground systems, seem to suffer less damage from lightning. Once a lightning strike enters the tower, its path toward ground is determined by the reactance in its path. Because the rise time of the wavefront is rapid a reactance that might normally be considered insignificant can develop catastrophic voltages, which can bypass ground paths and jump to adjacent objects.

A lightning strike on a power line can enter through the line itself. Regardless of the amount of lightning activity in a station's local area, surge protectors are essential. Some power lines contain intermittent spikes caused by load

excessive heat to build due to resistance, and no sections that could present high reactance to the fast-rising lightning strike.

Taking charge

Most people have seen summer lightning or heat lightning; lightning merely flashing within the clouds often without thunder. The up-and-down drafts within the clouds in a lightning storm provide the mechanism that generates the electric charge. This charge forms on the underside of the clouds, and is called the base charge. This induces a charge of the opposite sign on the ground.



Photo courtesy of ERI

Lightning dissipaters, such as this lightning spur, reduce the potential for a lightning strike between the tower and storm cell by transferring electrical charge to the adjacent ionizing air molecules, thus reducing the probability of a lightning strike.

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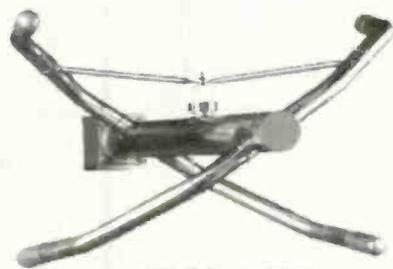
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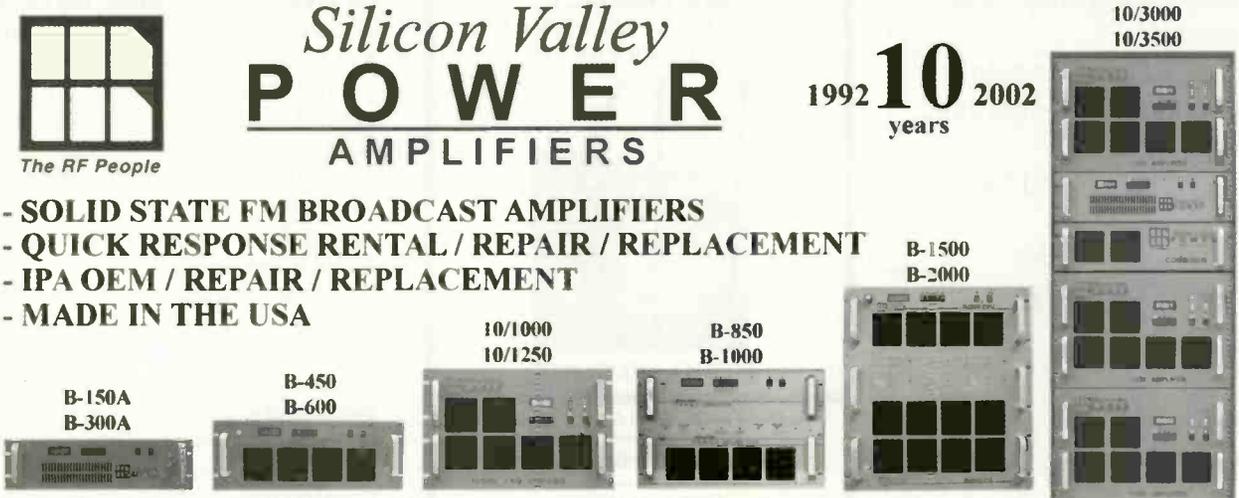


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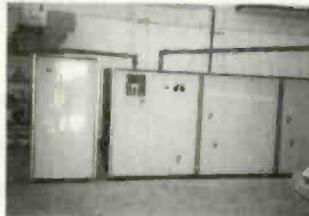
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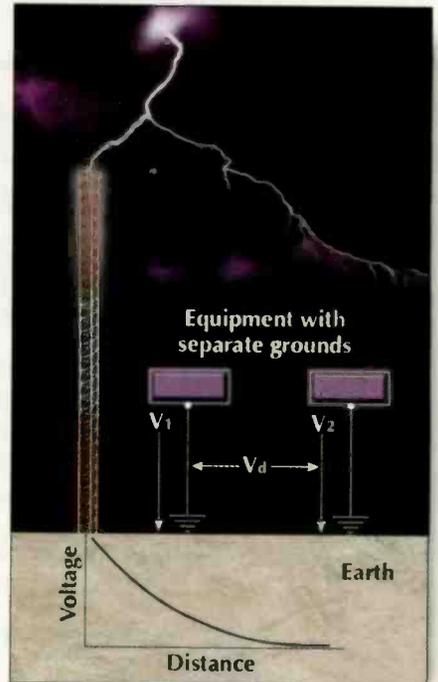
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RF Engineering

changes, as well as severe over-voltage surges caused by lightning. The surge protector should be located where the line enters the building, and additional surge protectors on individual pieces of equipment are advisable. It is essential that surge protectors be connected as closely as possible to the equipment to be protected, and in no case should long connecting cables be used.

There should be only one ground system connection. Otherwise it is possible for



Different ground points can result in a voltage differential between devices.

high voltages to develop between them in the event of a heavy strike. The extensive ground system required by AM transmitters sometimes provides an ideal unity ground. However, all connections to this ground should be made with a flat, wide copper strap to ensure a low-impedance connection. If possible, bring all ground connections close together so that there can be no potential differences between them.

If a lightning strike occurs near the transmitter building a voltage gradient will be produced across the area. If these three lines are brought through widely separated ports, surprisingly large voltages can develop between them if they are grounded in three places. Locating them together and connecting them to the same ground should reduce or eliminate lightning damage.

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Data Backup Methods

By Kevin McNamara, CNE

Did you know that 93 percent of companies that lost their data center for 10 days or more due to a disaster filed for bankruptcy within one year of that disaster? While the term *data center* in this case may apply to a different type of business, radio facilities rely heavily on network servers to support their on-air programming and business functions. Here are more interesting statistics:

- A hard drive crashes every 15 seconds
- 2,000 laptop computers are stolen daily
- 32 percent of data loss is caused by human error
- One out of five computers suffer a fatal hard drive crash

Critical data loss can occur on a server, workstation or laptop, so it is important to

tion. However, several software vendors offer programs that create an *image* of the installed operating system, including its configuration files that can be copied to a disk. These programs typically store data on a CD-ROM. These programs also create a set of start-up files that permit the PC to boot directly from the created backup disk.

Loss of data can be caused by a number of factors such as hard drive failure, mechanical or electrical; viruses that may replace or corrupt data files; human error, inadvertent formatting of a drive or erasure of certain data; or theft of PC containing critical data. Figure 1 shows a breakdown of some of the typical sources.

The decision as to which type of backup system may be appropriate is based on a number of issues, such as the potential loss of revenue or operational flexibility should data be lost; the cost of purchasing, installing and maintaining a suitable backup solution; the time required to backup data; the ease of backing up data, i.e. manual vs. automated backup systems; the life span of the backup media; and personal preference.

A final factor in determining a proper data backup solution is whether the backups will be stored on-site, offsite or over the Internet.

On-site storage may include something as simple as keeping copies of the backup in a fireproof safe or duplicating information on drives located in other rooms or floors.

Offsite backups provide the highest level of protection for data because the backups are located in a different premise, such as in the next building, or a different city, state or country. Many large companies, such as financial institutions and telecommunications companies, mirror data across several data centers throughout the world. Using this approach, even a major disaster—an earthquake or flood—would not cause systems to fail and incur a loss of data.

Internet storage sites are becoming popular methods for storing backup data. The benefits are similar to that of traditional offsite storage, but without the need to purchase and maintain equipment at the remote locations. Another advantage is that the data is available through any sufficient Internet connection, which helps to return a system to service from alternate locations. An example would be an office fire. Internet-based storage is typically priced by the amount of data stored that makes it a viable option for large organizations or individual users. The downside of Internet-based storage is the inability to ultimately retrieve that backup data without an Internet connection.

Servers

Servers play a critical role within any organization that uses a network to store and share data between two or

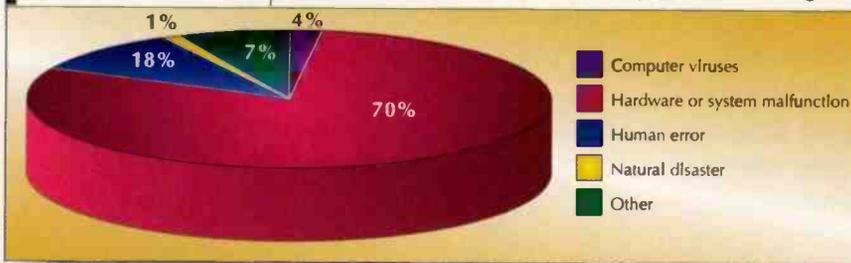


Figure 1. A breakdown of typical sources of data loss within a business.

understand what methods are currently available to back up data and how to properly implement data backup procedures.

The basics

Is it necessary to back up all of the data on a PC? The answer might change for every user, depending on his needs. Data residing on a PC, whether it is a server, desktop or laptop, using any operating system, can be divided into two primary categories: program or data files.

Program files are those that permit a program to be executed properly on the PC. Data files are those that support the application or contain raw data.

In many cases, backing up data files may only be sufficient to recover from a major drive crash, assuming the user has ready access to the original program disks. If operating system files become damaged, it may be necessary to re-install the applica-

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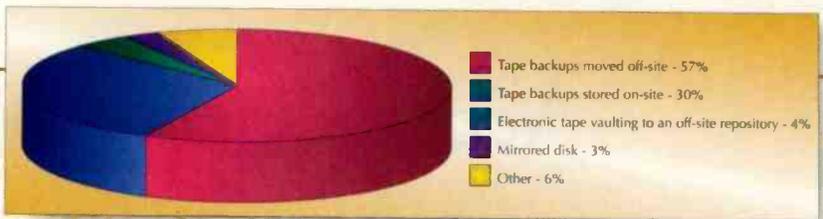
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more users. While the broad definition of a network requires at least two users, most are much larger and have built a dependency on the data that resides within their servers. Total loss of data can mean severe operational and financial impact for the affected company.



A summary of the most popular forms of data backup used.

Storage area networks (SAN) provide the ability to mirror data amongst backup servers spread over a local or larger geographic region. Disk mirroring can also be accomplished using a redundant array of independent disks (RAID), where data can be simultaneously written to multiple disks using a variety of techniques. Other methods include optical and magnetic based storage devices such as tape, CD-ROM and magneto-optical drives.

Workstations

Network-connected workstations can be backed up to remote network drives. In many cases the network is configured such that all data is automatically saved to a network drive by default. The user of the workstation can download copies of data to the local machine, but the original remains on a server. A good example of this is Microsoft Exchange Server. Users connect to the Exchange server using Microsoft Outlook, but all of the e-mail, contact information and calendar information resides on the remote server. To retrieve the latest information on the local machine, a user *synchronizes* with the server, which creates copies of the desired folders.

Backing up a PC workstation, either attached or not attached to a network, can also be accomplished locally using more inexpensive hardware solutions such as removable hard drives, CD-RW, high-density magnetic disk drives such as the Iomega Zip or just simple floppy disks.

Laptops

The options for backing up data from a laptop PC are the same as that of a desktop machine, but laptops are by definition portable, which makes them susceptible to theft and damage. The number of laptop thefts increased 53 percent in 2001 from 2000. I recommend that all laptop PCs use a Windows NT-based operating systems such as Windows 2000 Professional along with formatting the hard drive to the NT File System (NTFS). Using this approach, along with good user name and password schemes, will afford a high level of security. Files saved to drives formatted as NTFS are not easily readable by anyone but the most sophisticated hackers.

McNamara is president of Applied Wireless, New Market, MD.

The Networks articles have been approved by the SBE Certification Committee as suitable study material that may assist preparation for the SBE Certified Broadcast Networking Technologist exam. Contact the SBE at (317) 846-9000 or go to www.sbe.org for more information on SBE Certification.

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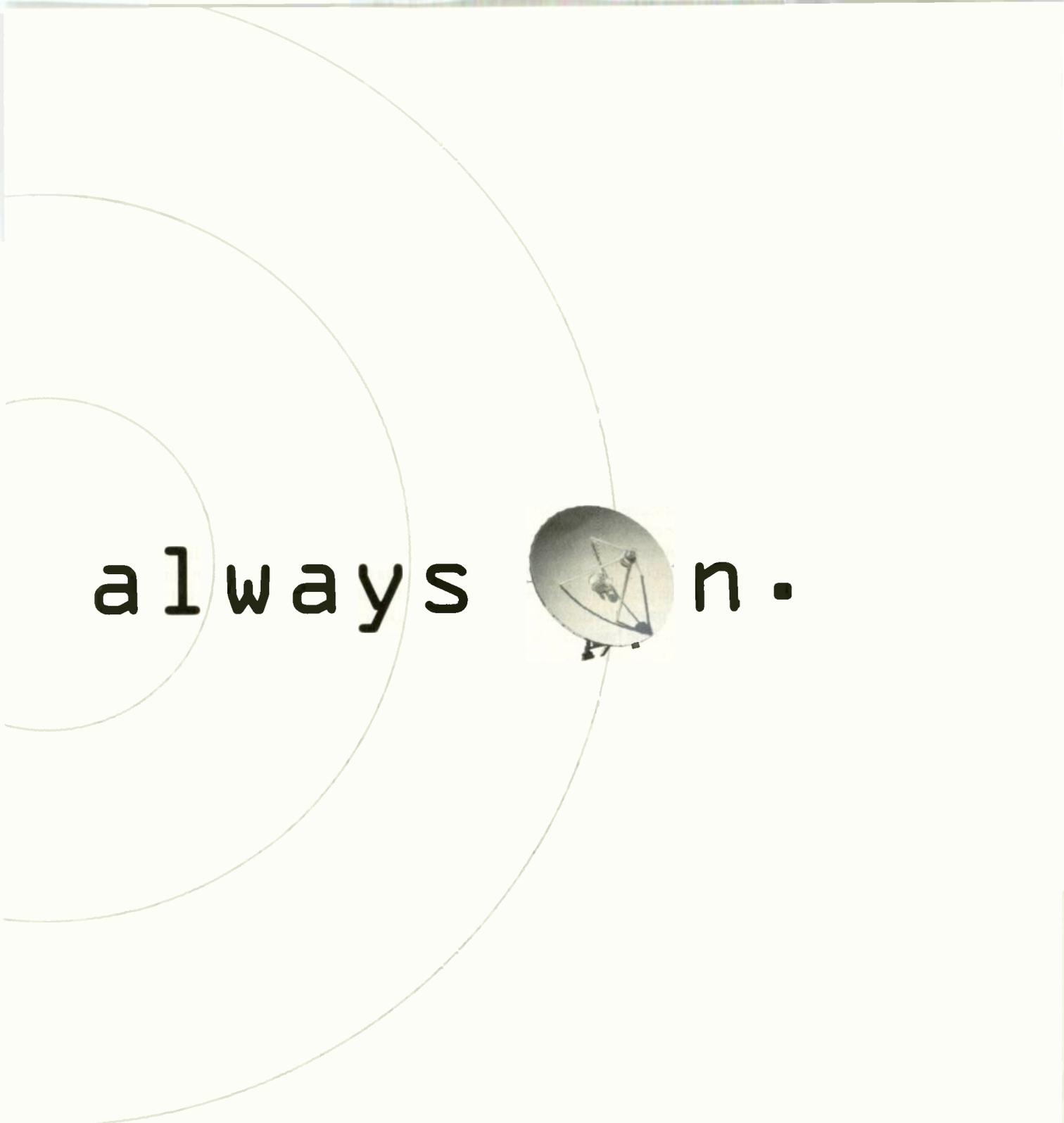
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Payola controversy heats up

By Harry Martin

Changes in the broadcast industry have suddenly made payola a hot issue again. For decades payola has been a sleeper, with radio station owners vaguely recalling the scandals involving Alan Freed in the early days of rock n' roll. Now Congress is getting numerous requests to take a closer look.

Payola is the acceptance of money, services or anything of value in return for broadcasting music or other programming without disclosing on the air that the programming has been paid for and by whom. The Communications Act and FCC regulations have prohibited payola for decades on the theory that the public has a right to know who is trying to persuade them.

The current concern about payola involves more than the traditional payoff to a DJ or program director. Consolidation in the radio industry has given large radio group owners the leverage to force record companies to pay radio stations before the stations will play their music. But because direct payments are subject to the prohibition against payola, it is alleged by some that group owners may be using alternative, less direct methods to achieve the same end. For example, one group owner has drawn the wrath of record companies because it also holds a dominant position in the music concert business. Record companies claim the owner pressures them to use the company's concert services for the record companies' artists. If they don't, the artists' songs are not played.

Another allegation is that record companies are relying on middlemen, or independent promoters, to make improper payments. Using the record companies' money, these promoters ostensibly pay for advance copies of stations' music playlists but, in the process, gain access to the personnel who create the playlists and, because of the large sums involved, are able to influence music selections. The Commission's staff has stated informally, however, that such payments by independent promoters are legal so long as there is no quid pro quo for airplay.

Various congressmen are leading efforts to stop these practices. Sen. Russell Feingold (D-WI) is planning to introduce legislation that would reform the radio industry practices that some say have led to higher concert ticket prices and homogenized radio programming that only features artists whose record companies or agents are willing and able to exercise financial clout. Rep. Howard Berman of California has called for a reversal of radio ownership consolidation because it has concentrated power in only a handful of conglomerates.

Industry groups such as the RIAA and AFTRA are urging Congress and the FCC to address this issue.

While nothing may come of these initiatives during this election year, complaints from affected businesses, public policy groups, trade associations and consumers, particularly when they come in increasing numbers, ultimately get the attention of Congressional committees and the FCC. Stations involved in these arrangements or promotions should review their practices with an eye to a future crackdown.

Free time, spectrum fees proposed

Legislation sponsored by Sen. McCain (R-AZ), Sen. Feingold (D-WI), Sen. Toricelli (D-NJ) and Rep. Martin Meehan (D-MA) would require radio and TV stations to provide at least two hours a week of free air time to candidates and for issue-oriented programs in periods immediately prior to elections. At least half of the donated time would have to be in drive time or prime time and none could be during graveyard hours (midnight-6:00 a.m.). Also under the proposed legislation, broadcasters would be billed a one percent spectrum user fee, the proceeds of which would fund the purchase of advertising time by candidates. Candidates would be issued vouchers which could be redeemed for advertising time. The vouchers would be presented by broadcasters to the government for payment.

This plan includes elements of the Toricelli amendment, which proposed free time for candidates, but was defeated during the debate on campaign finance reform last year.

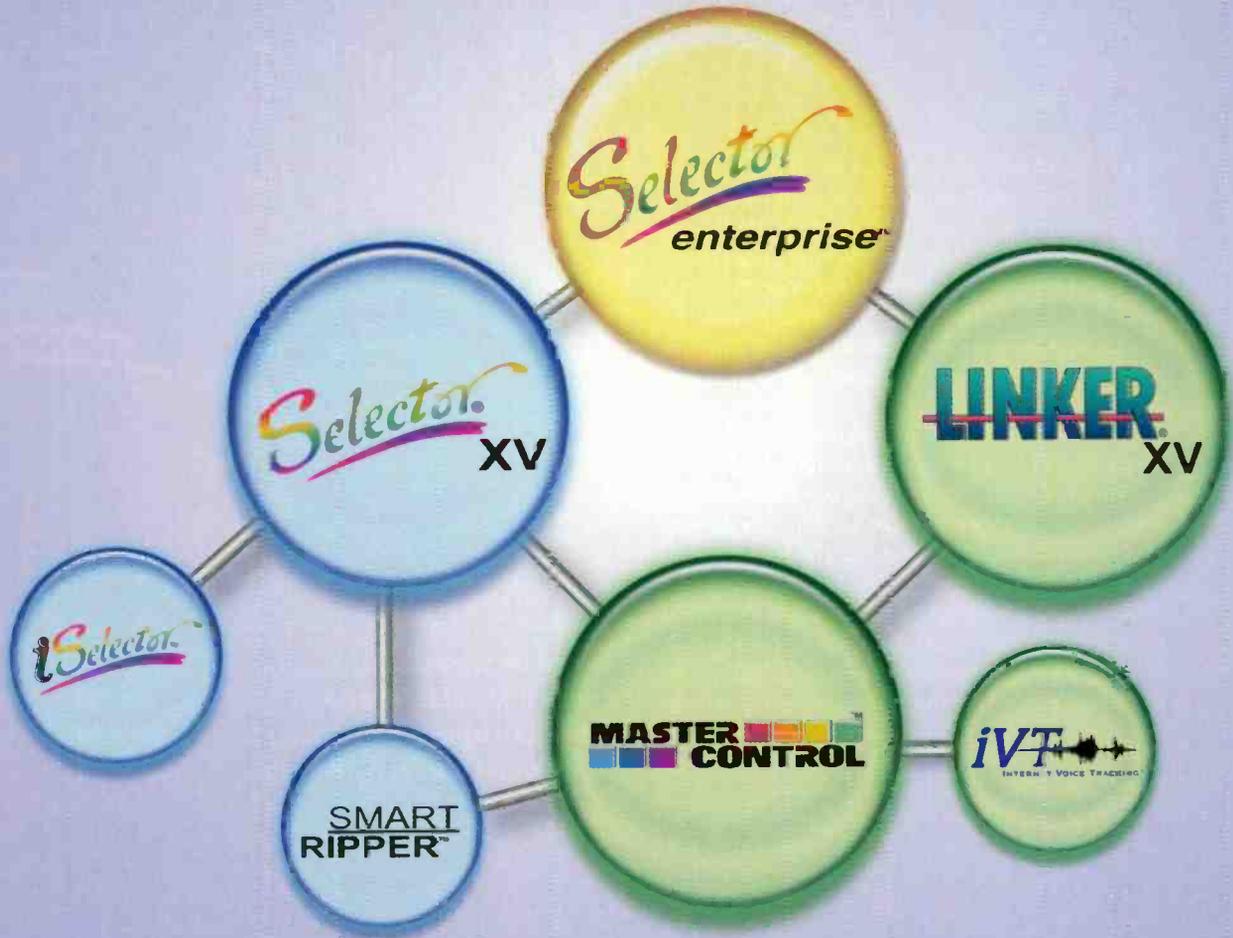
Congressman Fred Upton (R-MI), who chairs the telecom subcommittee in the House, has already announced his opposition to the new McCain-Feingold initiative.

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

Dateline:

The next renewal cycle begins March 1, 2003, when stations in Washington DC, Maryland, Virginia and West Virginia must begin broadcasting their pre-filing renewal announcements. Renewal applications for stations in those locations will be due June 1, 2003.

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A chance for radio to shine

So you're going to Seattle

The NAB Radio Show allows the radio industry the opportunity to shine on its own without being lost in the shadows of other media segments. Its core focus is on delivering audio entertainment to a mass audience. However, the event goes beyond the borders of traditional radio by integrating information about non-traditional radio topics, such as streaming and a station's online presence.

The event returns to Seattle this year, which was a successful location for the convention four years ago. Discussions before the show always speculate as to the success of the event, but the true measure of a show's success must be measured by the individual attendee.

The sessions and show floor offer something for almost everyone at the station. *BE Radio's* NAB Radio Show preview provides plenty of useful information to help you get the most from the convention. ■

NAB Radio Show Preview

Insight on Sessions	page 25
Out and About in Seattle	page 28
Exhibitor Listings	page 32
New Products from NAB Radio	page 68

Insight on sessions

By Chriss Scherer, editor

The NAB Radio Show continues to carry the misconception that it is only a sales and programming convention. The reality is that there are three full days of technical sessions. Unfortunately, the complete schedule does not appear in all the promotional materials for the show, making it difficult for engineers to show their managers that attending the convention is important for the technical staff as well.

In addition to the technical program, there are other sessions in the management track that cover radio technology. Between the exhibit floor and the sessions, attendees will have plenty to do to keep busy for three days.

Technically speaking

The Technical Workshops concentrate on radio transmission for analog and IBOC digital systems. Each full-day workshop features speakers who are recognized as experts in their field. The sessions provide practical and theoretical information that should help attendees improve their stations today and prepare for the changes tomorrow. Workshop attendees also receive a certificate signifying their attendance. Attendance may also be used to earn SBE recertification points.

Workshop Schedule

Thursday, 8 a.m. to 4 p.m.

AM/FM Antenna Certification Workshop

AM Session Description: The first part of the workshop will cover the RF components of AM directional antenna systems, bandwidth optimization concepts for AM transmission, keeping an AM directional antenna system in good repair and tactical troubleshooting for AM directional antennas.

AM Segment Presenters: Ron Rackley, vice president, du Treil, Lundin and Rackley; Benjamin Dawson, president, Hatfield and Dawson

FM Session Description: The two parts of this segment are *FM Antenna System Design and Implementation Basics*, which addresses antenna-bay spacing, array factors and array-factor design, terrain effects, cavity filter systems and directional antenna pattern development and design criteria; and *FM Antenna Maintenance*, which will focus on antenna inspection requirements, antenna repair, tower access plans, the effects of tower movement on antenna performance and antenna lifetime, FM signal strength measurements and RFR measurements.

FM Segment Presenters: Tom Silliman, president, Electronics Research Inc.; Bob Surette, manager RF engineering, Shively Labs

A chance for radio to shine

Friday, 9 a.m. to 4 p.m.

Digital Radio Certification Workshop

Session Description: Produced in cooperation with Ibiqity Digital, this workshop will highlight the status, station benefits, implementation and latest cost information about IBOC. Presenters include representatives of companies that offer IBOC equipment. They will discuss options and estimated costs of transition.

Presenters: Ibiqity Digital Rollout Strategy and Status, Scott Stull, director, broadcast business development, Ibiqity Development, Field Testing and Regulatory Update
Glynn Walden, vice president broadcast engineering, Ibiqity
Wireless Data Business Opportunities
Pat Walsh, vice president wireless data business development, Ibiqity
Wireless Data Opportunities in a Mobile Environment
Bill

Whitehart, senior technical specialist, Visteon Tom Wroblewski, strategy and implementation engineer, Lincoln Mercury Engineering
Manufacturer Implementation Panel I Moderator: Jeff Detweiler, Ibiqity
Panelists: Eric Wandel, ERI; Bill Gould, Harris/Intraplex
Manufacturer Implementation Panel II Moderator: Jeff Detweiler, Ibiqity
Panelists: Bob Surette, Shively; Dave Chancey, Moseley

Saturday, 9 a.m. to 4 p.m.

AM/FM Transmitter Certification Workshop

Session Description: This three-part workshop focuses on maintenance issues at the transmitter site. The session workbook is a reference that can be used long after the session. The workshop will also feature a session on preparing a transmitter site for IBOC.

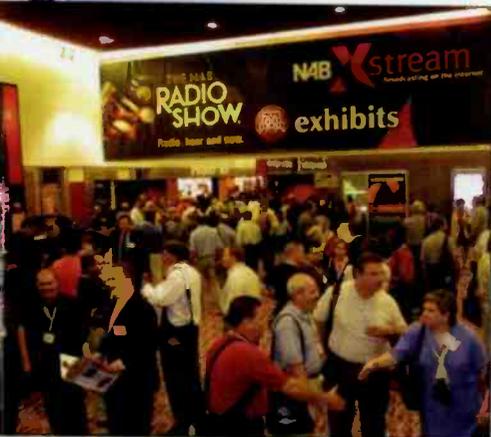
Basic Troubleshooting will concentrate on diagnosing practical transmitter problems and developing a logical strategy to correct these problems.

A Discussion With the Transmitter Manufacturers is an opportunity for attendees to talk with representatives from several transmitter manufacturers. This interactive session offers a chance to learn about various transmitter manufacturers' design approaches and recommended maintenance and troubleshooting suggestions on specific transmitter models.

Living Through the Nightmare-You're Off the Air will be a discussion of some real off-air experiences. Attendees will learn how other stations made it through the experience and what lessons were learned from it.

Instructor: John Bisset, Harris

continued on page 30



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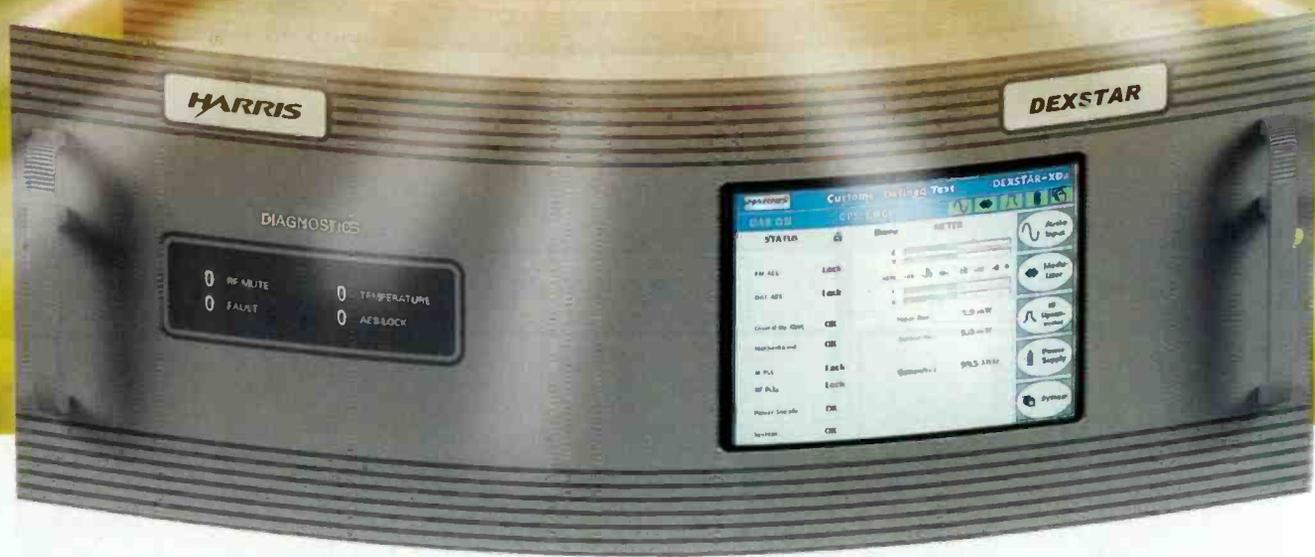
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that Harris is also the leader in IBOC DAB products. The DEXSTAR IBOC exciter is designed by Harris engineering, built to exacting standards in the world's largest broadcast transmitter-manufacturing facility and backed by a service department, recognized the world over for quality and commitment. If you're looking for a digital broadcast solution, from beginning to end, that offers the most advanced performance and reliability, stop searching. X marks the spot for Extreme Digital from Harris.

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A chance for radio to shine

Out and about

By Kari Taylor, associate editor

If you have some spare time while visiting Seattle for the NAB Radio Show, take a look around the city. Here are some points of interest that might pique your curiosity:

The **Space Needle** at the Seattle Center is the recognized symbol of Seattle. The tower stands 605 feet (184 meters) tall and boasts fabulous views of Puget Sound, Mount Rainier, the Cascade and Olympic mountain ranges and, of course, the actual city itself. Built for the

1962 Seattle World's Fair, the Space Needle celebrates its 40th anniversary this year. Eat dinner at the revolving restaurant, SkyCity, or visit the observation deck, which is 520 feet (52 stories) high. The Observation Deck is open daily from 8 a.m. to midnight and a ticket costs \$12 for

adults. Visit www.spaceneedle.com for more information.

South of the Seattle Center is the **Seattle Waterfront** on Elliott Bay. This used to be the last stop in the states for gold prospectors heading to Alaska. Now, it is a good place to ride a trolley or eat some fish and chips. The Waterfront is also where you will find the Seattle Aquarium and the Omnidome Theater. Washington State Ferries also depart from the Seattle Waterfront carrying passengers and cars to Bainbridge Island and the Olympic Peninsula. Cruises to Victoria, British Columbia, also leave from the Seattle waterfront. If you're feeling adventurous, you can even go parasailing here.

Pioneer Square is home to many of Seattle's art galleries, eateries and Web development companies. Pioneer Square is rich in history so take the Underground Tour that visits the sunken storefronts of what was ground-level Pioneer Square before the Great Fire of 1889. Klondike Gold Rush National Historic Park is a small museum that recounts a time a century ago when gold-seekers came to Pioneer Square on their way to the Yukon. This historic district becomes an entertainment district after dark. But when the sports fans and the club crowds depart, Pioneer Square is a good place to shop, especially for books.

Speaking of sports, don't forget the NFL football season will have started so you can always watch the **Seattle Seahawks** play Arizona on Sept. 15. Beginning in 2002, Seahawks football will be played in a new stadium, designed with a 67,000-seat capacity and a roof that covers 70 percent of the seating area. Buy your tickets now—if they are not already sold out. ■



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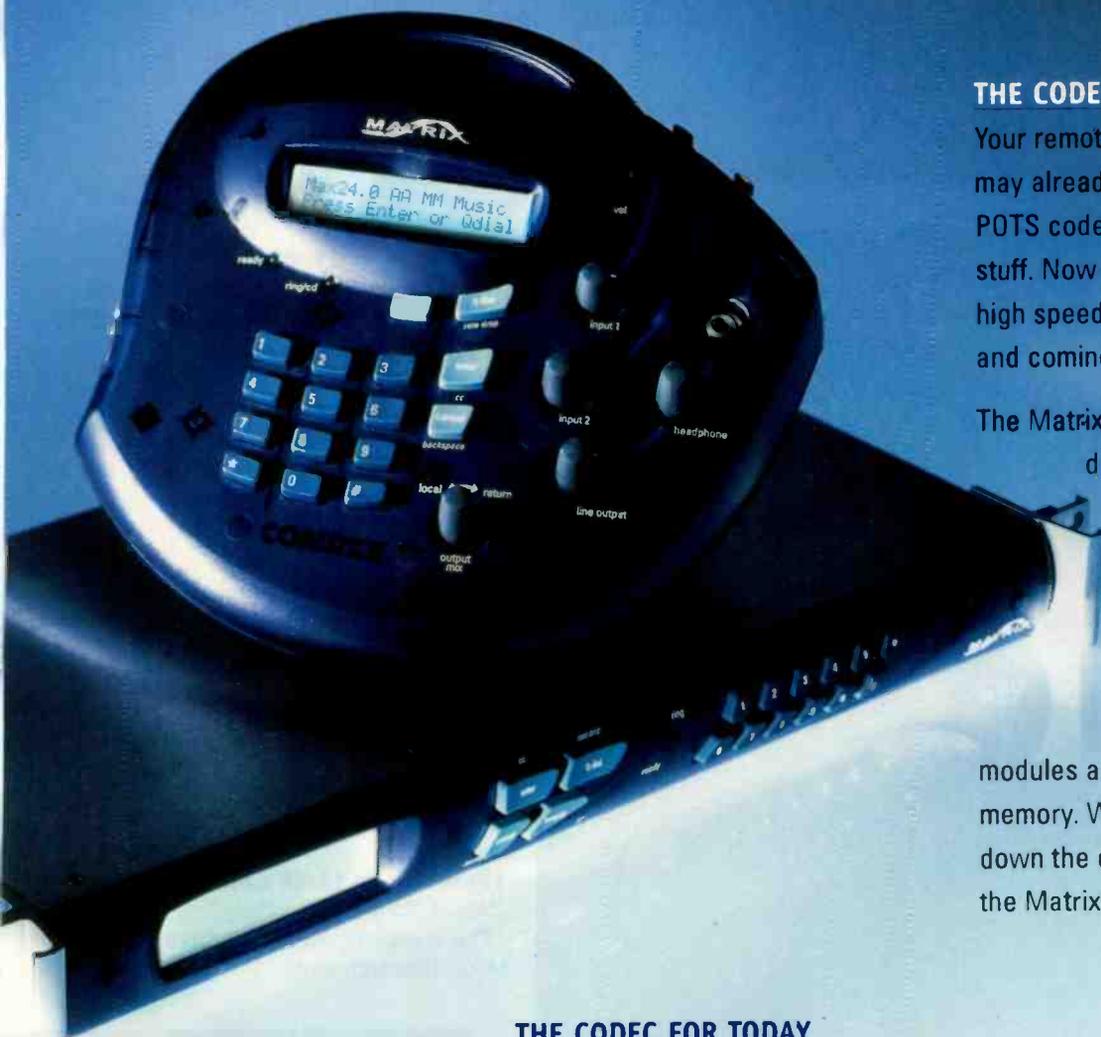
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COMREX

A chance for radio to shine



Still more to do

Outside the technical workshops, several sessions cover topics that may appeal to *BE Radio* readers.

Thursday

2 p.m. to 3:15 p.m.

FCC Rule Enforcement

An update on rule changes and common violations

2 p.m. to 3:15 p.m.

WWW: What's With Our Website?

A look at website strategies and profit plans

Friday

10:30 a.m. to 11:45 a.m.

The FCC's Audio Service Division Speaks

Covers issues of FM allotments, new filing requirements and more

3 p.m. to 4 p.m.

Radio Station Streaming

Looks at sound recording royalties, music licensing fees and substitutions

4:15 p.m. to 5:15 p.m.

Satellite Radio: Us vs. Them

Provides insight into the satellite broadcasters and what stations can do to stay competitive

9 a.m. to 10:15 a.m.

IBOC Rollout—Across The Industries

IBOC implementation from the retailers' and broadcasters' perspectives

Saturday

10:30 a.m. to 11:45 a.m.

Internet Study IX

The results of the latest Arbitron/Edison Media Research study



And another thing

If the sessions and exhibits aren't enough to keep attendees busy, the convention will also hold the Radio Opening Reception on the exhibit-hall floor on Sept. 12 from 5 p.m. to 7 p.m., The FCC Policymakers' Breakfast on Sept. 13 from 7:30 a.m. to 8:45 a.m., and the NAB Marconi Radio Awards Reception, Dinner and Show on Sept. 14. The reception begins at 6 p.m., dinner and the show begin at 7 p.m.

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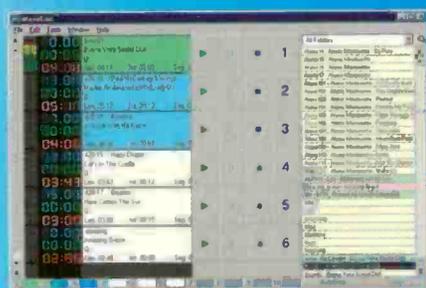
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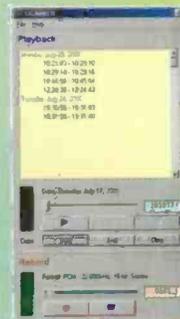


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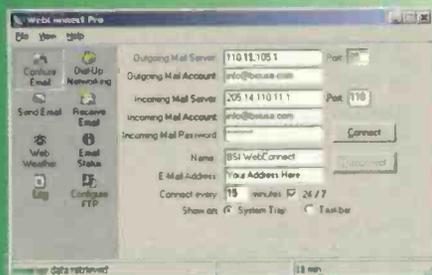


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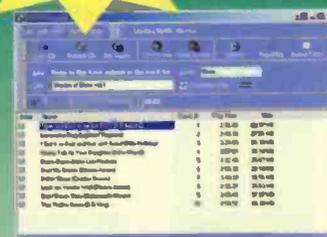


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SRC-32 Serial Remote Control

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The Tower and the *Winnipeg* Inferno

By Barry Thomas, CPBE CBNT

While the actual disaster was not that severe, the legal and political issues surrounding the famous Hollywood building made the task of resuming business that much more difficult.

Broadcast engineers generally enjoy a certain amount of crisis. Most like being resourceful and switching to battle mode when there is a serious problem that threatens to keep the stations off the air. It's a good way to test one's mettle. When a fire left the Lotus Communications stations in Los Angeles in peril, Chief Engineer John Cooper had the opportunity to test his mettle as a broadcast engineer.

Lotus Communications owns three stations in the Los Angeles area. KWKW-AM 1330 is a 5kW Spanish-language talk-format radio station that simulcasts on its sister station KWKU-AM 1220. KWKW serves the Spanish-language segment of Southern California's population and is the Spanish voice of the LA Lakers, Dodgers, Sparks and Chivas. KIRN-AM 670, *Radio Iran* is America's first commercial Iranian-language station serving another segment of the multi-cultural Los Angeles area.

KWKW, KWKU and KIRN studios were on the 6th and 15th floors in a landmark building at Hollywood's Sunset and Vine. The building was a 20-story high-rise that offered a breathtaking view of the LA basin from its 360 Club on the top. The building, memorialized in the 1974 disaster film *Earthquake*, is on the Hollywood Walk Of Fame.

On Dec. 6, 2001, disaster really struck the so-called Earthquake Tower when the main electrical room in the basement was destroyed by fire. The building was built in 1964 and didn't have many electrical backups and improvements that are required today. Although the building was structurally sound and all the electrical and plumbing was fine, the entire building was evacuated. Everything was destroyed at the main building electrical bottleneck meaning no elevators, no lighting, no non-battery emergency lights. The building was dark—except for the stations. The radio stations were operating from their

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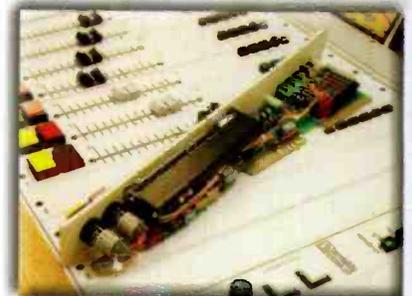
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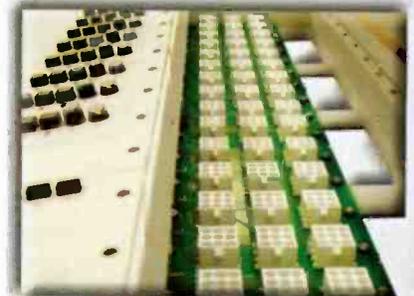
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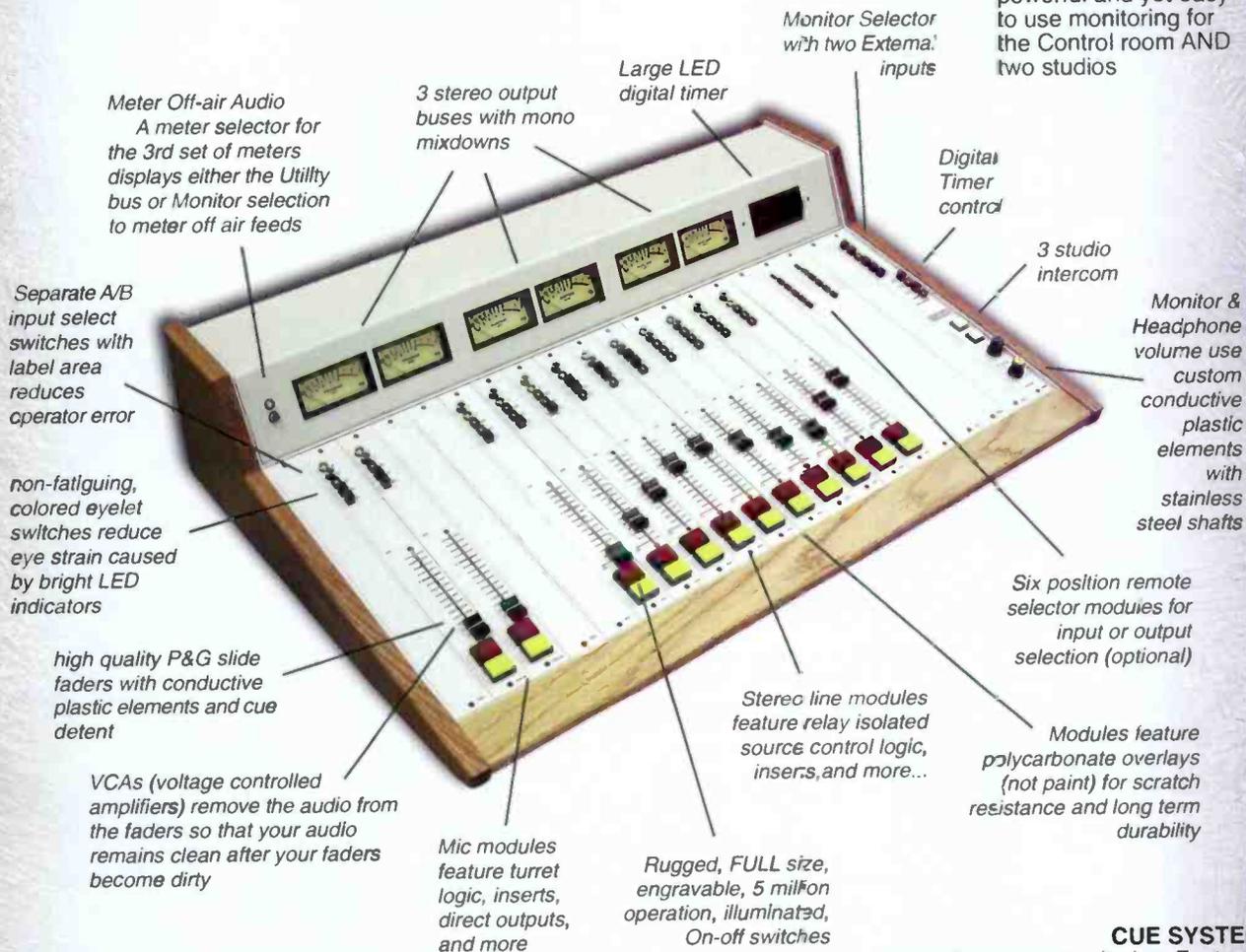
18 input position model shown. Available in 8, 18, & 28 module sizes. Universal design allows any module in any position. Fully shielded with metal side panels. All electronics is on modules for ease of repair. I/O connectors are under VU meter panel for ease of access while in use (no connectors under modules).

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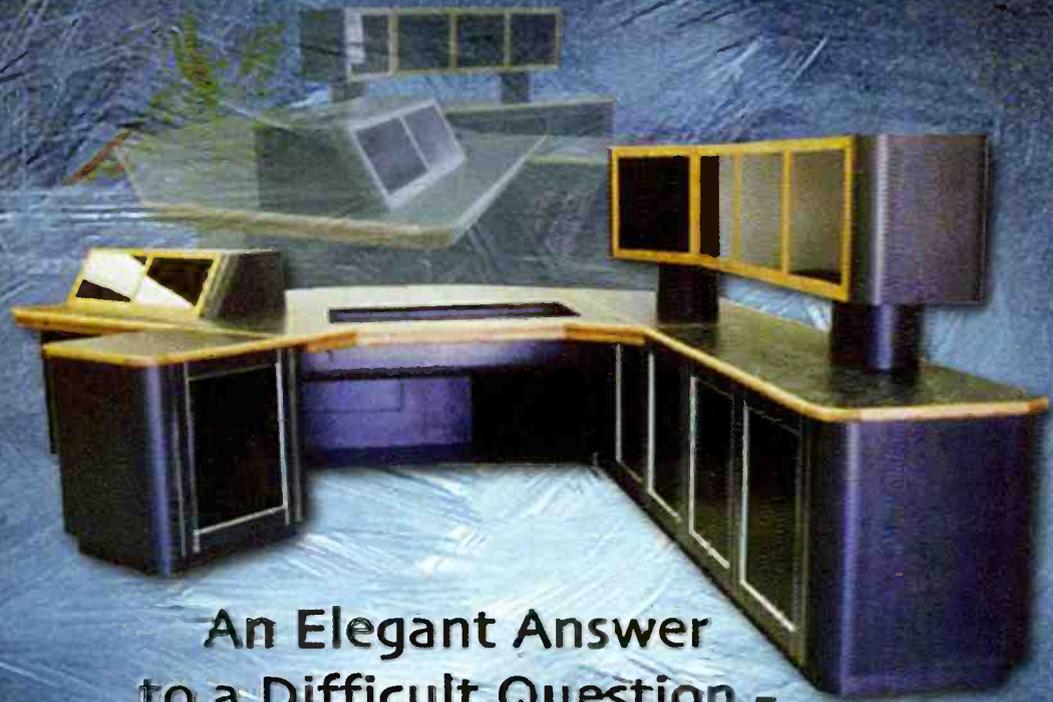
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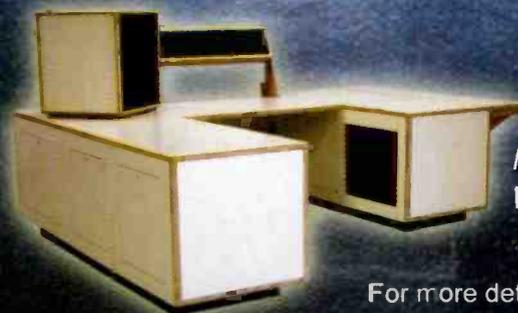


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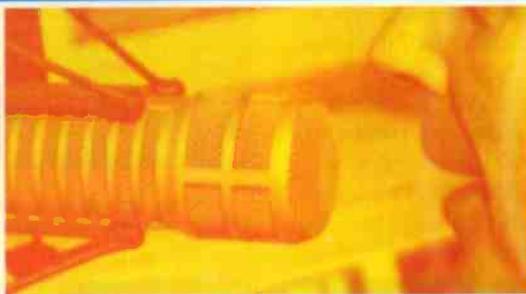
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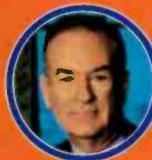
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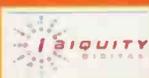
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THE NAB
RADIO
SHOW

The Tower ^{almost} and the inferno

own generator without a hitch. Proper disaster planning had kept the station from suffering a debilitating shutdown—almost.

Because the building had no elevators, lights or life-safety electricity, the fire chiefs would not let the station personnel remain inside and work within the spaces operating on the generator. Cooper got to work. First he instructed the station producers,



The transformer vault is accessed through this underground opening.

announcers and whoever would help to retrieve all the mixers, cables, microphones and remote equipment they could carry down 15 flights of stairs. This equipment would be needed to set up temporary studios. The fire chief allowed them one visit to get the equipment. At the same time, Cooper worked with the fire chief and inspectors to allow him to use the building if he could secure a generator large enough to support all building emergency lighting, life-safety equipment and at least one elevator. He then found and ordered a 1,500kW generator that would suffice.

Unfortunately, the stations were not out of the woods yet. The fire inspectors reconsidered their previous decision. They could not allow the building to be occupied because too much of the electrical feeder equipment was destroyed and was considered unsafe. The fire chief allowed the station one more trip into the building before sealing it. Again more salvageable equipment was brought down including 105 computers, which would serve the studios and sales departments of all the stations. This included the Audisk automation computers.

Back to plan A

Cooper packed as much equipment as he could fit into vehicles and started a long drive to the KWKU city of license, Pomona, CA, to begin operating KWKW and KWKU from their main studios. He used the equipment at that studio along with remote equipment and an Audisk system to get the station back on the air and operating with all programs, including commercials, within six hours of the fire.

KIRN didn't have a separate studio location like KWKW so Cooper had to be more creative with his solution. The stations leased space from an uplink/translator site in the west San Fernando Valley. The landlord had a small studio at this location, which also served as an uplink facility for DirecTV. The landlord allowed KIRN to use

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The Tower ^{almost} and the inferno



this remote location as its studio. More remote equipment and another automation system were quickly wired and LA's Radio Iran was on the air again within 24 hours after the disaster.



The new studio space is being prepared for the early 2003 move-in.

This was sufficient to get the stations back on the air for the short term. Unfortunately, the damage at the Sunset Vine Tower was significant so reoccupation of the space was not going to be soon in coming, if ever. The challenge now was to find a home for the studios and offices of the station for an extended period of time.

Just a block down Vine Street, at the corner of Hollywood and Vine, Hispanic Broadcasting had just vacated its studios, which housed the historic 10Q radio station. Lotus quickly made arrangements to lease the space and use whatever equipment and furnishings that were left to make a temporary home for all three stations. Fortunately, the facilities included raised studio flooring, furniture, racks and infrastructure sufficient to serve the stations. All available consoles, mixers, cables and microphones that could be acquired were installed. Core drilling through 20 floors was necessary for all the cables needed. Six hundred telephone pairs were run in addition to the more than 200 pairs already in place for the HBC stations. Within a month's time, 105 employees of Lotus Communications' LA stations had a new home and were back to normal production and broadcasting.

Still more to come

There were more trials to be had. Access would be limited for a significant time while legal hassles, liabilities and even criminal negligence issues were being settled. Lotus decided that it would be best to be in control of its own facilities and purchased a building overlooking the Hollywood Hills near Universal Studios. This building has facilities for 11,500 square feet of new station space per floor. Lotus is preparing the space for a January or February 2003 move-in. The new location has also presented an opportunity for the station to install a nearly turnkey studio using routers, consoles, components and systems provided and built by Wheatstone.

Thomas is a contract engineer in Los Angeles and chief technology officer of Stratosaudio.

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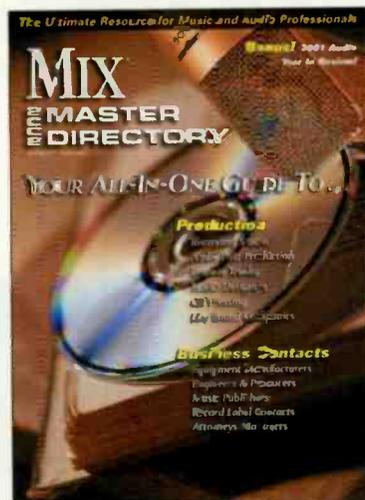
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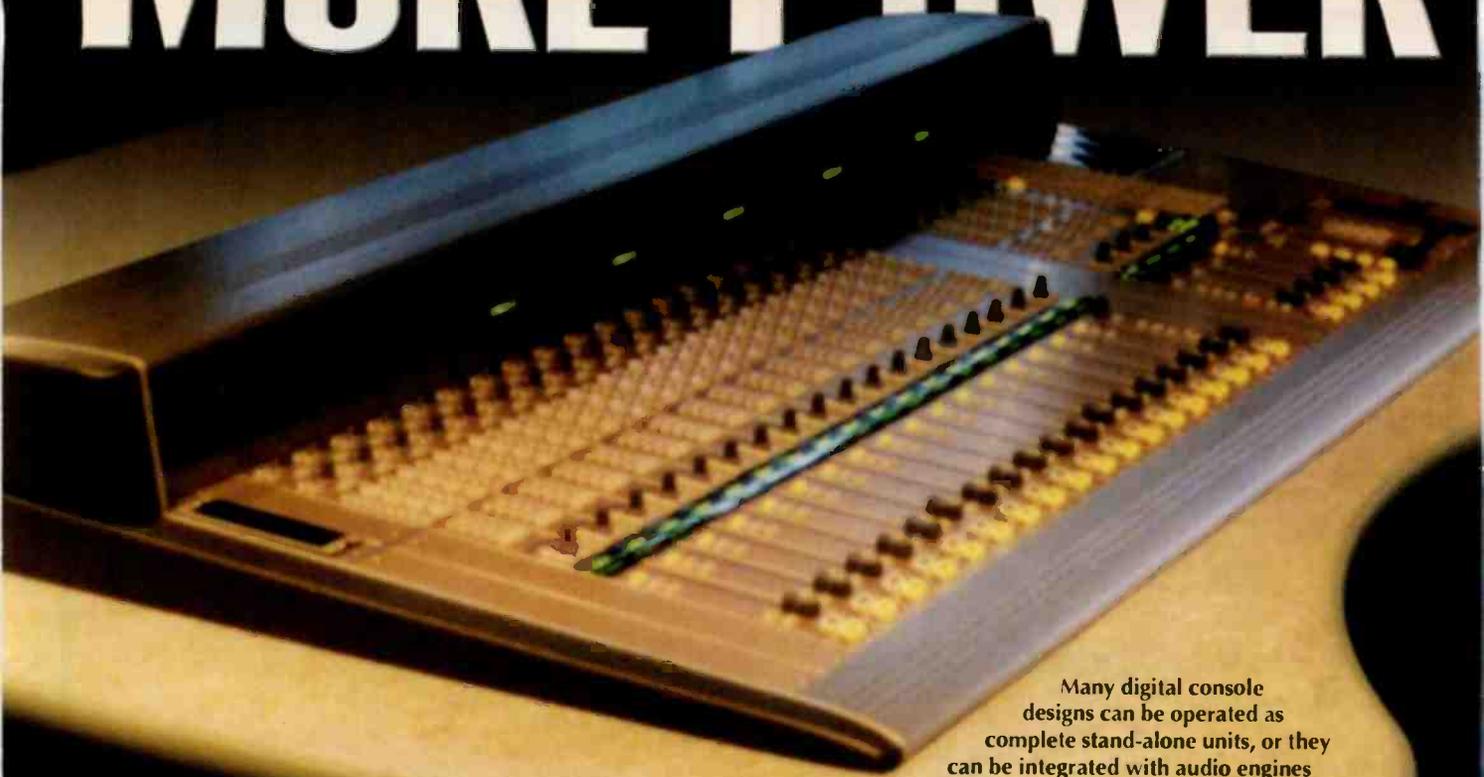
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Many digital console designs can be operated as complete stand-alone units, or they can be integrated with audio engines and router frames for greater versatility.

for Less Money

By Steve Fluker

The newer control room audio console designs may look and operate like

consoles of the past, but they are not. What is under the hood is different and doing a little research may save you money and make your job much easier.

Since the mid-1980s, radio station control rooms have been evolving from analog to digital, first with CDs and then DAT. Before long, reel-to-reel recorders were replaced by computer digital editors, and portable cassettes were replaced with mini-disc recorders. Even the CD is now being replaced by computer audio storage.

As digital technology evolved, more and more equipment was being designed with digital inputs and outputs. Unfortunately, engineers had to ignore these digital ports and continue to use the balanced audio standards because of the limited availability of digital audio consoles. When the first digital on-air consoles hit the market, they were expensive, controlled by a computer

that made them subject to crashing, and had fixed numbers of digital and analog inputs, making them less flexible. Today there are a wide variety of digital boards designed to fit any need and budget so there is no excuse for not considering them.

More complex than analog

One of the reasons for the late arrival of digital consoles was the complexity of their design. An analog design passes the audio through an adjustable resistor or potentiometer and through a buffer audio stage, and then bridges the output of multiple channels to a common mixing bus (see Figure 1). Digital no longer deals with a varying analog voltage, but rather changing the digital

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data itself. Passing data through a device isn't the problem. Varying the volume and mixing digital data streams makes it more complicated.

Figure 2 shows one method of adjusting and mixing the audio digitally. A digital data input feeds a level processor that, like a calculator, performs a mathematic function to the signal. The console pot

provides a control signal that instructs the processor to vary the digital signal level. The converted data is used as a multiplier of the original digital audio data. (See *A Point Worth Making*, page 53.) The level of each input must be individually adjusted and then mixed together. Like the analog counterpart, this mix process sums the data of all the inputs into a new digital bitstream.

New flexibility for digital

To be practical for a radio control room, consoles must have the flexibility of accepting digital and analog inputs. To accomplish this, an analog input will pass through an A/D converter. Manufacturers use a variety of methods to handle the conversion of analog inputs. Some have different modules for analog or digital inputs, which are ordered according to specific needs, much like ordering microphone or line input modules on analog consoles. Others use one type of module with a separate add-on circuit board used to select digital or analog. This method gives a one-module-fits-all solution and makes future changing of a module from analog to digital easy and relatively inexpensive. Some of the high-end consoles will have A/D converters available for any input allowing the user to easily make changes in the console configuration without purchasing anything new.

When designing a new studio, carefully consider the audio console. With so many available options, don't rely on what you already know. While modular analog consoles are still available and work well for some applications, there are newer and better ways to control audio. The first consideration is to decide if the studio will be part of a consolidation project and one of many studios in the facility, or if it is to be used as a stand-alone installation. Next, note every source that will be needed in the room. For larger projects, consider a console that can be easily interfaced to a routing switcher system. Many modular consoles offer custom drop-in modules, which are com-

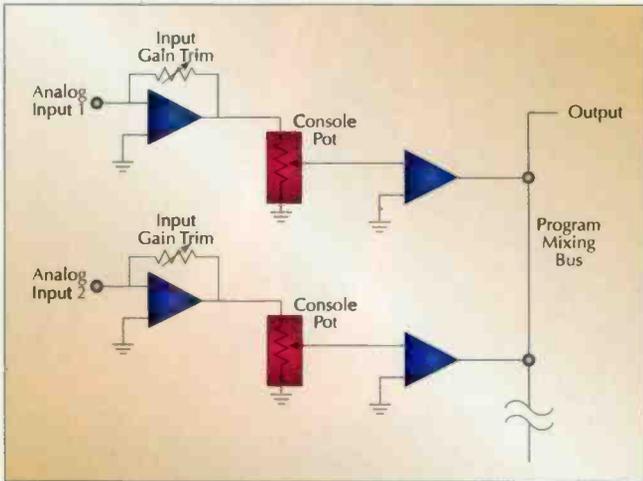
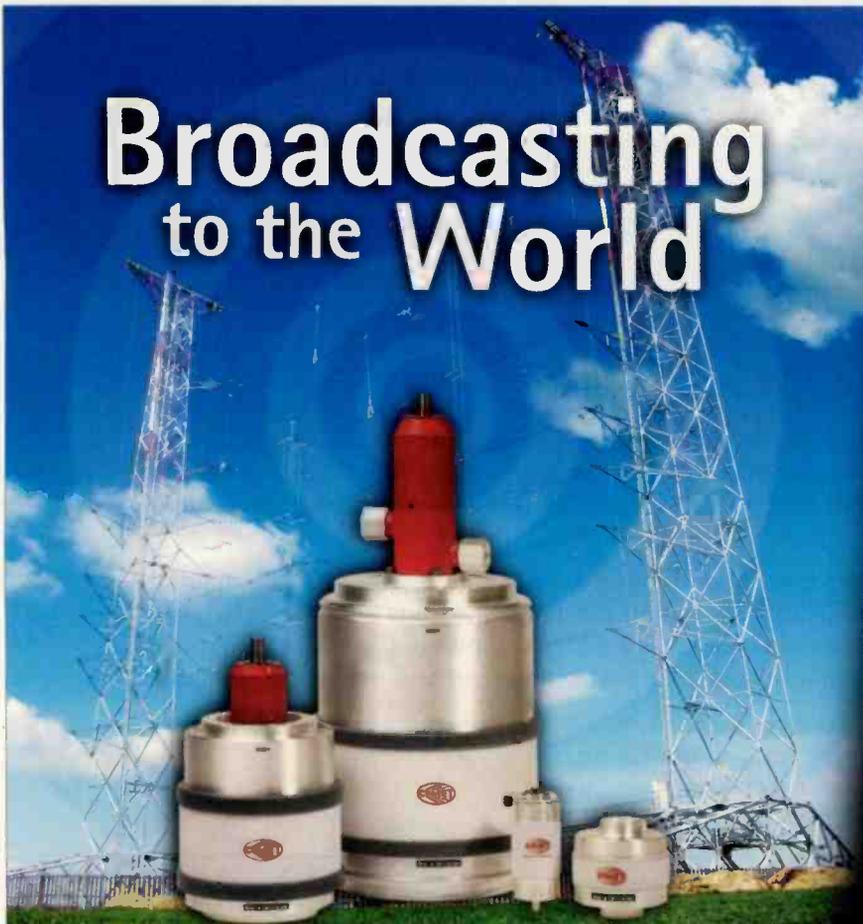


Figure 1. A block diagram of a traditional analog audio console.



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patible with many of the popular routing switchers on the market and actually serve as a controller for the switcher. These replace the old remote line selectors and allow selection of any

source that is connected to the router instead of being limited to just eight or 10 inputs. Some of the newer consoles also provide serial data ports, which can connect directly to the router and will allow routing of the machine logic.

Another type of console is the router-based console. These control surfaces don't use individual modules with audio inputs and outputs, but rather directly control the audio inside the routing switcher itself. With this type of system, the mixing bus for the console is created in a single routing-switcher output. Typically, a single output of the routing switcher will actually have as many as 24 or more internal mixing cells, with the volume level of each cell

individually controlled by a different pot on the console. There are several benefits to this type of arrangement, the main advantage being flexibility. All audio sources and their associated remote control functions are connected to the routing switcher and become a pool of sources. This allows any source to appear in any studio, on any console or even multiple locations on a control surface. These systems can allow literally hundreds of inputs to be available on a single console and every pot on the board becomes a routing-switcher controller/selector. These consoles can be programmed so that each announcer can have his own layout on the console. This is great for complex formats such as news-talk stations. Another benefit is that the electronics and wiring are dramatically reduced. These consoles typically are connected with one CAT5 cable, a multi-conductor cable for GPI logic inputs and outputs, and a power cord. While they might not be modular in design,

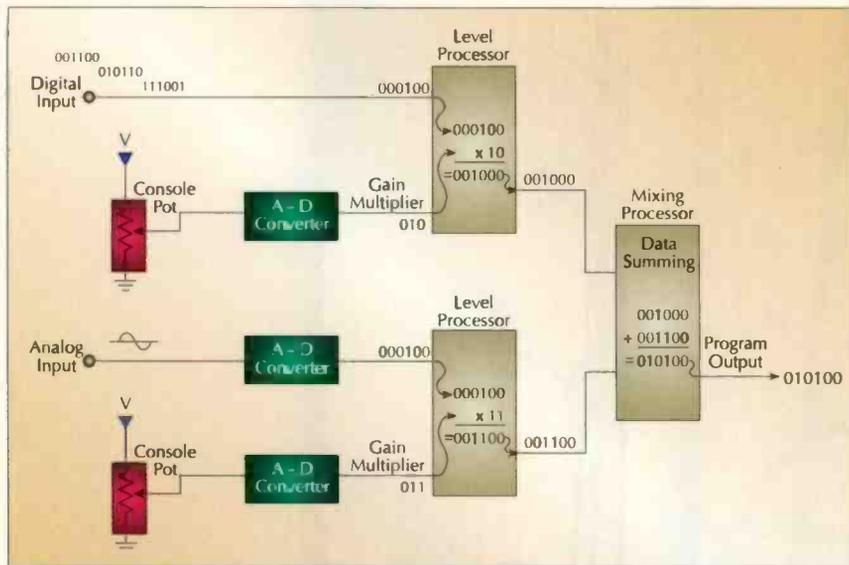


Figure 2. Conceptual diagram of a digital audio console.

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they are lightweight, and one person can swap an entire console in as little as five minutes without taking the station off the air or causing a glitch in the audio. This is because there is no audio passing through the console. Think of the console as a fancy keyboard to a computer. All of the audio inputs and outputs are connected and remain in the routing switcher itself. With the reduction of



A router-based design relies on an audio engine to handle the routing and mixing functions. The consoles are just control surfaces.

electronics comes a lower price as well. You may be surprised at how much more you can do for the same money you would spend on a conventional router and control console.

There is a downside. Because there are no direct inputs or outputs on the control board, outputs from microphones and CD players must be wired out of the control room to the equipment room to be directly connected into the routing switcher. Still, you will find a significant reduction in wiring between the equipment room and control room.

Some manufacturers are introducing hybrid systems to address this rack room/control room routing issue. Routing control modules are used for the sources coming from outside of the room. Direct inputs are provided within a room for sources that originate there. In most cases, these local sources still appear on the central routing system and are available elsewhere in the facility. These hybrid systems still use serial ports connected to the routing switcher for control of the common sources and logic on the router.

Digital features

As digital technology continues to move forward so do the features and capabilities of the consoles. Control boards with digital displays to indicate the source of each pot are common. This eliminates the added expense for etching legends on the on/off button caps, and prevents the unsightly label-maker tape stuck to everything.

More features now appear on the consoles as well. Digital consoles now have built-in microphone processors, equalizers, compressor/limiters and other digital effects such as reverb and flanging, which can be used on any channel on the control surface. While some of the high-profile talent may still want to use their favorite outboard processors, the quality of these built-in digital effects is good, and they are ideal for processing RPU receivers and codecs, or cleaning up telephone caller audio. It can also be a cost-saving measure for smaller-market stations, eliminating the need for expensive outboard processing and effects. The built-in processing can be

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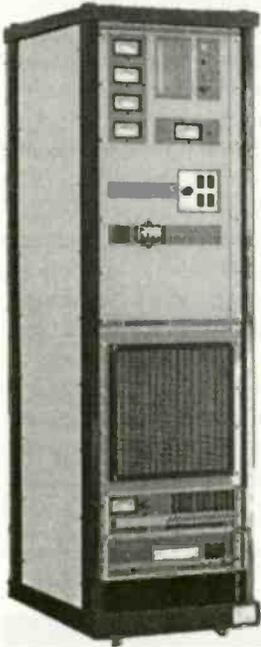
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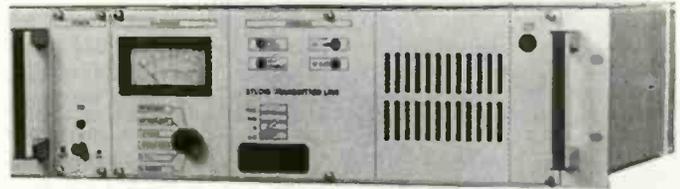
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assigned not only to inputs, but also to any of the output buses as well. This gives the user the ability to take a clean program mix busto an air chain, then take a second program mix bus, specially processed within the console, and feed it to other sources such as a streaming audio server.



Smaller control surfaces can be used to provide complete access to all audio sources and destinations without occupying a large space.

Digital consoles also provide more auxiliary and mix/minus buses than their analog counterparts, thus addressing the needs of complex formats.

Expect to see more features in the future such as a built-in obscenity delay for morning and talk shows. With the built-in digital effects and the ability to accept any type of input source (AES, SPDIF, fiber, analog balanced and unbalanced), thousands of dollars can be

saved on outboard processing and matching devices.

Manufacturers need to remember to keep the control room console simple and not make drastic changes that the on-air announcers must deal with. Announcers like to say that they have the latest in technology but don't like to deal with job changes.

The production room is a different story. New production consoles have built-in features that rival, and in some cases outperform, some of the best outboard effects. They can also directly interface with digital editors to offer a complete package with full automation of faders, EQ, panning and digital effects. Because they can be complex, many of these consoles allow all of the settings to be stored as a project. Any saved project can be instantly restored. These new production consoles offer incredible power at exceptional prices. A fully loaded digital production board with built-in effects and more than 70 inputs can cost less than \$10,000. Once again, there is a downside. These consoles have become complex and take time to learn to operate. This is not a problem for the production manager who uses it every day, however, it can be intimidating for announcers or other staff members to come in and quickly record a voice track. Having a smaller, more traditional dub room available for this type of work may be useful.

Take time to pre-plan a new studio before jumping into a console purchase. It takes a change in your way of thinking, but with proper planning, you will be able to have a state of the art digital facility with flexibility you probably never thought about all for a price tag that might be less than you imagined.

Fluker is the director of engineering of Cox Radio, Orlando, FL.

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Photo courtesy Kevin Terry

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A point worth making

By Kevin Nosé

Digital doesn't guarantee perfection in the production domain. The way that audio data is processed can actually cause unwanted noise in an aspiringly pristine mix.

The key point to understand in a production environment is that with any desired final dynamic range and signal-to-noise goal, there must be an even greater internal dynamic range and signal-to-noise capacity to make that goal possible. Without it, the numerous round-off errors that are always present from digital signal processing could accumulate to the point where they become audible. So even though 16 bits of resolution go a long way to represent a final mix with 96dB of dynamic range, intermediate stages of the signal chain deserve more.

Consider the following worst-case scenario where the amplitude of one 16-bit signal is being scaled down almost entirely, for instance by 95dB. Ideally the result would maintain all accuracy and support 96+95dB of dynamic range, but that would require a lengthy 32 bits of resolution to correctly represent. The additional 16 bits would have to be added to the bottom, or least-significant side of the sample, for this to work properly. Systems that add additional resolution in this way are making use of fixed-point logic, because each sample has an implicit scale associated with it and each bit in the sample represents a known magnitude. The name comes from the idea that the *binary point* (the base-2 equivalent of a decimal point) for each sample is fixed to a predefined location. With this added resolution, any round-off errors caused by the scaling process would be too small to influence a final 16-bit output. Because of this benefit it isn't uncommon to find systems that make use of 40 or more bits of fixed-point resolution per internal audio sample.

Other systems employ floating-point logic to support a large internal dynamic range. These systems associate a second parameter with each sample that defines the scale of that sample. This parameter, called the exponent, can help represent a massive dynamic range (~1,000dB with a 10-bit exponent) in a way that simply isn't practical with fixed-point logic. Although floating-point logic is flexible, it tends to be computationally expensive and is still largely dependent on the resolution of the original audio sample to maintain good signal-to-noise performance.

However it's accomplished, through fixed-point or floating-point logic, the bottom line to the user should be that the output audio remains free of unwanted production-related artifacts. This depends on the design of the production tools, not the fact that they're digital.

Nosé is president of NeoSonic Industries, Cleveland, OH.

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How It Works



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IBOC transmission

By Doug Irwin

AM 2002 has come and gone, and we can now assess equipment availability for use in a DAB system. The introduction of radios that are capable of receiving the Ibiqumity system is slated for the January 2003 CES, so it's time to get started. Before deriving budget numbers, review the information at hand so that you know how IBOC works.

AM and FM IBOC systems have much in common. They carry the same audio as the analog portion as well as ancillary data services. The AM and the FM IBOC DAB systems use the spectrum already allocated to the particular broadcast station, hence the descriptor in-band on-channel.

Instead of transmitting all of the data serially, on one carrier, the data is transmitted in

The primary group is transmitted from about 10kHz to 15kHz from the center frequency. The secondary group is transmitted from about 5kHz to 10kHz from the center frequency, and the tertiary group is transmitted from about 360Hz to 4.7kHz from the center frequency. The power of each subcarrier varies according to its group. The strongest subcarriers are in the primary group. Each subcarrier in the primary group is modulated at 30dB below the carrier level (i.e., about 5W per sub-carrier for a 5kW station). With FM IBOC the data is transmitted via two groups of subcarriers. The lower digital side-band group spans the spectrum from almost 200kHz to about 130kHz below the center frequency, and the upper from 130kHz to just under 200kHz above the center frequency. Each subcarrier in these groups has a power of -48dB below the unmodulated carrier level, and the total average power for each of the groups (upper and lower) is 23dB below the unmodulated carrier level.

Transmitting the IBOC signal

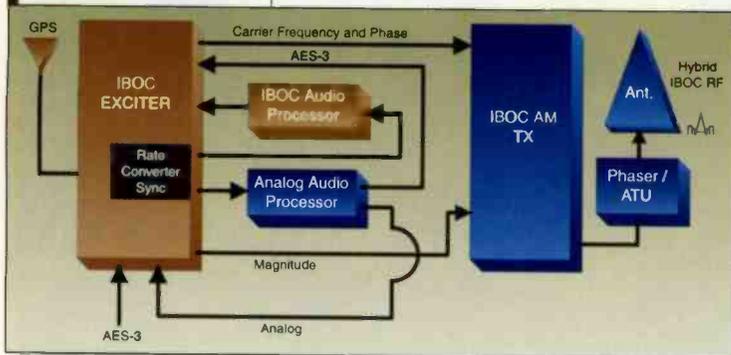
The AM and FM IBOC transmission schemes use exciters that are similar. Both have two AES inputs (44.1kHz sampling frequency). The first AES input feeds the Ibiqumity Perceptual Audio Coder (PAC) encoder, which is used in generating the data stream that ultimately carries the program through the system. The second AES input is delayed in time and then processed for the analog transmission.

The delay on the analog portion is needed to synchronize it with the digital signal. This way the receiver in the field can accomplish a graceful blend from digital to analog and vice versa.

The AM IBOC exciter interfaces with the AM transmitter via two signals: one representing magnitude, and one representing frequency and phase. To transmit an AM IBOC signal, a station will need a transmitter capable of transmitting the IBOC subcarriers while faithfully generating and transmitting the backwards-compatible AM signal. The FM IBOC exciter output signal consists of just the digital side-band groups centered around the carrier frequency. The Ibiqumity system specification is for the transmission of the digital side bands (added together) 20dB below the unmodulated carrier level. There are three methods currently being discussed for accomplishing this: low-level combining, high-level combining and the use of separate antennas for the two signals.

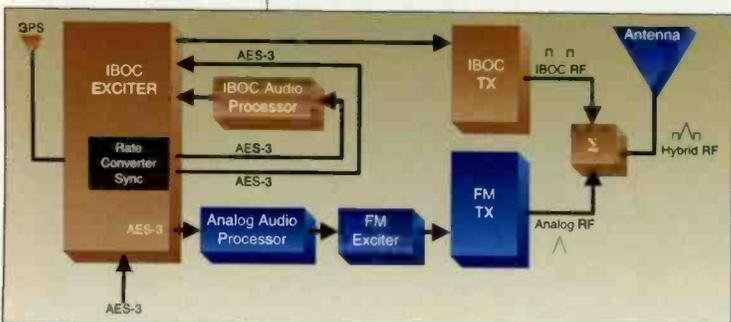
Low-level combining is accomplished by summing the output of the digital exciter and the analog exciter, and amplifying the resulting signal with a linear amplifier. A linear amp is necessary because the IBOC carrier levels vary in amplitude by as much as 5.5dB with respect to their average levels. The advantage to this method is simplicity; however, there is a major disadvantage.

Only recently have transmitters been created to



Block diagram of an AM IBOC transmission path.

a parallel fashion, diluted over multiple groups of subcarriers that are spread about symmetrically with respect to the center carrier frequency. In the case of AM IBOC, there are three sets of subcarrier groups: primary, secondary and tertiary.



Block diagram of an FM high-level combining system.



The Source

A Newsletter from Electronics Research, Inc.

ERI Collects Two Awards at Spring NAB2002

This year's Spring NAB Show held in Las Vegas proved to be a huge success for ERI. Two different panels of radio industry professionals recognized ERI for one of its many innovative products. The **Axiom Broadband antenna** received the "Pick Hit" award from *BE Radio* and the "Cool Stuff" Award from *Radio World*.

The Axiom antenna is one of the most advanced multi-station, side-mounted antenna platforms ever offered to FM broadcasters. The Axiom can accommodate several stations in multiplex mode, making it the answer to crowded tower loading situations where additional wind loading is critical. Its unique design incorporates three-stage transformation, shape-factored elements and feed-point reactance compensation.

BE Radio's "Pick Hit" Award, with the products selected by a panel of radio industry professionals rather than the magazine staff, recognized the 10 best new radio products shown at the NAB convention. The "Cool Stuff" Award panel was composed of veteran broadcast engineers and audio and production experts. The "Cool Stuff" Award given by *Radio World* was one of only 26 awarded to

new products at the NAB2002.

"We're honored to be recognized from within the industry," said Kinsley Jones, ERI Antenna Engineering Manager. "We listen to broadcasters and try to understand their requirements, then design and create products to solve their problems and serve their needs. These awards confirm that we've heard and understood the industry's message."

Despite lower overall attendance at the NAB, visitation to ERI's booth was down just slightly from last year. ERI staff had positive reactions to the quality of customers that visited the ERI booth.

Scott Beeler, Director of Worldwide Sales, stated, "This NAB was one of the best I have been to in years for spending quality time with real customers." Over 260 individuals visited ERI's hospitality suite, which provided a wonderful environment for ERI to engage potential clients on a personal level. Beeler added, "We came home with several qualified leads for both our structural and antenna products. We have made everyone in the industry stand up and take notice that we are in the tall tower business."

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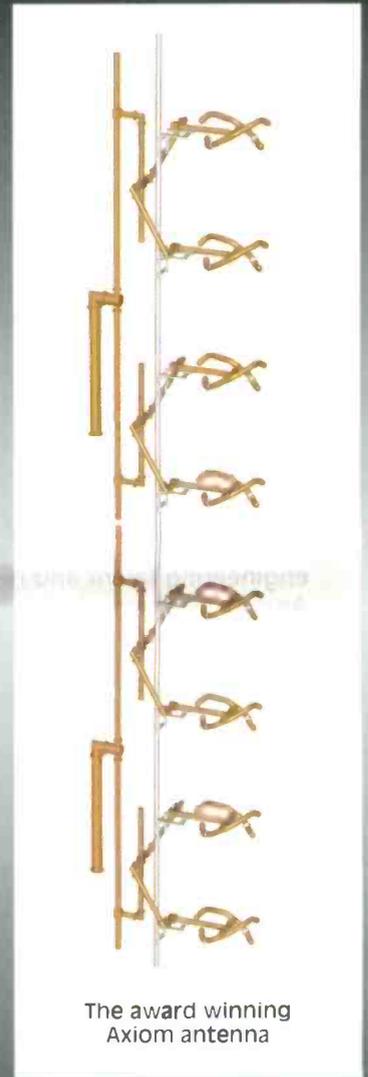
Tom Silliman at Spring NAB2002



Two of ERI's most recent engineering awards.



Summer 2002
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The award winning Axiom antenna

Inside:

- Trivia
- Employee Spotlight
- Technical Feature



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Employee Spotlight

Several generations of FM broadcasters have learned to expect antenna solutions from ERI that are technically advanced as well as reliable, practical and long-lasting. Kinsley Jones, Antenna Engineering Manager, is responsible for building on that tradition.

"We understand how much the business environment has changed for our customers," Jones notes. "More and more, current generation broadcasters are taking advantage of ERI's expertise to solve not only problems of coverage, but also limitations imposed by crowded tower structures, zoning restrictions, and severe environmental conditions."

In today's world, broadcasters frequently face challenges that include transmitting a superior signal across an increasingly competitive radio market, spread out across a growing geographic area. Many also have or will face displacement from their tower in order to make room for other services such as digital television.

Jones, who only recently joined the company, believes ERI has the horsepower to stay ahead of the industry's challenges. "ERI has proven it can apply its exceptional RF engineering talent and resources in very creative ways. And we're unique in our ability to address the structural issues that are very much a part of every antenna system, because of the strength of our Structural Division working alongside our electrical engineers."

Jones' position was created to enhance ERI's planning capability and to provide engineering leadership as the company continues to grow. The antenna division's engineering organization includes product development, product management, engineered systems and technical services for manufacturing, installations, and consulting services. Additionally, he handles the division's marketing and leads the effort to develop new products for broadcast and related industries. "Our customers drive these activities," Jones says. "We don't design from an ivory tower. Many of us have worked in the broadcast industry and we'll continue to listen to the people who rely on our products as we devise new solutions."

With thirty-five continuous years in the broadcast industry, Jones has done a little of everything. Starting out in small market radio and television in the Pacific Northwest, he served as disc jockey, sportscaster, times salesman and engineer. "From the beginning, I was interested in engineering. It was fascinating to watch the 833 final tubes and 8008 rectifiers glowing in the transmitter." The next few years brought new challenges and opportunities in increasingly larger markets ranging from Salem, Oregon to Fresno, California, then San Francisco and Los Angeles.

After serving as director of engineering for the Drake-Chenault radio station group, Jones was offered an opportunity to work for equipment manufacturer Harris Corporation and has been in the equipment business ever since. "I've been blessed with a lot of diversity", he says.

"There's a great opportunity to learn when you continue to be presented with new challenges." Those challenges have come in the form of small companies and startups as well medium and large corporations. Over the years, Jones has held positions of responsibility not only in engineering, but also in sales, marketing, manufacturing and general management. "Having done a lot of different kinds of things," he says, "I've gained a perspective that's very valuable. If you want to succeed in the broadcast industry, you have to understand your customers' business and you have to listen to them in order to create great solutions. Too many companies try to impose their paradigms on their customers."

"I'm excited by the opportunity at ERI", Jones adds. "The company has a terrific heritage, great people and a strong position in the market. We'll continue to build on that and we'll continue to grow as our customers reward us for listening and presenting them with increasingly better solutions."



Technical Feature

I-SAM Offers More for Less to Master Antenna Facilities

Offering a myriad of impressive and unique features, ERI's **I-SAM** is a versatile and complete Master Antenna monitoring system. Rather than utilizing a PC to monitor antenna performance, where a system crash can lead to catastrophic failure, the **I-SAM** is composed of self-sustaining smart sensors that continually monitor, measure, and evaluate all functions of your antenna site.

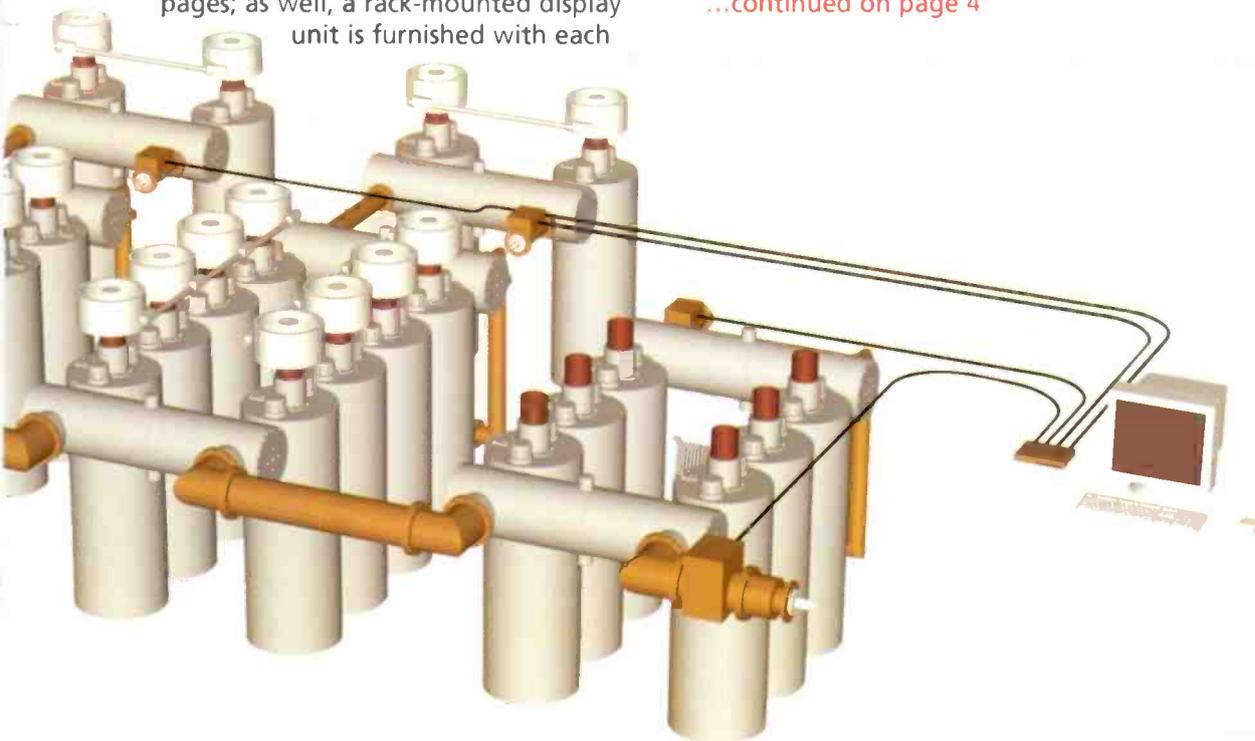
All **I-SAM** units are connected on a common Ethernet trunk with a multi-port Ethernet switch handling communication with the individual components. An optional router can be added to allow multiple Site Antenna Monitor (**SAM**) units to connect as one Internet gateway. Facility monitoring is accomplished via browsing **I-SAM** web pages; as well, a rack-mounted display unit is furnished with each

SAM sensor. Real-time performance data is accessible from any Internet connection worldwide. Alternatively, customers may access **SAM** information from a local PC connection.

I-SAM features:

- Easy to operate and personalize site information using **I-SAM's** "Setup Menu"
- View real-time data from an Internet connection
- Automated weekly or event-triggered e-mailed reports and warnings
- Web-Page presentations of numerous measured system parameters
- Activation of Transmitter Interlock Control is configurable by user

...continued on page 4



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I-SAM Product Spotlight cont.

A typical **I-Sam** layout calls for a number of intelligence sensing modules to be placed at key locations throughout a multi-user antenna facility. Commonly only three types of devices are necessary. An antenna feed sensor module monitors the antenna and antenna feed line, a combined feed sensor module keeps vigil over each station's combiner unit, and the **SAM Monitor** provided with each Sensor Module completes the package. However, a stripped-down version of the monitoring package can preclude the imbedded processor, leaving only the smart sensor kit. If desired, a site manager can integrate the smart-sensor kit into existing OEM monitor and alarm devices.

The **I-SAM** is cost-effective in comparison to other conventional monitoring packages, while offering so much more. Its reduced complexity provides for easy deployment in all types of existing combiner schemes.

Broadcast Trivia Challenge

In this edition of "The Source", we have an offbeat challenge for you!

He was the early 20th Century's Scientific Renaissance Man: oddball inventor, science fiction author and publisher, and futurist. His 80 patented inventions include several circuits, including the Interflex and the Peridyne, the first circuit to use non-magnetic metal in the field of a coil; and a book condenser, used in early Crosley TV sets with a compression-type variable capacitor. He published a well-known electronics magazine beginning in 1929. Who was he?

Be one of the first to respond with the correct answer and win a custom "Trivia Winner" t-shirt and other prizes! Please include shirt size (L, XL, XXL) and a mailing address.

For answers to the last Trivia Challenge and a list of winners, go to ERInc.com.

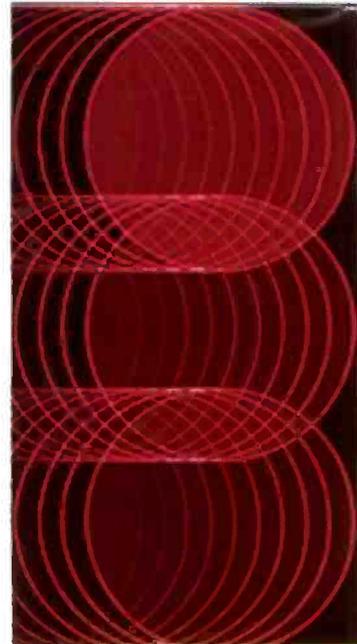
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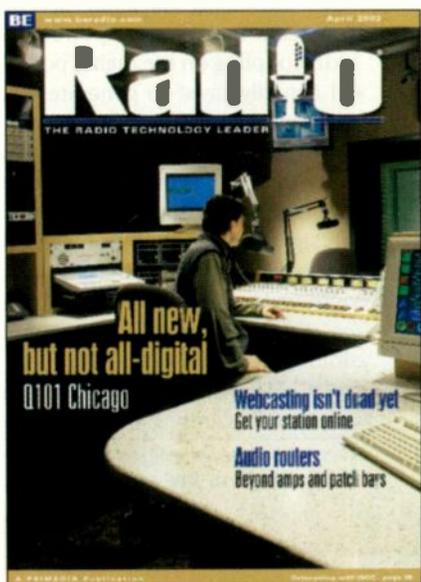
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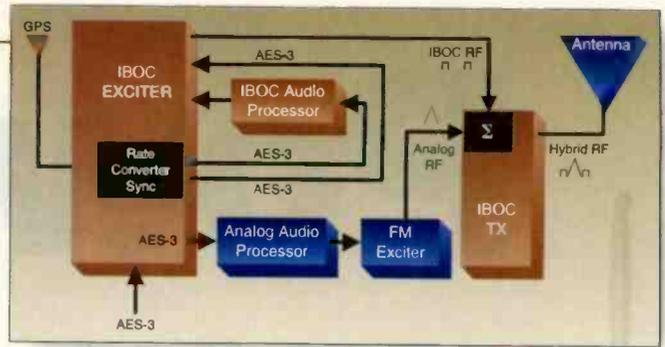
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How It Works

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accommodate the IBOC+analog signal. A station planning to transmit IBOC in this way will be compelled to buy a brand new transmitter or even two. The station will reuse its current antenna.

High-level combining makes use of more readily available technology. The analog portion of the broadcast comes from the transmitter the station already has. The digital portion comes from a separate linear amplifier with the IBOC carrier. The signals are then added at high power levels in a four-port combiner. The



Block diagram of an FM low-level combining system.

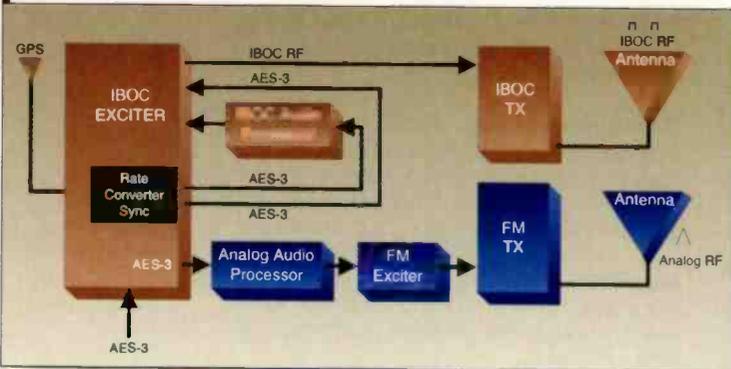
output of this combiner feeds the antenna the station already has.

The major advantage of this method is that the analog transmitter can be reused. However, due to combiner losses, the analog transmitter will need to produce about 10 percent more output power. Additionally, due to the -10dB coupling on the digital port, the digital power amp will actually need to generate 10dB more power than would otherwise be needed. Ninety percent of the output of the digital transmitter is wasted in heat.

The final method is that of the separate antenna. The station adds a second antenna and transmits the IBOC-only signal from it. The advantage is that the IBOC transmitter can be a much smaller unit, and that the station can continue to use its older analog transmitter and antenna. The disadvantage is that the station will need to use additional tower space.

IBOC DAB is on the verge of becoming reality. Now is the time to start planning ahead for it.

Irwin is director of engineering for Clear Channel, San Francisco. Diagrams courtesy of Ibiqity Digital.



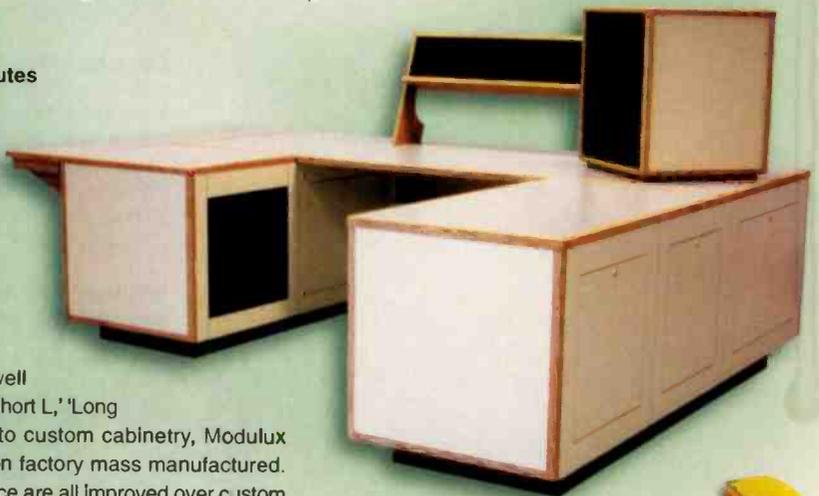
Block diagram of an FM system with separate antennas.

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RCS Master Control

By Russell Smith

www.beradio.com

It's commonly thought that growing up on video games leads to certain side effects as an adult. For me, Super Mario Brothers and Metal Gear were a gateway to things like phone editors, traffic schedulers, remote control software and for the past four years Radio Computing Services Master Control. It's easy to master, offers factory support and is flexible and reliable.

RCS has a friendly, trained technical support staff answering phone calls 24 hours a day to assist with any problems a station might encounter. Because the company has a global base of clients, it operates several foreign offices that handle the off-hours calls. This allows callers to reach a technical person at all times—no answering services.

The service doesn't stop with the software. The hardware is supported by the manufacturer's on-site service program that covers replacement and repair of things such as hard drives, power supplies and motherboards.

Built for backup

One of the best features of the software is its redundancy in audio and data storage. Each RAID array consists of several large drives that distribute the data, so a drive may fail, but the system will continue to run. The audio files of each station are primarily stored on the air studio machine. Audio is also stored in a backup database on the admin machine. Should one air studio machine fail, downtime is minimized because a few clicks on one of the production machines will make admin the on-air machine. Once this is done, the on-air operation relocates to that studio or we swap the machines in the rack. In this backup mode, audio plays over the network from the admin machine; operators and listeners don't know the difference.

Loss of an entire system or studio facility could be a huge crisis, especially considering the loss of music and commercials. Fortunately, RCS uses standard CPUs and common hardware regularly available. The audio library is backed up regularly to a common removable media that can be stored in a safe location.

No problem with change

As programming needs change, so changes Master Control. All of the applications needed for basic operation span two monitors. One displays a bank of audio drops with three virtual players, plus the three main decks for programmed elements from the log on the opposite screen. In live-assist mode, jocks can point and click their way through an airshift. Users can juggle items, play a drop or insert a song—all while rarely using the keyboard. Most operations are easily handled via a Preh

keyboard or by using the track ball. The Preh pad is a multi-function keypad that allows operators to play drops, change segues, skip items and control the recording of voice tracks.

Voice tracking makes automation easy and reliable. Announcers voice their shows in about one third of the normal time, cutting payroll and improving the station's sound. Mistakes can be corrected by rerecording the track. Segues can be edited and played back as if they were being aired live.

Performance at a glance

- Proof, edit and reconcile logs
- Easy-to-read, colorful screens
- Search and index audio cuts
- Multiple event chaining
- Paperless studio operation

Satellite programming is also easily handled.

It can decode and generate contact closures using its A d v a n t e c h opto-isolator/relay boards. I use the relays and the scheduling of control events to manage my silence sensors and what action they take. Other features include the ability to interface to CD players to run syndicated shows and start the recording of commercial feeds for later editing. We never miss feeds. The logic functions are limited only by the number of inputs and outputs on the card.

Master Control works with music scheduling software to link songs to a Web page, so that a Web browser will display the artist and song title. The data can be formatted in a variety of ways to suit a station's website needs in displaying the current on-air information.

Smith is chief engineer for the ABC Radio Group, Atlanta.





V-Soft Probe II

By Carl E. Gluck, CPBE

The Technical Research Department at Salem Communications employs four people full time, myself included, to do research, FCC application preparation and allocations and acquisition study work. During that time we have purchased several broadcast study software products.

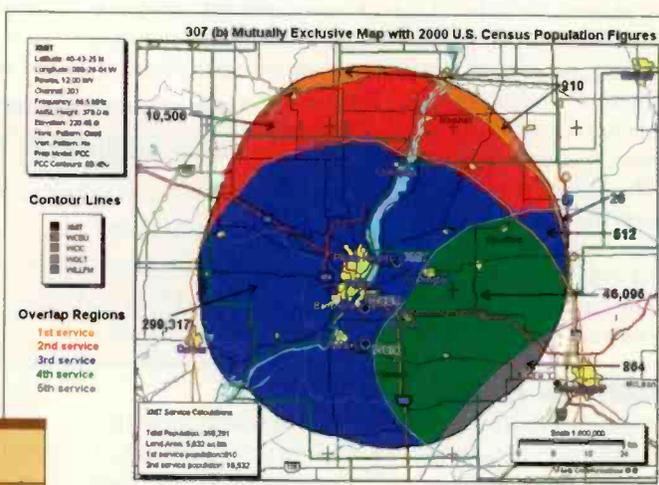
The Probe II, offered by V-Soft Communications, is a foundational building block among four or five "must-have" modules for the engineer working to understand and improve the coverage of an AM or FM radio station (other essential tools include FMCont, InterDLG and AMPro).

What it does

The program creates an atlas-style map using several user-selected backgrounds, features and overlays. Interstates, state highways and surface streets all have a distinctive

Point to Point, the Terrain-Integrated Rough-Earth Model (TIREM), Okumura/Hata and COST-231-Hata, as are the FCC's curves [F(50,50), (50,10)]. Any user-defined contour may be created or imported as well.

A wide variety of signal coverage, overlap and interference plots can be created with FCC or user-defined criteria. Two-dimensional path profiles can be created by clicking and dragging map points. Population maps can be created



Performance at a glance

- Professional-looking, atlas-style maps
- Wizard based project startup
- Instant population and demographic reports
- Professional and eye-catching radio coverage maps
- Click and drag two-dimensional path profiles
- Easy contour overlap area and population evaluation
- Good documentation and support

appearance that may be manipulated and enhanced by the user. Feature details change with the map's scale according to the user's definition so that maps may show as much or as little as is needed for any particular application.

Rivers, lakes, terrain and land may be displayed to prepare a professional-looking map with various colors, line widths and font types. A valuable tool in the map creation process allows the user to import a graphic such as a radio station's logo.

The Probe II also plots coverage contours and field strength predictions once the underlying area map is created. Various propagation models are available, including Line of Sight, Longley Rice,

Mutually exclusive FM application studies can be done using the Probe's contour overlap feature.

to show demographics by county, Zip code or housing information. AM signal contours can be plotted using imported distance-to-contour (.dct) files.

How it works

The Windows-based program has a "wizard-style" front end. Users begin by answering several questions or by selecting features. With little more than an FM radio station's call letters, a map can be created. The wizard provides the setup for coverage or interference plots.

The atlas-style map appears with a cross marker showing the tower site and the station's call sign. By double-clicking the cross marker the user can pull up (and if necessary modify) any of the transmitter properties. Right-clicking the cross marker offers options such as instantly adding F(50,50) contours and generating population counts. Once a user-defined or imported contour, such as an AM .dct file or circle contour, is shown on the map, population counts and demographic information are readily available too.

Support and drawbacks

A binder of information is delivered with the product as well as in a Windows help file within the software. The manual helps the user to set up the computer subdirecto-

ries and folder hierarchy, and in some cases even test the accessibility of the databases. The only thing lacking in the documentation is a trouble-shooting section that lists some of the common error codes that may be displayed when there is a data error or user mistake.

Problem areas or shortcomings of the software are hard to find. Nevertheless, during the software installation process a person should allow time for an e-mail or call to V-Soft to obtain any missing Windows drivers or a customerspecific software file.

FCC and program databases are updated through the company's website as often as desired. Program bug fixes, enhancements and upgrades are always posted for download.

The Probe II is not cheap and once you purchase this software you will find databases, add-ons and other tools will become an ongoing habit to feed. All of the software products offered are hardware key locked so they cannot be pirated to other computers or users.

There are a couple of misconceptions about purchasing this type of software. Some believe that if you purchase the software you will automatically gain an easy knowledge about FCC rules and engineering practice. Nothing could be further from the truth. Time must be spent with any



FCC coverage maps can be made with the Probe's terrain backdrop.

allocation software to achieve any level of expertise. Another mistaken notion is that radio evaluation software will eliminate the need to use broadcast consulting engineers. The fact is that as you find the potential to improve and upgrade a radio station a consultant can ensure your success.

Gluck is vice president of technical research for Salem Communications, Camarillo, CA.

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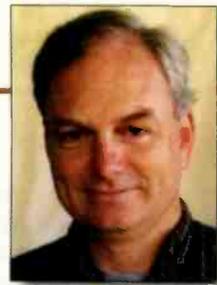
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Armstrong FM-20000T

By Don Mussell

had some tough choices to make. The 20kW transmitter at WPFW, Washington, was more than 10 years old and was showing signs of increasing fragility. I had to purchase a new transmitter for WPFW, and I had to do it soon.

I had been visiting the NAB for a couple of years, looking at all of the usual choices and trying to develop an informed sense of what would be the best transmitter choice

for the long term. After looking over all the equipment on display, an engineering friend suggested that I look at the Armstrong booth. At the booth I found a cleverly designed, grounded-grid amplifier that incorporated many of the features I needed.

My first thought was that the transmitter looked like a Collins 830-D. I fondly remembered some of the Collins transmitters I had installed during the past 30 years. Many of them are still operating dependably. However, it appeared that Armstrong

need for tube neutralization and allows easy tube changes with minimal fuss. It also increases the gain of the grounded-grid design, allowing for a smaller IPA section and improved overall efficiency. The tuning is smooth, gradual and wideband. To reach 20kW, only 750W of drive are needed. This is achieved with the solid-state IPA.

The other idea that caught my eye was the rollout internal high-voltage power supply. Easy access to the high-voltage section, for installation and maintenance, makes it possible to thoroughly clean without the risk of accidental shock or backache. Everything is within easy reach.

The transmitter is affordable. I am a firm believer in the saying "you get what you pay for," so I was a bit skeptical about its quality, performance and longevity. Because Armstrong was unknown to me, I checked with existing users of similar Armstrong transmitters. Everyone I talked to liked the design and the operation, as well as the price. I ran out of questions, and decided to make the choice. Because the price was affordable, I changed our overall plan and bought two 20kW transmitters. The price for two was only a few thousand more than buying one major brand transmitter of the same size and configuration.

Before delivery, I paid a visit to the Armstrong factory in Marcellus, NY. Armstrong is a small company, but the staff was competent, professional and happy to demonstrate the transmitters on the factory floor. We put them through their paces, even simulating a power failure and hard start from cold. The transmitters were rock solid. I came away satisfied we made the right choice.

Putting it in place

We scheduled installation for the end of February 2001 at the WPFW transmitter site. The Armstrong factory staff personally delivered the transmitters, and despite incoming snowy weather, managed to deliver both transmitters safely inside the transmitter building, put one on the air and removed the old transmitter. The entire FM-20000T is in two full-size racks, joined at the center, less than four feet wide. Both cabinets, as well as the high-voltage transformer, are on heavy-duty wheels, allowing for easy placement and installation.

After another full day of installation, remote control cut-over and plumbing the new coax runs completed the job of installing both new transmitters. Because the Armstrong design incorporates an internal low-pass filter, the output plumbing installation was straightforward, without the heavy lifting required for high-power external low-pass filters on typical grounded-grid units. A remote control interfaces to a hinged, rear-mounted rack panel that extends for easy access.

Performance at a glance

- Single-tube grounded-grid design
- No external low-pass filter
- Self-contained power supply
- Smooth motorized PA tuning
- Wide-band solid-state IPA
- Microprocessor control
- Optional AES-3 exciter input

had taken the design and improved it.

The transmitter uses a quarter-wave resonant final cavity. This cavity closely resembles the classic design, but improves on it with a motorized plate-tuning assembly and the use of a 4CX15000A7 tetrode running as a grounded grid. This eliminates the



The transmitter uses microprocessor control of nearly all parameters, and tracks power output, VSWR and temperature of various points within the IPA and PA. In the event of a power failure, the transmitter will soft-start and ramp up to the previous operating power stored in non-volatile memory. The LCD is easy to read, and a wealth of internal operating information is available within the easy-to-navigate menu system.

The FMX-100LCD is the 100W exciter we ordered with each unit. These exciters can be upgraded to an AES/EBU input for direct connection to a digital audio processing chain. We chose the analog input for the time being, and the results are impressive. Measurements of noise, harmonic distortion and frequency response revealed a quiet and clean exciter. The wide-band IPA and final amplifier had



The high-voltage power supply rolls out for easy access.

virtually no effect on the overall measurements. AM noise was well below what was possible with the old transmitter. The difference between our old transmitter and the new system was apparent even to the station staff, who could now hear clearer definition and clarity in the on-air sound.

While there were some initial minor problems with a defective IPA cable, Armstrong provided timely help and quick delivery of the needed part. We realized the problem on a Saturday at 4 p.m., called the emergency number and reached the factory service rep at a picnic. He had a delivery scheduled within the hour. They have continued to be friendly and available when questions and concerns have surfaced.

Overall, the installation of these new transmitters was painless and easy. I now have a better choice available when I make my next transmitter purchase.

Mussell is a consulting engineer serving a nationwide client base. He is based in Borntown, CA.

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Denon DN-F20R

By J. Kirk Chestnut, CSRE

The DN-F20R portable recorder captures audio digitally using tapeless, solid-state recording media. I have found that this recorder will withstand the demands of radio news gathering or field audio recording.

Engineering departments on close budgets and tight schedules will appreciate this low-maintenance device. News reporters will find it easy to operate as well as lightweight. Turn it on, set the level and record. It's that simple, and there are no flaky mini-plug adapters. For the budget conscience, this recorder's initial up-front cost will be justified by its long-term viability.

The big transport buttons are the first things to catch the eye. The unit has a solid feel and a simple, orderly layout. The only moving parts

our Westwood, KS, studio facility. If a piece of equipment can stand the RF levels here, it will do well in the field. We operate two AM stations on site with a total of 15kW of power. One tower is located directly over our heads on the roof. Aside from the AMs, we have seven STLs and dozens of cell phones running around the news department. In conducting my tests, I used a budget microphone, a 10-foot microphone cord and a pair of headphones. On its first bench-top test, the device performed flawlessly.

Digital cell phones have become a major source of RF interference. In many cases, our news crews will send in



Performance at a glance

- Easy-to-see and use buttons
- Mic/line level input selector
- Bass roll-off, mic limiter settings
- XLR, 1/4" and RCA audio connections
- Linear, MPEG 1 and MPEG 2 recording formats
- Dual card recording with optional recording redundancy
- Backlit display
- As many as four hours with a single card installed
- Protective carry case

on the Denon DN-F20R field recorder are the controls. The biggest feature of this recorder is that it's the smallest of its kind. Program material is captured digitally on a half-dollar-sized memory card called a Compact Flash Card.

The menu-driven controls are easy to understand and navigate. Clearly illustrated instructions are included in the manual, but the operation is so intuitive that I referenced the manual only to determine my recording time.

Performance

Serious RF interference is a way of life in

their stories coupling a cell phone to their recorder. The annoying digital chatter from a news reporter's phone can wreak havoc with a feed. In my un-scientific test, I placed my digital phone next to the recorder. While holding the microphone with one hand, I began to move the cell phone in and out within proximity to the recorder. Spaced about four inches away, I could hear a little chatter in the background (around 42dB down from reference level). It wasn't until I placed the phone in direct contact with the unit—an unusual condition—that interference was noticeable.

Time vs. quality

As with any digital recording device, the compromise between recording time, recording quality and equipment cost becomes an issue. The DN-F20R will record CD-quality audio, but at the cost of memory storage space. A typical 64MB card will yield almost six minutes of CD-quality, stereo PCM audio. Using MPEG1 Layer 2 compression, the recorder yields a clean 30 to 68 minutes of music-grade stereo audio. MPEG2 Layer 2 will yield anywhere from one hour to 1.5 hours of acceptable voice-grade AM-quality audio.

Recording made below the 48kb/s rate were tolerable but contained a considerable amount of warble typical of highly compressed audio. I would limit the use of these

slower sample rates for recording conferences, meetings or other non-critical/non-production quality applications. Although this recorder will sample stereo at 16kb/s, set the device for mono to maximize the recording time. That same 64MB card would yield an impressive 546 minutes of fair but listenable audio at 16kb/s. (The Denon website offers a recording time chart: www.denon.com.)

Recordings can be played back through the RCA analog audio connectors or read directly from the compact flash card with an external computer interface. The computer maps the card reader as a drive. Audio files will be located in 10 designated directories. The DN-F20R automatically assigns an eight-character file name to each cut. Once retrieved, the file can be assigned a more recognizable name for storage on a local hard drive. Users cannot, however, use long file names to label cuts on the flash card.

Budget accordingly

A recovering economy may be a sign that companies are poised to invest in equipment. Plan a capital budget that includes about \$1,300 per recorder. For typical newsgathering applications, figure in a headset and dynamic microphone with cord. There is no built-in microphone or phantom power on the mic connectors. Plan on purchasing

IC cards from Denon or a Denon approved vendor. The manual warns that products from third-party vendors may not perform quickly enough for the faster sample rates.

Overall, I would give a good grade to Denon's development team. They have packaged all the basic features needed for field production with an eye for the future. The initial cost of this unit might make it a stretch for smaller market operations, but it would be a welcome addition to any news or production department looking for a dependable recorder.

Computer, recording and broadcasting equipment are melding together at an ever-increasing rate. This recorder is the next step. Who knows, maybe the next generation of digital recorders will include network connections or a digital cell phone inside.

Chestnut is an engineer with Entercom Kansas City.

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New Products

By Kari Taylor, associate editor

www.beradio.com

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www.nautel.com; info@nautel.com

On-air console Wheatstone



D-8000: A new digital flagship of the D-Series console line, the completely modular D-8000 ranges across multiple format needs with flexible configurations, frame sizes and metering types. Available features include universal input modules, the Bus-Minus function providing an independent MXM feed with talkback interrupt on every input channel, alpha-numeric source displays, choice of master clock rates, two programmable stereo aux sends per input, 99 preset snapshots, individual channel four-band EQ, compression, gating and digital level trim. Mainframe design elements include a stainless steel meterbridge, wrist rest, composite fused-finish endcaps and a low-profile frame. The built-in serial communication interfaces with Wheatstone network router and many automation systems.

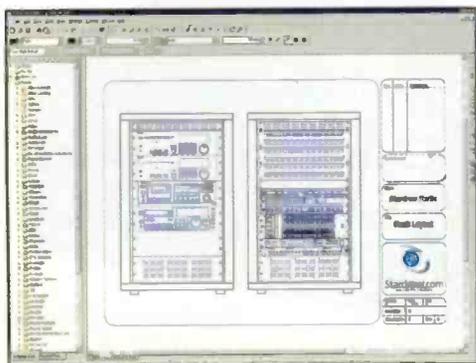
252-638-7000; fax 252-637-1285
www.wheatstone.com; sales@wheatstone.com

Transmitting tubes Econco



Power tubes: Tubes such as the 3CX3000A7, 3CX6000A7/YU148, 3CX15000A7, 4CX3500A and 4CX7500 are the first power tubes to be manufactured by the company. These tubes are noteworthy for their plug-in compatibility. The company's line now includes additional klystrons, magnetrons and traveling wave tubes for high power amplifiers.

800-532-6626; fax 530-666-7760
www.econco.com



Engineering software Stardraw.com

Stardraw Radio: A CAD program designed for the needs of radio stations without the cumbersome and unnecessary features found in more complex CAD programs. The application boasts a library of more than 10,000 industry-specific symbols, drawing tools, full DWG compatibility and advanced reporting facilities. Regular updates add hundreds of new symbols and a new program feature every month. Existing symbols can be edited and modified as needed.

212-672-1855; fax 212-372-8798

www.stardraw.com; information@stardraw.com

Software LakeSoft

Eskimmer Appliance: The Eskimmer Appliance runs the newest release of the Eskimmer 4.2 software. This software offers increased stability along with features such as logging capabilities, automatic gapping and segmenting of longer recordings, a visual shift editor and multiple simultaneous storage formats. The Webskimmer and LAN clients now support playback format preferences as well as server-based emailing of audio files, which expedites the sending of audio files through e-mail.

866-599-5253; fax 541-967-8721

www.lakesoft.com; info@lakesoft.com

Audio console Energy-Onix

Perfect 8: Suitable for LPFM and production room installations, this console has two microphones, four line-level stereo channels and two built-in telephone hybrids. Each channel has two selectable inputs. The bargraph metering is switchable for cue, audition and program buses. Talkback allows communication with a second studio.

888-324-6649; fax 518-758-1476

www.energy-onix.com; energy-onix@energy-onix.com



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Digital on-air console AEQ

BC-2000 D: Accepting a maximum of 144 mono audio or 72 stereo channels, this console distributes input modules of 24 analog inputs (six mic/line switchable) and 12 digital stereo inputs. It offers 144 audio sends, distributed through output modules with 24 analog mono outputs, 12 digital stereo outputs or mixed output modules with eight analog stereo circuits and one digital and three analog+digital circuits. It also incorporates remote bi-directional or two-way modules with 24 digital inputs and 24 digital outputs through TCP/IP v6. Input and output routing are included. Additional features include EQ, dynamic control, PFL/CUE, control and studio monitoring, three headphone outputs, fader-start, on-air signaling, remote mute, intercom and phantom power.

954-424-0203; fax 954-424-0902

www.aeqbroadcast.com; aeqsales@aeq.es

Telephone codecs Comrex



Bluebox and Matrix:

The Bluebox (above) is a low-cost codec option for remote broadcasts over plain telephone lines (POTS/PSTN) or wireless services. Compatible with all other Comrex POTS/PSTN codecs, it weighs 1.5lbs. The Matrix can be used with POTS/PSTN, ISDN (with optional module) and wireless services. It works with all other Comrex POTS/PSTN and ISDN codecs as well as other manufacturers' ISDN codecs with the G.722 and ISO MPEG Layer 3 algorithms. The multipurpose data port and modular design provide for future upgrades. Both of the codecs can be flashed in the field for product upgrades.

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Cindy Ruff cruff@netins.net

Dominic Andreozi dominica@sepatriot.com

Wireless phone tap JK Audio



CellTap: This wireless phone tap allows cell-phone conversations to be recorded. Users can connect Celltap between the 2.5mm earpiece jack of a cell-phone and the earpiece or headset. A tape recorder connected to the 3.5mm mini jack will

record both sides of the call. This product works with any wireless phone that accepts a third party headset or earpiece. For group listen, simply connect a powered speaker to the audio output jack. Everyone in the room can hear the conversation, but only the person wearing the headset can talk to the distant party. While this is not a speakerphone, in many cases it is suitable for sales presentations or contract talks.

800-552-8346; fax 815-786-8502
www.jkaudio.com; info@jkaudio.com

System operating upgrade Burk Technology

ARC-16 v5.4 firmware: The new 5.4 firmware improves the performance of the ARC-16 and includes several new features: adjustable alarms delays, adjustable command durations for remote activations and Windows-based autoload software for programming the ARC-16. Adjustable alarm delays add a delay (per channel) in seconds, instead of instant notification. The default



command duration can be adjusted for long or short pulses. Autoload allows the entire site image to be downloaded and many of the fields to be edited. Saved images can be uploaded as well.

800-255-8090; fax 978-486-9081
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Master-antenna monitor ERI-Electronics Research



ISAM: This monitor is an Internet-ready, accessible antenna site control monitor that provides the broadcast station engineer with data, alarms and corrections. Virtually instantaneous equipment function and malfunction notification is provided.

This tool handles all aspects of care and protection for a master antenna system. The system will incorporate as many combiner module sensors as are required by the station. Feed-line sensors are standard and two are employed if dual feed lines are used. It acquires, analyzes and presents operational information to the local operator and is accessible anywhere in the world via the Internet. With immediate access to site data, an operator can make an informed decision on a possible weather-related incident. A quick call to the local repair crew dispatches them to the site to investigate. Possible long-term downtime is likely to be avoided because analysis was quickly and easily available. Designed to provide added value service for master antenna owners and operators, its benefit is to oversee vital master antenna operating conditions and alert responsible parties of probable trouble spots.

812-925-6000; fax 812-925-4030
www.ERInc.com; dcombs@erinc.com

Digital/analog AM transmitters

Harris

DAX-5/6: This is the first in a family of 1kW to 6kW AM transmitters designed to provide analog and IBOC performance. The design of this transmitter family began from the ground up. The transmitters provide linearity and wide bandwidth to deliver a clean analog sound. This design also provides a highly accurate reproduction of the IBOC signal.

800-622-0022; fax 513-459-3890
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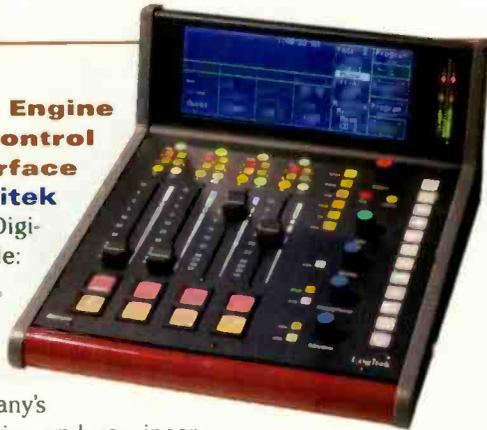
Audio Engine control surface Logitek

Remora Digital Console:

The small, modular control surface for the company's Audio Engine and can incorporate one or more pieces. The main control module incorporates fader input selection, monitor and headphone controls, and stereo VU meters along with four faders. Fader modules, containing six faders each, can be linked to the control module as desired. Because it is simply a control surface, the faders do not have to be dedicated to specific inputs; Users can set up fader assignments to accommodate individual needs and tastes. Applications for this product include news workstations, small edit suites, production rooms and on-air studios where space is at a premium. Because the unit is designed to sit on a desktop, it can be used in locations where traditional consoles are not a practical choice.

877-231-5870; fax 713-664-4479

www.logitekaudio.com; info@logitekaudio.com



Traffic and billing software enhancements Wicks Broadcast Solutions

DeltaFlex III: This traffic and billing software meets the needs of duopolies, with traffic and billing performance delivered through an array of features, including streamlined order entry, flexible copy rotation and flexible inventory management. Advanced program logs help in managing inventory more effectively, allowing as many as 98 program logs in the assembly and editing stage. Other features include new program log presentation controls including log editing and printing controls, individual minimum conflict separation, contract confirmations with full contract history, new comparison options to the daily report, which can now be set as a weekly report, new sorting options on YTD charges report and five-year history report, and installations and updates furnished on CD.

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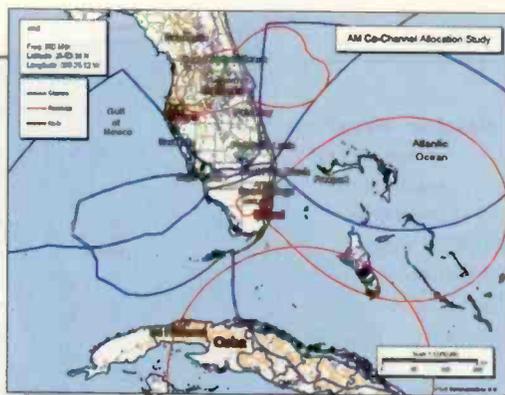
New Products

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Broadcast engineering software V-Soft

AM-Pro: This program performs all the studies required of the spectrum designer in working with AM standard band broadcast coverage and allocations. AM-Pro is configured to apply the M3 or R2 ground conductivity curves depending on where the study is carried out. The program will plot ground-wave and sky-wave signal contours and perform RSS studies to determine the level of interference a given station receives and therefore its nighttime coverage limits in mV/m. This product implements an automatic sky-wave coverage analysis routine that operates according to a set of programmable rules. A tabular listing of all stations having a distance and channel relationship can be directed to a printer. The software has check boxes for toggling on or off co-channel, first-, second- and third-adjacent channel relationships. Clicking a listing will bring up the parameters box for the station selected allowing the user to change the station's operating parameters if desired.

800-743-3684; fax 319-266-9212; www.v-soft.com; kmichler@v-soft.com



Music library Promusic

Audio Express: This music library contains 50 discs with more than 2,500 tracks of music beds, stings, accents, idents and logos specifically for radio production. The package also has a complete search catalog that allows instant track location by looking up any of hundreds of keywords, styles or genres. By combining a variety of useful beds in a compact, highly categorized package, production time is cut and quality is improved. The library is updated and expanded every month with a new disc that is included in an annual license.

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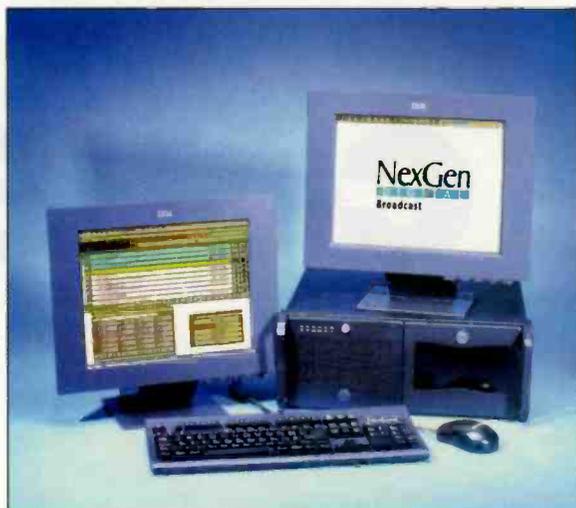
Automation and voice tracker system RCS

Master Control XV: Use Internet Voice Tracking to air top talent from across town or around the world with this system. It is no longer necessary to copy logs and carry them into the studio; all schedule changes are immediate and can be seen from every computer on the network simultaneously.

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Core and stand-alone tools Prophet Systems



Automation enhancements: The company's stand-alone products provide new tools for any station, regardless of what automation system they use. Remote Buddy is a portable system that can be used by any station looking to draw people to its next remote. Events can be enhanced with sound effects, lighting and video. Musicgen, the company's music scheduler, integrates directly to any digital automation system. Nexgen Digital meets the needs of today's broadcasters through high levels of system redundancy and connectivity, as well as database fault tolerance capabilities. The system is engineered to anticipate future growth. The entry-level product, Nexgen Digital NS, allows users to select only the features that meet particular needs and budget size. Nexgen Digital offers a complete digital solution for all broadcast applications, from individual stations to large groups.

800-658-4403; fax 308-284-4181
www.prophetsys.com; sales@prophetsys.com

Digital audio router Audioarts Engineering



ADR-32: The 2RU self-contained rackmount unit is a 32x32 AES switcher with front panel X-Y control and built-in monitor speaker. It interfaces with Wheatstone digital console source displays and may be controlled by the Wheatstone family of console- and turret-mounted control heads as well as the Wheatstone X-Point PC software package.

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New Products

DAB transmission equipment Broadcast Electronics



IBOC generators and transmitters: The direct-to-channel digital exciter offers input flexibility because input selection and other operating parameters are programmable from a full color, front panel LCD screen. The FXI-60 can be used as the only exciter in a low level combined FM IBOC signal. There is no need for a separate IBOC exciter and external combiner and filter. A new line of IBOC-compatible transmitters, the FMi series (above), is based on the C and S series FMs. The FMi series transmitters use linearization techniques so they can be used in a high-level combined system or common-amplifier system.

217-224-9600; fax 217-224-9607
www.bdcast.com; bdcast@bdcast.com

Digital console Arrakis

Nova-10C: This console's inputs are RCA unbalanced to accommodate consumer sources such as CD players, DAT and MD. The broadcast design offers 1/8" hardened aluminum surface, epoxy finish and solid oak trim. Program and record mixing buses have analog and digital outputs. Other features include a control room monitor, headphone and cue outputs, talkback input and output with logic for inter-studio communications and 10 mixing channels.

970-224-2248; fax 970-493-1076

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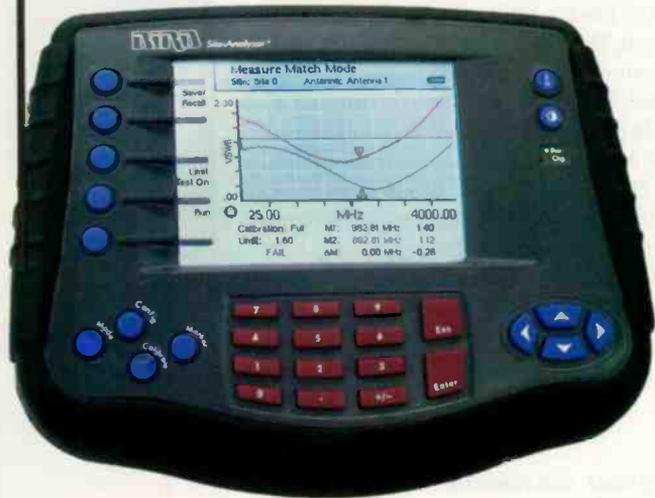
Version 6.01: The new software release provides enhancements to the bass management system, remote control and daypart-scheduling functions. Enhanced functions include a phase rotator network with improved symmetry on asymmetrical waveforms for smoother sound, PHAT Bass parameter tuned for broader effect, a wideband AGC includes smoother attack functions to allow slower settings while preserving system headroom, full support of Ethernet control connections, editable security settings for greater control of user access, a new Stealth Mode that lets users turn off the bar graph meters in the processing section and hide the selected preset from view when the unit is locked. Other features include improved daypart menu functions, time display showing time to the second and an upgraded remote control client to allow access to a wider range of system settings via remote.

216-241-3343; fax 216-241-4103

www.omniaaudio.com; info@omniaaudio.com

Transmission system tester Bird Electronic

Model 4000 Site Analyzer: This easy-to-use cable and antenna tester with a digital power meter option is ideal for installing, maintaining, and troubleshooting antenna and cable systems. It is capable of measuring VSWR and return loss with precision. Match or sweep tests can be performed across a specified frequency range. Fault location mode indicates VSWR or return loss levels at points along the cable and antenna system



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440-248-1200; fax 440-248-5426

www.bird-electronic.com; sales@bird-electronic.com

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New Products

Water-blocked cable Belden

Low-loss 50 Ohm Coax: This low-loss 50Ω coaxial cable is now available in three water-blocked versions designed for use in excessively wet environments by using a gel-filled construction method. The new cable includes an RG-8X with a 15 AWG solid-copper conductor (part number



7808WB), an intermediate type with 13 AWG solid-copper conductor (part number 7809WB), and an RG-8 type with a 10 AWG solid-copper conductor (part number 7810WB). The cable also features gas-injected foamed high density polyethylene (HDPE) insulation and a Belden Duobond II+95 percent tinned copper braid shield with water-blocking gel. All three cables are polyethylene-jacketed and are sweep tested to 6GHz to ensure performance in high-frequency applications.

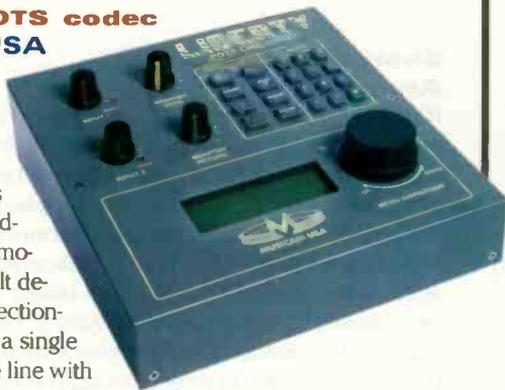
800-BELDEN1; fax 765-983-5294; www.belden.com; info@belden.com

POTS codec Musicam USA

Liberty: This low-cost POTS codec is compact and portable yet contains advanced encoding algorithm and modem technology. It delivers 15kHz bi-directional audio through a single analog telephone line with line connection rates as low as 24kb/s. If line rates below 24kb/s are encountered, this codec gradually reduces high-frequency audio response to find the best possible audio performance. Audio end-to-end delay is minimized at less than 100ms. If line quality changes during a connection, this codec can automatically renegotiate in less than one second. The dual mixing inputs have independent level controls for send and return audio monitoring, and programmable function keys for instant access to frequently dialed numbers or menu functions. An ancillary data path is also provided.

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ATI

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TRS cue and stereo line inputs allow easy loop-through and connector flexibility. A mic/line cue input is adjustable and selectable into left, right or both internal distribution buses mixed with the stereo line feed. Clipping LEDs monitor cue and line inputs. Six independent, 100mW, high-compliance stereo headphone drivers are fed from the internal distribution buses or from individual rear TRS connectors configurable as stereo-unbalanced or mono-balanced inputs. Signal presence LEDs monitor each input. Headphone outputs are duplicated on the front and rear of the one-rack unit.

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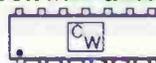
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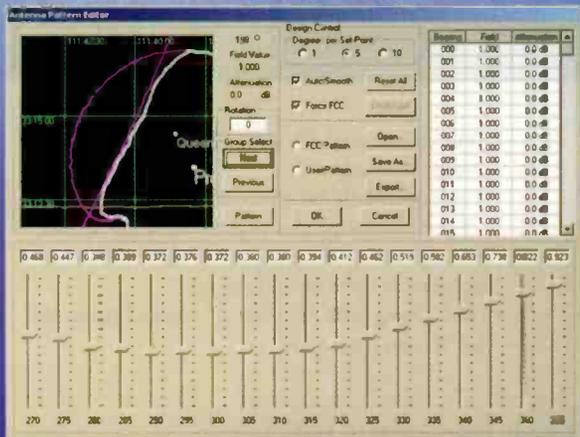
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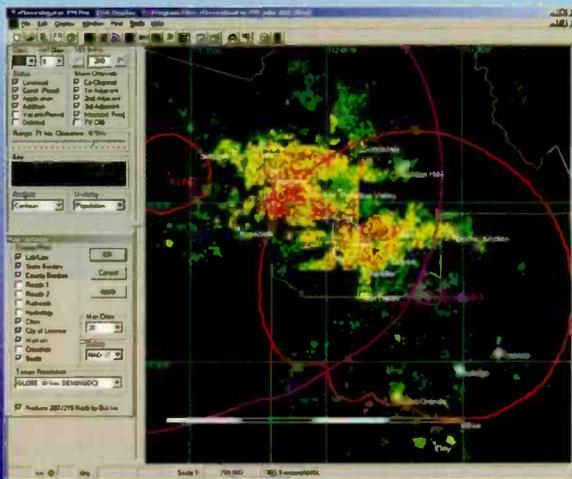
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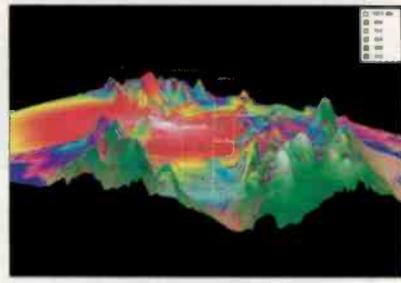
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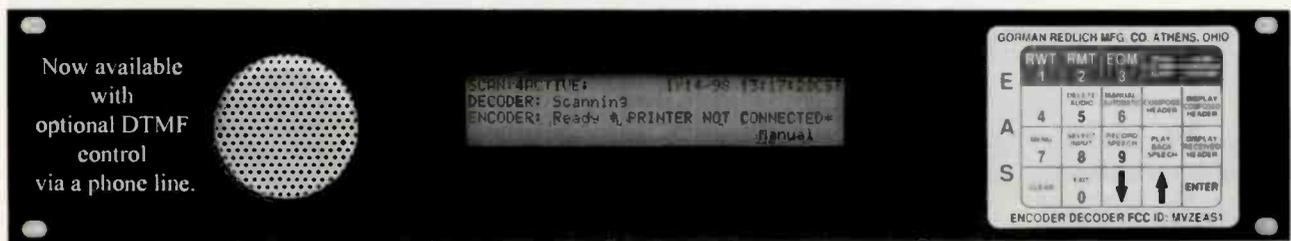


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10KW	FM	1974	Harris FM10H/K
15KW	FM	1980	McMartin BF15,000
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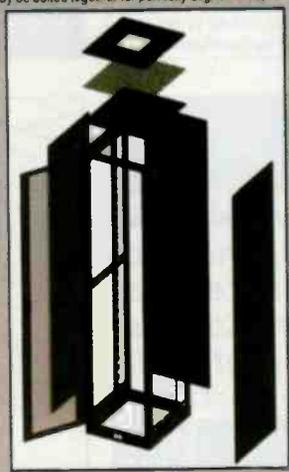
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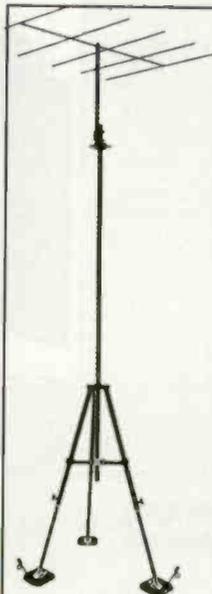
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Meet the professionals who write for *BE Radio*.
This month: Trends In Technology, page 44.



Steve Fluker
Director of Engineering
Cox Radio
Orlando, FL

Fluker's love for radio began at the age of 12 when he spent time DX-ing the FM band. He started as a DJ in 1979 and became the student engineer for the University of Central Florida's FM station. He graduated in 1983 with a bachelor's degree in Electronics. In his senior year he secured a job as the assistant engineer for a local AM radio station. Since then he has designed and built several major studio and transmitter sites. In 1999 Fluker was involved in one of the first IBOC FM test stations that was put on the air for the NAB Radio show.



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Shaping radio today and tomorrow

By Kari Taylor, associate editor

Do You Remember?



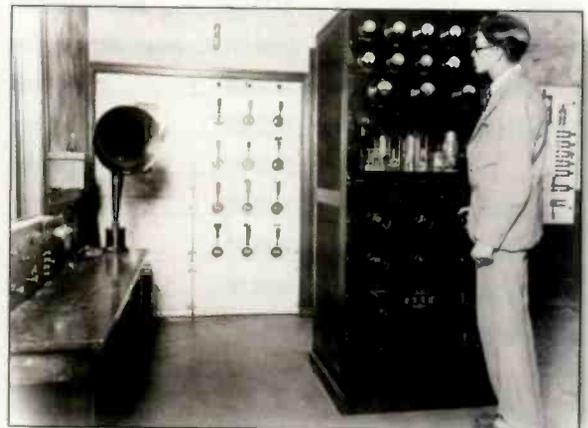
The Time Tunnel digital audio delay system offered a broadcast-quality, six-second audio delay that used a digital memory system to provide consistent audio reproduction. Unlike tape delay systems, it had no moving parts to wear, no preventative

maintenance was necessary and the performance did not degrade with time.

The Time Tunnel was offered in two models: the TDG-1 with a 15kHz bandwidth and the TDG-2 with a 7.5kHz bandwidth. Both models created a frequency response flat within 0.25dB and a total harmonic distortion of less than 0.5 percent.

They offered an operating range of greater than 66dB with a clipping level of 12dB and a system signal-to-noise ratio of greater than 80dB.

That was then

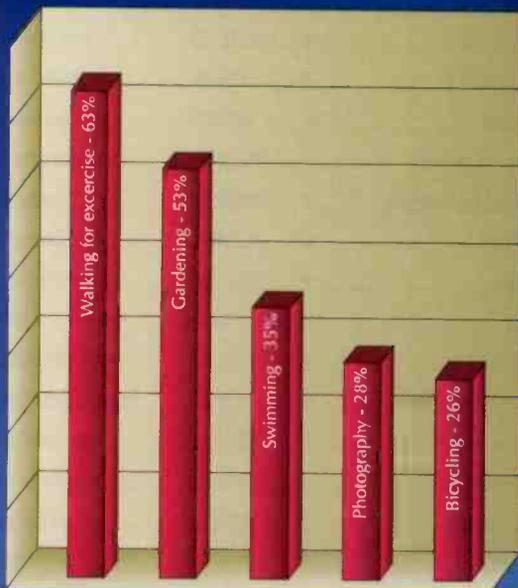


This is the radio transmitter room of KPO in Hale's Department Store, San Francisco, in 1925. Shown in the foreground is the Western Electric 1kW model 6A transmitter. In the background are marble-faced electrical control panels, which at the time were the only ones of their kind in the country. The KPO employee inspecting the transmitter is probably Claire Morrison, KPO's first full-time announcer. The transmitter was a newer design and unlike earlier transmitters, it was capable of 100 percent modulation. By this time, most stations were assigned to their own frequencies and transmitted for significant portions of the day. KPO is now KNBR, San Francisco. Photo courtesy of Bill Ruck, KNBR.

Sample and Hold

A look at the technology shaping radio

What do talk-radio listeners do while listening to the radio?



Source: Scarborough Research, Release 2 2001

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