BE Radio™

March/April 1996/$10.00
An INTERTEC Publication

...from the Editors of BROADCAST ENGINEERING

This Month:

- Computer-based Radio

Also:

- DAB Update

NAB 96 Preview

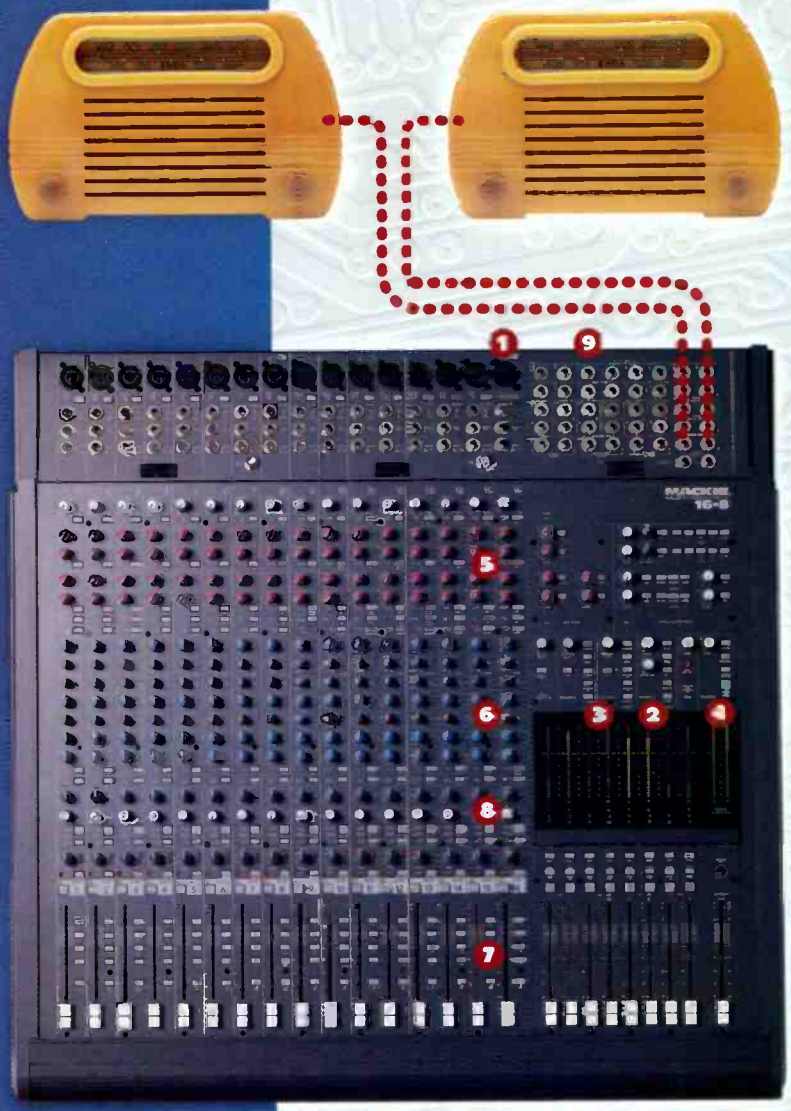
WHAT TO TELL YOUR GM WHEN YOU WANT A NEW PRODUCTION MIXER WITH MORE THAN FOUR FADERS.

First and foremost, tell them that you can get a studio-quality 16x8x2 console for just $3199*. $3199 won't buy an extra hard disk for that digital cart doofrabulator that keeps going south during morning drive. Heck, go whole hog and request a superb 24-channel Mackie Designs 8•Bus console — they're just $3999*.

Second, tell 'em that Mackie 8•Bus consoles are built like tanks. All three models feature solid steel chassis, sealed rotary controls, double-sided thru-hole plated fiberglass circuit boards and special impact-resistant design. Many 8•Bus consoles have been in continuous, 24-hours-a-day, hands-on use for years in high-pressure production facilities. Some have actually survived on-air jocks for prolonged periods of time.

Third, tell 'em the station's probably already playing music recorded on an 8•Bus. That's how good our consoles sound. Tons of headroom. Low noise. And no coloration. It's no wonder that the list of platinum and gold albums tracked and mixed on 8•Bus boards grows daily.
Sure, arguing sound quality rarely sways a GM, but it's worth a try.

If necessary, call your broadcast supply house, or Mackie direct and request our 48-page 8•Bus console brochure. It has a lot more arguments as to why our consoles are the best value around.
Finally, if all else fails, consider begging.



*Suggested U.S. retail prices: 16•8, $3199; 24•8, $3999; 32•8, $4999. Slightly higher in Canada. Contact your broadcast supply house for exact pricing.

The 16•8 shown above is part of a complete mixing system. Optional meter bridges and stands are available for all 8•Bus consoles. There's also a matching 11-rack-space "SideCar" for outboard gear. Add a 24-channel expander to the larger 24•8 and 32•8 models.

9 Internal goodies such as double-sided, thru-hole-plated fiberglass circuit boards, gold-plated interconnects, sealed rotary control, ultra-high duty cycle switches and exceptionally-high RFI rejection.

Not shown: The massively over-engineered, triple-regulated 200-watt, 2-rack-space external power supply.

Selected highlights of the Mackie Designs 8•Bus console...

1 Studio-grade mic preamps on every channel. Discrete circuitry with conjugate-pair, large-emitter-geometry transistors contribute to specs like –129.6 dBm E.I.N., 0.005% distortion and 10Hz-300kHz bandwidth. Phantom power for condenser mics switchable in banks of 8 channels.

2 Monitor section with separate Control Room and Studio stereo level controls. Select any combination of L/R mix, Mix-B, 2-Track or External feeds. Mono summing switch included at no extra charge.

3 Double headphone section lets you create two different headphone feeds with any combination of Monitor, Mix-B, Aux 3 & 4 or Aux 5 & 6.

4 Separate Talkback section with built-in mic. Selector switches let you address any combination of Aux 1, Aux 2 or Tape/Submasters.

5 Six pre/post-switchable aux sends per channel. Four available at any one time.

6 Big-console equalization: 12kHz Hi shelving, 80Hz Lo shelving, swept Lo Mid (45Hz-3kHz) and true parametric Hi Mid EQ. Band center is sweepable from 500Hz to 18kHz; bandwidth is variable from 1/12-octave to 3 octaves. ±15dB boost/cut throughout. PLUS an 18dB/octave Lo Cut filter that cuts room rumble and mic thumps.

7 100mm faders with true, logarithmic taper. Gain is smooth throughout the fader's travel instead of erratic and unpredictable like it is with cheap D-taper faders.

8 In-line console design with separate Mix-B/Monitor section. Doubles inputs during mixdown or create two different stereo feeds at the same time.

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Circle (1) on Action Card

What do these numbers have in common?

94,608,000.

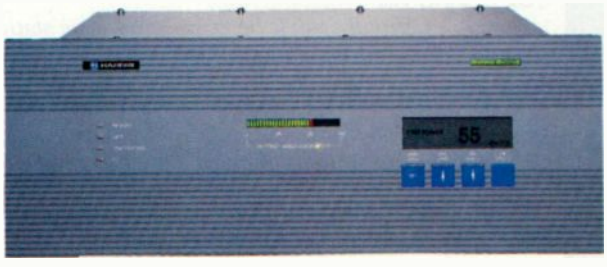
1,576,800.

26,280.

1,095.

36.

3.



The Clearly Digital answer? They all represent the length of warranty on Harris' DIGIT™, the world's only truly digital FM exciter. And, whether you look at these numbers by seconds, minutes, hours, days, months or years, they add up to the **only** 3-year FM digital exciter warranty in broadcasting!

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✓**Only** DIGIT has a DSP digital stereo generator that provides unsurpassed stereo performance with inaudible noise and distortion.

✓**Only** DIGIT has a DCL, a secret weapon that eliminates overmodulation peaks and provides the loudest, cleanest signal on the dial.

✓**Only** DIGIT--standard in all Harris tube and solid state FM transmitters above 1 kilowatt-- gives you assurance that you can upgrade from an analog to an all-digital air-chain quickly and easily when you are ready.

These are only some of the reasons why more than 400 FM stations have chosen to put DIGIT's advantages to work for them.

To find out how you can begin your journey to a 100% digital FM station with one step--the purchase of a DIGIT Digital FM Exciter, please give us a call. Our friendly staff would love to hear from you.

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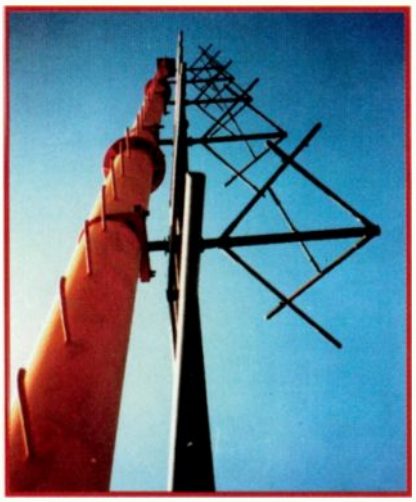
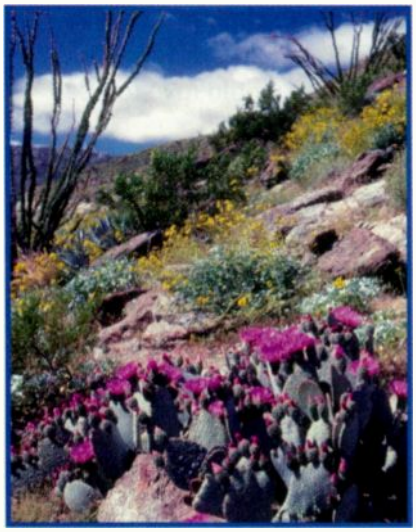
BE Radio™

March/April 1996 • Volume 2 • Number 2



14 *RF Engineering*

26 *Computer-Based Radio*



42 *NAB 96 Preview*

ON THE COVER: *(Right)* Fisher Broadcasting has implemented computer-based operations at its KOMO-AM/KPLZ-FM/KVI-AM facility in Seattle. Photo by Michael Craft, Seattle, © 1996. (Photo courtesy of Computer Concepts Corporation.)

This month...

Departments...

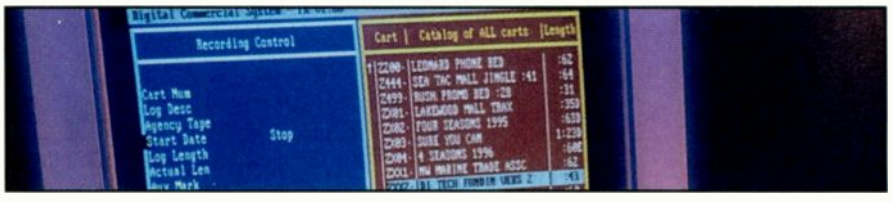
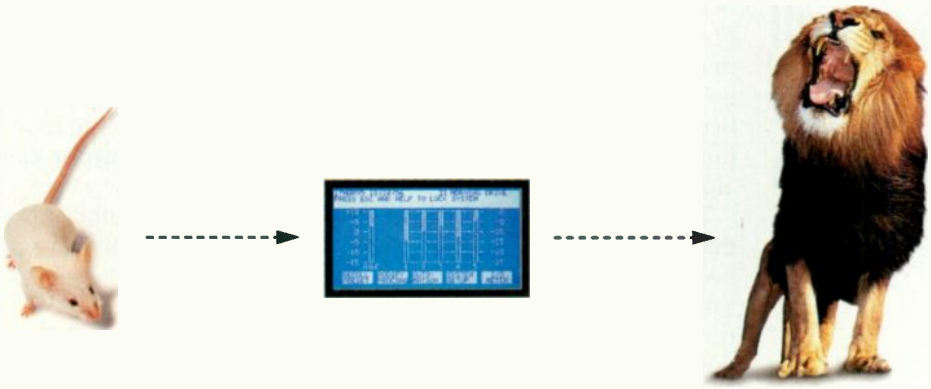


IMAGE MAKING WITH OPTIMOD
First In A Series



The More Powerful Your Sound, The Stronger Your Image.

Using image to attract listeners is nothing new to radio. Just the rules have changed. Now even loyal listeners have become "dial scanners." More stations are broadcasting into every market. And, suddenly, everyone seems to be competing for the same listeners. To stand out, you need a sound that's as unique as your station's personality. And that's where the power of OPTIMOD comes in. No other FM processor lets you optimize your audio image so completely. You get loud, clear sound tuned precisely to your format, your audience, and your identity. And that's important, because: ***In Radio, Image Is Everything.***

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Editorial:

...And the geek shall inherit the earth

A reading from the Book of New Technology: "In a high-tech environment, power and influence flow to those who understand both the technology *and* how to best apply it in their business." These twin goals should serve as a beacon to everyone in radio today. Non-engineers should learn as much as they can about technology, and engineers should learn as much as they can about the radio business. It may not be a cake walk for either, but personal and company gains will result.

The editor of a major Silicon Valley newspaper once told me that he thought the future belonged to those who could explain new technology to others. I'm inclined to agree. The French have a word for it: *vulgarisateur*. It means someone who can take a high concept or esoteric idea and make it understandable to a wide audience; hence, the power of the *geek* in a world dominated by computers. If you find the term insulting, trust me, it has become a positive appellation in most circles today. (Some may prefer the term *guru*, but as the well-known consultant Don Markley says, "Anyone can be a guru; it takes a 'double-E' to be a geek.")

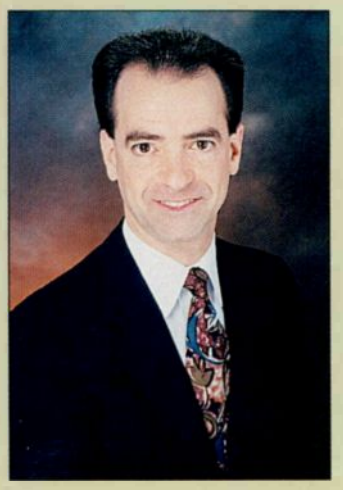
The inherent power of this knowledge can lead to trouble, however. People who feel that they lack sufficient knowledge and have nowhere to turn for it often feel helpless and become desperate. When this happens to a manager, look out below. Management's resentment toward technologists who don't share information nor explain things well can make things pretty ugly. For the geek, it doesn't matter how much you know if you're out of a job. For the manager, it doesn't matter how big an office you've got if you can't progress against the competition. Both parties will benefit from frequent and positive information exchange.

Respond via the *BE Radio* FAXback line at 913-967-1905 or via E-mail to beradio@intertec.com.

The best way to establish this dialog is to deploy your company's collective expertise to study, synthesize and teach. Doing this will allow every team member to balance his or her micro and macro views. Engineers should keep track of every detail on the technical side, and pass along the big ideas to management, in as clear a manner as possible. Managers need to look closely at the business side, and explain the important elements to engineers in an understandable fashion. As this goes on, each will learn more about the other's environment, which will in turn help them both make better presentations to one another. With this synergy of communication, positive growth is nearly inevitable.

This kind of effort isn't just a nice idea, it's the law of survival. It will be an essential part of any operation that expects to succeed in the face of increasing consolidation within the industry, and new competition from without.

Technology will be the way to reach that future success, but it can also get *in* the way of achieving it. Positive interaction between managers and engineers can make this technology constructive, not obstructive, toward the fulfillment of mutual goals. Know the code, share the wealth and do the right thing. These are the beatitudes of the modern age, so practice them well. The job, the company and the industry you save may be your own.



By Skip Pizzi, radio editor

P.S.: Speaking of explaining technologies, I'll be participating in a panel discussion at NAB 96 called "New Technologies in Plain English," at the Radio Management Conference, Monday, April 15, 12:30-1:45 p.m. Stop by and join in if you can. For complete NAB 96 information, see our comprehensive pre-show coverage that begins on p. 42.

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INTRODUCING

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Contract Engineering:

Maintaining computers, part 1

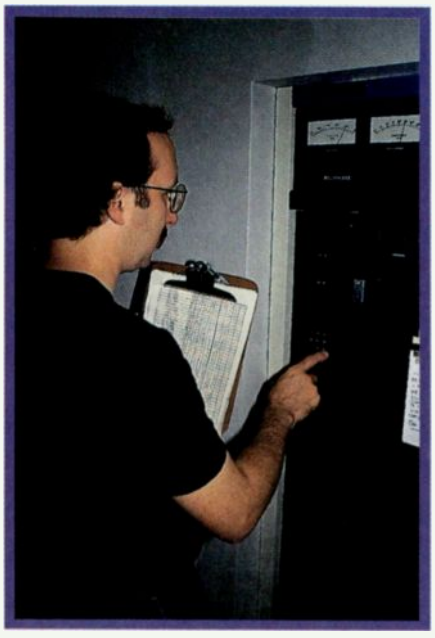
By Chip Morgan

It's a fact of life these days that radio engineers have to be computer-literate. It won't be long until the entire radio studio environment is fully computerized. The first step in supporting computerized systems is knowing how they are supposed to work under normal circumstances.

Setting yourself up

Tools for computer hardware are not always the same ones we use for transmitters or audio equipment. Some special items to consider are cable testers, breakout boxes, cable/connector tools, data testers and wrist straps.

Just as you bench a new piece of audio gear before installation, a PC also should be tested before installation. You should run all of the standard diagnostics, pull and reseat the cards, inspect for loose components, and ensure that the hardware is operating correctly.



In network installations, a test will consist of a server and a few machines running all of the expected applications in all hardware configurations. Once the hardware passes the lab testing, it moves into a beta test group of higher-level users for bug detection before the masses are allowed on-line. This allows you to benchmark the performance so you can detect failures and network-resource hogging.

Because your first priority is to minimize downtime, a stock of common spare items is your primary line of defense. The ultimate solution is a spare PC of each of the major types in use at a station. More realistically, the next best solution is to stock spare major parts. In a networked environment, you'll want a spare hub and plenty of spare patch cables, net cards and any other major items.

Mission-critical systems, such as traffic and billing computers, and certainly any networks, should be set up to allow remote access for troubleshooting and diagnosis. You can handle more workstations and users by remotely connecting and observing problems than by traveling to each of their sites. Many problems are operator-error or configuration problems that can be fixed via modem or a return call to the user.

Playing it safe

All important data must be backed up. *Regularly. Religiously. Automatically.* Be sure that someone on each station's staff is assigned PC-backup responsibility, that backups are stored off-site, and that you have an inventory of all computer hardware and software.

More than 95% of all catastrophes that disrupt business are not total surprises. Plan by preparing printed descriptions of what each employee is to do in the event of a disaster. Recommend cellular phones for use if the station's PBX is involved in the crash. Also, remember to *test* the backup plans.

Maintenance procedures

It's basic, but it must be said: Take the PC somewhere with good ventilation and blow all of the dust and the cobwebs out of the inner recesses. This should be done each time you open the box before any other work is done, and then at least twice a year, even if it works fine. Naturally, you shouldn't do this where the dust will fall back onto or into other equipment.

More than half of reported computer problems are cable-related; a cable is loose, the cable fell off, the conductors are frayed, the cable is the wrong kind and so on. Always check the cables first. It's like asking whether the meters are moving on the console when a station is off the air.

One area that tends to be overlooked after initial installation is the uninterruptable power supply. It runs on batteries and batteries wear out. Be sure to check the batteries regularly so you know when they are failing. To test the power supply, save all important data on the system being powered, and pull the plug to the UPS. It should carry the load for a reasonable time. If not, replace the batteries or the unit. UPS units on network servers or other mission-critical systems should have audible or visual alarms that notify personnel when the UPS is in use.

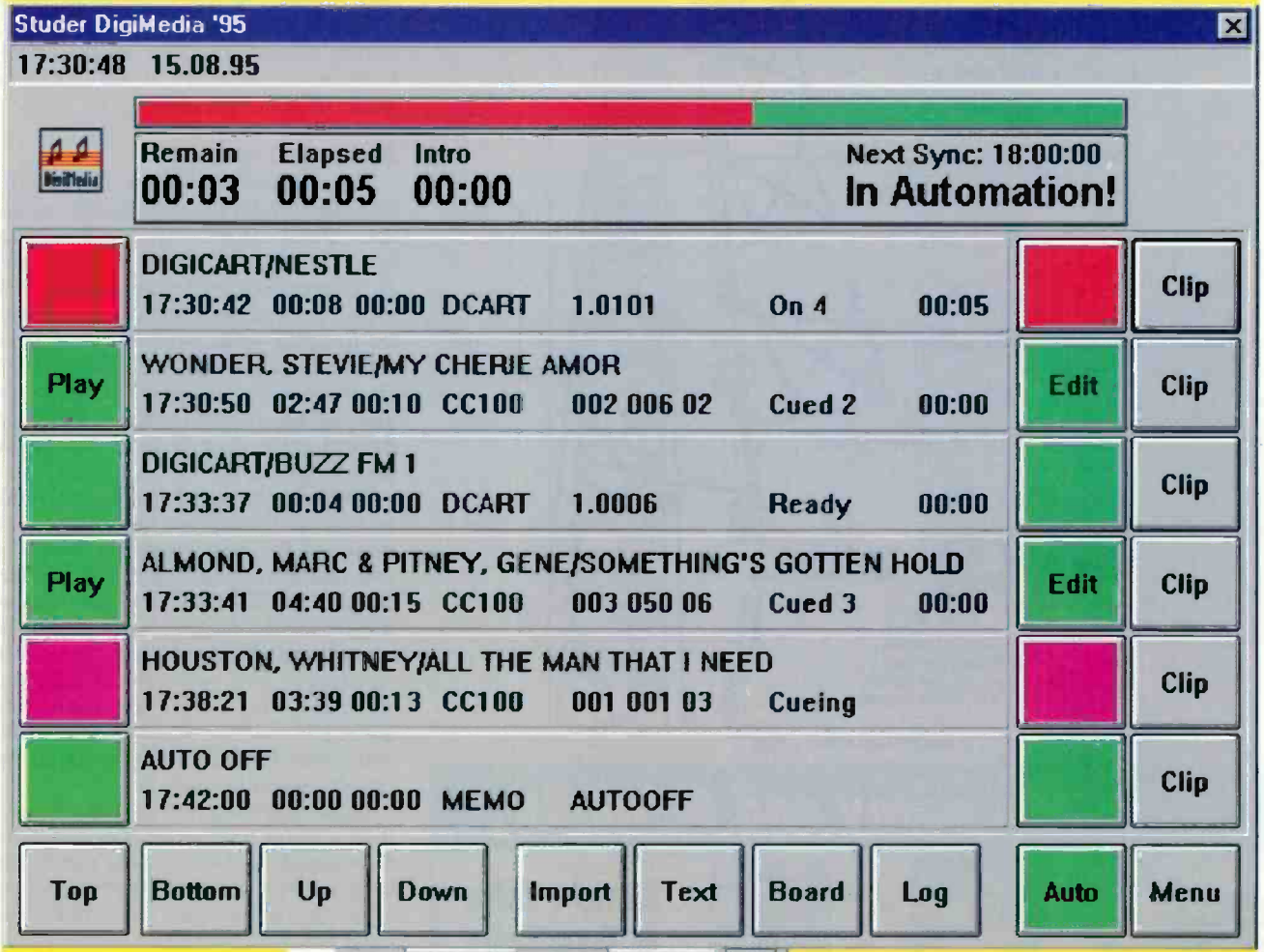
Individual component maintenance

- **Hard drives:** Failure of a hard drive is usually *whether*-related: It happens whether you like it or not. Be prepared with spares. Replace the drive before it fails by heeding the warning sounds (grinding or other unusual motor noises). Recommend RAID systems and proper backup procedures.
- **Power supplies:** A common problem arises from the addition of newer and bigger devices to an old computer chassis without upgrading the power supply. Even if you install new power supplies, it's good to have spares on hand. In an emergency, a good power supply can save the day.
- **Floppy drives:** Some system administrators remove floppies from users' computers to minimize the introduction of viruses. If so, you'll have a plethora of floppy drives and won't need spares. In general, a floppy drive is cheap enough to just install a new one when a unit fails.
- **Printers:** Like copiers and fax machines, printer maintenance basics include cleaning and more cleaning. Add toner or a ribbon and then clean again. Anything beyond this is probably best handled by a "professional."
- **Portable computing:** Everybody wants a portable computer with all of the bells and whistles. A reality check indicates that the affordable ones don't have the horsepower. Many portable PC problems are simply configuration or compatibility problems, which can be solved like those for any other computer.

Chip Morgan owns Chip Morgan Broadcast Enterprises (CMBE), a broadcast design, systems management and engineering firm based in Sacramento, CA.

INTEGRATION

DigiMedia '95 - The compact and modular Digital Audio Broadcast System



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Contract Engineering: Maintaining computers

The other big issue is battery life. Your experience with battery memory and proper discharge/recharge cycles will serve you well here (although newer battery chemistries like nickel metal-hydride and lithium-ion can minimize some of these problems).

Some general tips

Experienced engineers favor long-term stability and high-quality equipment when possible. They look for easy access to parts, simple designs and good customer service at the main factory. Unfortunately, some of this has to be foregone with computers. Most of today's systems will be obsolete within five years. Major components will probably fail two or three times during that period. However actual downtime should be quite low.

You can get expensive industrial-quality systems that mount in racks and are designed for harsh environments, or you can get off-the-shelf systems targeted at small businesses. Like choosing a console, the real issue should be interchangeability of parts and subsystems, as well as length of expected service. If the servers are industrial-grade and the PCs are consumer-grade, you cannot make a quick repair by simply swapping boards.

Regarding *when* to do maintenance, there's never a good time. Just be sure to schedule it in advance, notify the users early, and plan for the possibility of using your backups if the main systems fail. Just like transmitters or old cars, once you start poking around, the weakest links will fall apart.

In general, computer-system troubleshooting is like anything else: Start with a description of the perceived problem from the user. The actual problem may have nothing to do with the user's explanation, but at least you will know the symptoms.

Always ask the user what was done just before the failure. Was something new installed? Were cables or hardware changed? Try to reproduce the problem starting with the most basic system configuration. You're checking to see if other hardware or programs are causing the problem. If a basic configuration works, start adding hardware and programs to see where the problem starts happening. Some configurations just don't work well together, but many times changing settings in hardware and/or software will make it work.

In Part 2 of this series, we will consider the software side of computer maintenance at radio stations.

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Circle (6) on Action Card

Managing Technology:

Converting to computer-based audio

By Donna Hill

It's bound to happen in every radio manager's career sooner or later: Your station will decide to convert its on-air operations to a computer-based system.

If you're lucky, this conversion process will be a leisurely affair, driven only by a desire to upgrade or replace existing production and on-air equipment.

For other stations, it will be an urgent matter of survival when a way must be found to operate more cost-effectively "or else." Either way, the responsibility for a successful conversion to computer-based audio often falls most heavily on the station manager. If you hail from a non-technical background, it can seem like an especially daunting task. But there are steps that you can take to make the process go more smoothly.

Do your homework

First, do some basic research as soon as you suspect that computerized audio is in your future. If you're not already, get familiar with the basic functions of computers. Read a couple of computer books and check out some of the PC magazines. Give your secretary a break and start writing some of your own letters. Send some E-mail and surf the net. Without at least a basic familiarity with computers, you'll be managing the conversion in name only — chaos will really be in charge.

Next, start looking specifically for ads and articles on computer-based operation in broadcast and audio technology magazines (like this one). Call vendors for information about systems that intrigue you. Go to the trade shows where you can see some of the systems and talk to salespeople. If your budget won't allow you to go to NAB 96, try to attend some of the smaller regional shows.

If you've been managing the same station for a long time, it's especially important to be sure you're not stuck in a status-quo mindset, unable to visualize new possibilities. Not all stations do things the way your station does. Go and visit other operations, both commercial and non-commercial. Talk to their programming and operations people and check out their equipment. It can be a mind-opening experience.

Then, take a good look at your own staff. Do you have anyone on your production, operations or on-air staff who is familiar with computers or who finds them fun and exciting? If you don't, hire one. If you can, hire two — or more. These people will come in handy.

Choosing your system

Include not only engineering personnel in your planning process, but also on-air, production and operations staff. (See "Implementing Automation," July/August 1995.) These people are the ones who are going to have to live with the system you buy and who are most familiar with the station's current operation. Their input will be invaluable in making sure you don't forget significant, yet subtle details. As a side benefit, including them in the process will give them some measure of input into a process that can seem threatening.

Look for a versatile system that does what you need, but is user-friendly. The most-sophisticated system in the world won't provide much benefit if the staff hates it and it takes months to teach someone to use it.

If you're looking for a system that can *automate* some or all of your dayparts, have a fairly clear idea of what you want your station to sound like after it's automated. Then, as you research systems, make sure the products you're leaning toward can produce that sound. Be especially careful if you expect to keep some or all of your music and long-form programs on CD, DAT, MiniDisc or other external audio devices under the computer's control. Not all systems can handle this, and some that can don't do it flexibly.

The responsibility for a successful conversion to computer-based audio often falls most heavily on the station manager.

Once you know what you're after, make this clear to the vendors, and have them demonstrate their products. This is especially important if your format is substantially different from those the system was initially designed to work with. Likewise, be sure that you clearly understand what the vendors are telling you. Ask questions and be persistent. This is no time to worry about looking stupid. Just imagine how stupid you'll feel if you buy the wrong system for your station.

Don't let the techno-speak (either from vendors or your own engineering people) snow you under. Again, be persistent in making sure you understand one another, especially with the engineering staff. They, quite rightly, will want to find systems and equipment that work reliably and are quick and easy to install and repair. Your priority, on the other hand, may be to find the best system for your operations and air sound. Look until you find the system that meets both requirements.

Determine what existing systems or equipment will be affected by installing the new system. Will you need to replace your old reel-to-reels with DAT recorder/players? Do you have the kind of CD players that your automation system will require? To get maximum efficiency from your automation system, it should be tied to music scheduling

Donna Hill is director of radio broadcasting at WSKG/WSQX, Binghamton, NY.

Move Up from Carts to Touchscreen Digital Audio

Play Anything...At A Touch

The ***best*** way to improve your radio station is to put all your spots, sounders and sweepers ***on-line*** and ***ready to play instantly*** from hard disk. Creative talent sounds better than ever with ***Scott Studios'*** new touchscreen digital audio system.

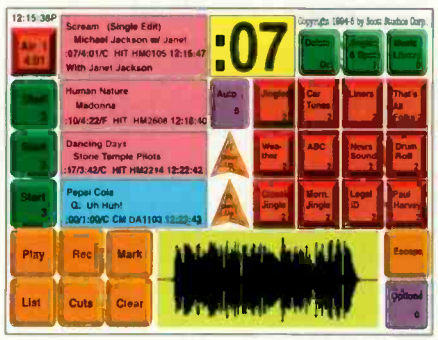
Here's how it works: Six buttons on the left of the large computer touchscreen play what's on your log. Scheduled spots, songs, promos, PSAs and live scripts come in automatically from your production studios, traffic, music and copy computers. Jocks can revise sweeps at a touch (with the arrows at mid-screen), or work with the full day's log and add or rearrange anything.

On the right, 17 "hot keys" start ***unscheduled*** jingles, sounders, effects, comedy or promos ***on the spur of the moment***. Your morning show will benefit from 26 sets of 17 user-defined instant audio "hot keys".

You can ***preview anything*** in a cue speaker at a touch. The Scott hard drive even lets you listen to endings ***while*** that song is playing on the air.

And ***nothing*** beats the Scott System for easy levels. Touch the label on the screen, moving right to left to fade as desired. If you'd rather adjust levels on the console, channel numbers show clearly on each start button.

The Scott Studio System is your *best* way to make the move to digital audio and eliminate troublesome carts. The touchscreen instantly plays whatever you want. All scheduled spots, jingles, promos, scripts and songs come in from your traffic, copy and music computers.



Phone Recorder On Screen

Touch ***one button*** and you're recording calls to hard disk. Another button and you've got the world's easiest editor. When it's ready, one touch and your call's on the air. The phone recorder only adds $1,000 to the system.

The *Best* Digital Audio

When spots, promos, PSAs, or any other digital audio events are recorded, they're immediately playable in ***all*** your Scott System air studios. Nobody wastes time carrying carts down the hall or redubbing spots for additional stations.

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Circle (7) on Action Card

and traffic systems or software. Do you already have such software in place, and if so, will it "talk" to the system you contemplate buying?

Have you budgeted enough money for your conversion to computer-based audio? Nothing is worse than spending your entire budget on a system, only to find that to make it work efficiently, you need to spend thousands more (that you haven't got) on peripherals. Make sure your system matches your budget. Also, remember that computers don't last forever. You'll probably have to make another heavy capital investment for equipment replacement within five to 10 years.

When you've narrowed your choices to a few systems, go to stations that are using them and see how they're working out. Talk to the engineers who've installed and maintained them. Talk to the programmers, producers and on-air people who use them. What problems are they having? What do they like or hate about the system?

Taking it out of the box

Once you've purchased your system, make sure there is adequate time for installation, familiarization, customization and staff training. Whatever the sales literature told you, you aren't going to plug this stuff in and start using it overnight, especially if you didn't hire those on-air and production people who find computers fun and exciting. Take advantage (and budget for) the training opportunities and facilities that the vendor provides.

Second, budget time in your start-up schedule for the surprises and unexpected problems that will inevitably crop up. Again, this is where your computer-oriented people will come in handy. They could save you hours of confusing over-the-phone consultations with your vendor, and likely save you money as well.

Third, learn to use it yourself. You may think you just don't have the time, but you'll regret it if you don't. You don't need to operate it on a daily basis, but get a good idea hands-on of how it works, how your staff uses it, and of the capabilities it has that you're not currently using. If you don't know these things, then your staff — not you — is in control of your air sound.

Be sure you're not stuck in a status-quo mindset, unable to visualize new possibilities.

Finally, remember that it's a computer, not a purely mechanical device. Hardware can crash and software can have bugs or viruses. You should have a plan in place for regular computer backup and for maintenance and repair on short notice. Ideally, your engineer should be able to handle your computer repairs right along with the rest of your equipment. (See "Contract Engineering," p. 6.) If this is not the case, make sure you have other staff or outside sources for computer service. You also should have an alternate plan that will allow you to stay on the air in the event the computer goes down completely for an extended period.

Converting to computer-based audio facilities may be one of the most-demanding tasks you ever face as a manager, but you'll also find that in many ways, it's one of the most satisfying. It will stretch your imagination, your abilities and your understanding of what's possible in radio.

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Circle (18) on Action Card

RF Engineering:

Solid-state RF

By William Fawcett

If you have been servicing broadcast transmitters for more than a few years, chances are you are already "up-to-speed" on tube-type units. Being knowledgeable about tube transmitters will probably remain a uniquely marketable skill for another decade or two. Today, of course, the proliferation of solid-state devices in modern RF power amplifiers requires familiarity with another set of troubleshooting techniques.

The first and second generation of solid-state RF amplifiers were (and still are) problematic. Devices had to be closely matched, and they often would self-destruct while repairs were being made. If you have such a unit, check with the manufacturer to see if there have been any upgrades. Another problem with the older units is the current availability (and cost) of replacement parts. One major manufacturer now suggests the wholesale replacement of their failure-prone IPA shelf with an outboard power amp. It's a worthy idea.

Given the variety of devices available and the advancing state-of-the-art, almost every transmitter design is unique. Fortunately, a deep knowledge of circuit theory is not needed to effectively troubleshoot most RF power amplifiers. Even with the ever-changing technology, the fundamentals of logical troubleshooting remain constant.

Base line measurements

First, you must establish a base line. While the transmitter is new or properly operating, record every reading available. It is best to have the readings made on your specific unit at its actual nominal operating power and line voltage. In a pinch, the manufacturer's test or generic data is better than nothing. Aside from the usual voltage, current and temperature readings, interstage forward and reflected power measurements are useful.

When trouble occurs, these base line readings can often be used to locate the problem down to the module or to the actual component. Reducing the power level or drive may enable you to take readings on a transmitter that shuts down at full power. Using a dummy load and a wattmeter will allow you to eliminate the possibility of an external problem.

Next, do a complete check of fuses throughout the unit. Some transmitters incorporate "fuse-finder" readings or have front-panel test jacks. Follow the instructions in the manual. If you're working on an AM transmitter, you may want to take some preliminary pulse-width measurements with an oscilloscope. Without these measurements, it is impossible to separate a modulator failure from an RF power-amp problem.

Armed with this information, you are now ready to find a quiet room and review the block diagram and schematics of the unit. More problems can be solved with a cup of coffee and a sandwich than with a room full of fancy test gear. If the problem is not obvious, swallow your pride and call the factory. You could save hours or even days, because the manufacturer is already aware of the most common failure modes and peculiarities of your unit. Having the base line and present readings available will give the factory technician a good starting point.

Three techniques

Once you have isolated the problem to a certain section, three basic troubleshooting techniques will be helpful. Substitution of a module will often verify the location of the problem. If you do not have a replacement module and more than one module is used in the transmitter, swap it with another module and see if the problem moves to that section. Be aware that this can sometimes cause damage to other components, so use this technique with caution. Make a list of test measurements with each swap, and if possible, swap only one module at a time.

It's not uncommon for many years to elapse between failures of modern solid-state power amplifiers.

A less dynamic approach is to take resistance readings on the suspect module and on another board that is known to be good. A DVM with a *diode* position is often helpful. Removing the solid-state device and comparing resistance readings with a known good device may allow you to locate the defective part. Triggering a MOSFET for dual-state testing may require a high-output-voltage ohmmeter, like the venerable Simpson 260. Testing a blown device may allow a determination of the normal failure mode, which will assist in identifying other bad parts. Measure from all three leads, in both polarities (six measurements), looking especially for blown junctions or high leakage.

A third technique is the "shotgun" approach, which on the surface seems extremely wasteful. In this case, replace *all* suspect components — perhaps all semiconductors on the defective module. When you factor in the value of your servicing time and the expense of transmitter downtime, the shotgun approach may actually be the most cost-effective. In cases where the component "ohms out" OK, but breaks down at full power, the shotgun method beats all others. The obvious downside of this method is its need for ample stocks of replacement devices.

Replacing components

Although AM transmitters may use socketed TO-3-type devices, the higher-frequency

William Fawcett is president of Mountain Valley Broadcast Service Inc., a broadcast engineering firm in Harrisonburg, VA.

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FM transmitters usually employ a tab-type device soldered to the printed circuit board. For these types, in-circuit testing is preferable. If you must remove the device, consider nipping the four tabs off prior to desoldering. Such removal requires less heat and preserves the printed circuit pattern, which may otherwise suffer damage after a few replacements. Of course, this is not practical if you are removing the device for an out-of-circuit test and you don't have many replacements on hand. You may be reluctant to perform destructive removal on a $100 device, but replacement boards are expensive and hard to obtain.

Deep knowledge of circuit theory is not needed to effectively troubleshoot most RF power amplifiers.

Buying generic replacements in quantity will often give you three components for the price of one from an OEM. Having such a stock on hand will allow you to effectively use the shotgun method and destructive removal when necessary. If you use a generic replacement, be sure it is appropriate. It is not uncommon for RF power amps to incorporate hand-selected components or to use a particular manufacturer's device that may have a higher rating. If the components are used in pairs or quads or complements, replace all devices in that set with one made by the same manufacturer. Otherwise, one device may take on more than its share of the load and subsequently fail.

The first and second generation of solid-state RF amplifiers were (and still are) problematic.

Pay close attention to the means of mounting the solid-state device to its heat sink. It is imperative that you properly re-assemble the unit in the same manner. The device may or may not be insulated. Use the same type of heat sink compound, and be sure to use proper handling procedures for static-sensitive devices like MOSFETs.

Stable operation

Vacuum tubes age and solid-state devices don't. With most modern circuits, touch-up tuning is not required. For broadband circuits, tuning is not even an option. It's not uncommon for many years to elapse between failures of modern solid-state power amplifiers.

Ironically, this reliability makes engineers less familiar with the inner workings of such complex devices, which can turn a major problem into a most befuddling experience. The methodical approach of logical troubleshooting, coupled with adequate stocks of replacement parts, will provide you with a problem-solving technique for solid-state transmitters that really works.

For more Information on solid-state transmitters, circle (150) on Action Card. See also "Transmitter Systems," p. 83 of the BE Buyers Guide.

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Circle (32) on Action Card

FCC Update:

Summary of tower registration procedures

By Harry C. Martin and Andrew S. Kersting

As reported in the January/February *BE Radio*, after July 1, 1996, all new antenna structures requiring FAA notification must be registered with the commission prior to construction. Under the procedures, construction of a tower, even if authorized by an FCC construction permit, may not begin until a registration number has been obtained. Owners of existing structures must register their towers according to the filing windows in Table 1.

The commission will not process applications that do not have an FCC tower registration number. The FCC will use revised Form 854 as the sole means to register antenna structures. Tower owners may register electronically or by mail. Those who register electronically will receive a number within minutes. There is no registration fee, nor will owners be required to renew their registration. Tower owners must notify the FCC of any change in structure height, ownership, owner's address, or upon tower dismantling.

The registration database will accept latitude and longitude data to the nearest second, and height data to the nearest meter. Owners must submit accurate site data regardless of the height and coordinates listed on tenant licensees' station authorizations. The FCC generally will not issue fines to owners or licensees attempting to correct errant site data during registration. However, changing the coordinates on tenant licensees' authorizations, depending on the magnitude of the error, may result in a violation of the interference-protection criteria in the rules, or may invalidate the original FAA determination for the site.

Tenant licensees should note any discrepancies in the site data appearing on the registration form and their station authorizations, and notify the appropriate licensing branch. Licensees will not be required to submit a filing fee when correcting site data. In cases where a correction of data for a tenant licensee would be in violation for a particular radio service, the licensee(s) involved may be required to take measures to avoid harmful interference, such as decreasing antenna height, reducing power, employing a directional antenna or even going off the air. This is a dangerous area that was not covered by grandfathering.

Corrections of previously submitted site data of less than one second in latitude or longitude or of less than one foot in height will not require a new FAA study, and the structure will retain the previously assigned painting and/or lighting specifications. However, a new FAA study will be required for corrections in latitude or longitude of one second or more or a correction of height of one foot or more. In this case, the owner must seek a new FAA determination prior to registration, and the tower will be assigned painting and/or lighting requirements based on the new FAA determination.

In general, the FCC will not require tenant licensees to cease operations while the owner seeks an FAA determination or while coordinating corrections with the individual licensing branches within the commission.

Joint sales agreements proliferate

Many radio broadcasters have turned to joint sales agreements to expand their advertising inventory. A "joint sales agreement" generally involves an arrangement between licensees in the same market, whereby one licensee purchases some or all of the advertising time on the other station(s), and sells the spots to fill that time. A joint sales agreement is similar to an LMA except the licensee of the brokered station continues to provide all of its own programming. For this reason, the FCC currently does not regard the sales of the commercial time on the "passive" station as an attributable interest under its multiple ownership rules.

Window	States/Territories
July 1-31, 1996	MI, MT
Aug. 1-31, 1996	AZ, HI, NC
Sept. 1-30, 1996	AK, NM, NY
Oct. 1-31, 1996	MA, MO
Nov. 1-30, 1996	IL, WY
Dec. 1-31, 1996	NV, OK, PR
Jan. 1-Feb. 28, 1997	CA, OH
March 1-31, 1997	IA, VA
April 1-30, 1997	GA, Guam, VI
May 1-31, 1997	LA, ME, RI
June 1-30, 1997	CO, MN
July 1-31, 1997	NE, PA
Aug. 1-Sept. 30, 1997	FL, IN
Oct. 1-31, 1997	DE, KS, WA
Nov. 1-30, 1997	NH, OR, WI, WV
Dec. 1-31, 1997	AL, DC, MD
Jan. 1-31, 1998	AR, ND, UT
Feb. 10-28, 1998	ID, MS, SD, VT
March 1-31, 1998	KY, TN
April 1-30, 1998	CT, NJ, SC
May 1-June 30, 1998	TX

Table 1. Timetable for owners of existing towers to register.

Historically, joint sales agreements were used only where the active licensee was prohibited from either purchasing another station in the market or entering into an LMA because of the local multiple ownership limitations. Those licensees who were prohibited from purchasing another station in their market or entering into an LMA due to the multiple ownership limitations used a joint sales arrangement to increase their advertising inventory.

In order to protect the active licensee's investment, the joint sales agreement should provide the active licensee with an option to purchase the brokered station or a right-of-first-refusal. These terms are necessary to prevent a competitor from buying the brokered station after the active licensee has enhanced the value of the station through joint sales arrangement.

Harry C. Martin and Andrew S. Kersting are attorneys with Fletcher, Heald & Hildreth, P.L.C., Rosslyn, VA.

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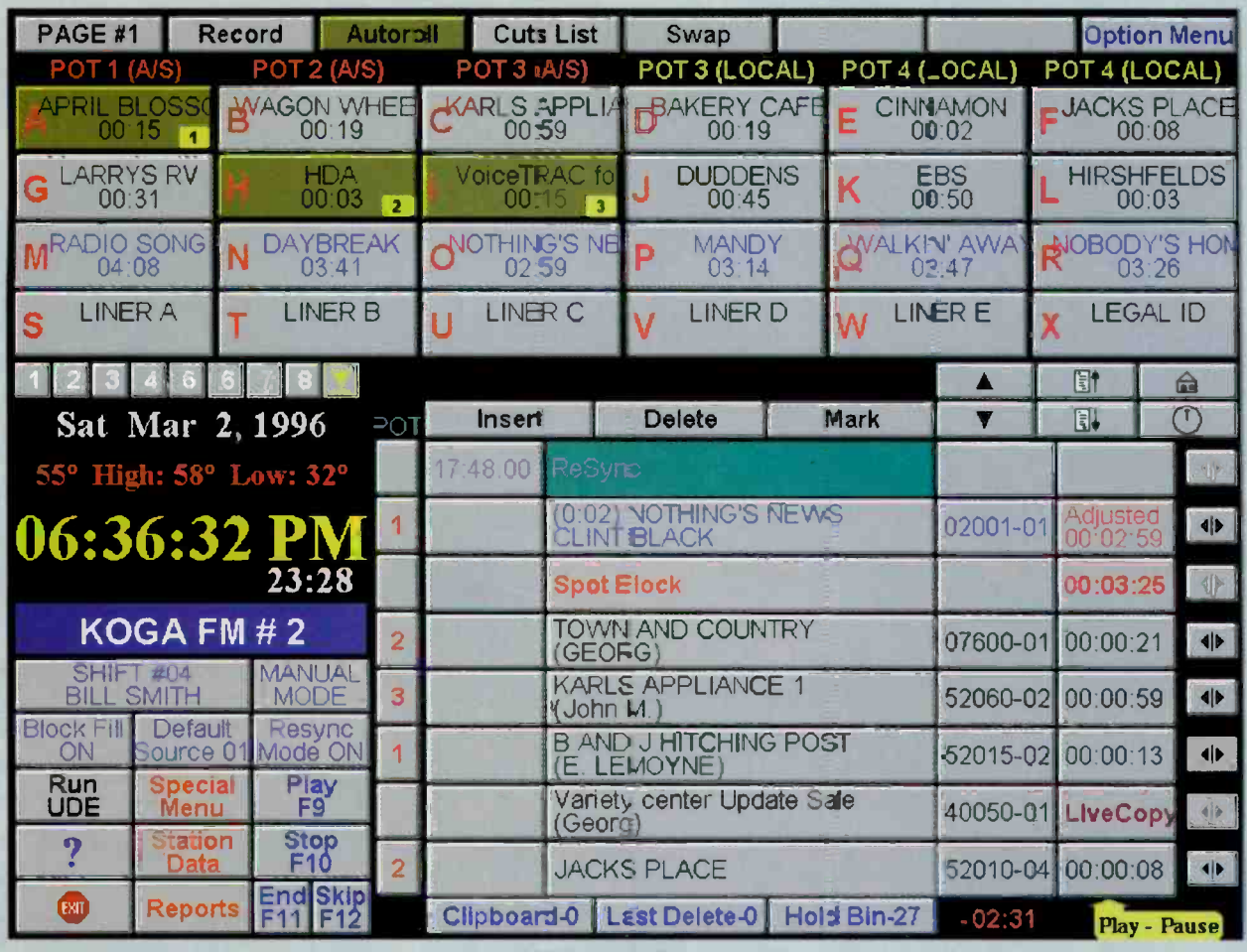
Circle (38) on Action Card

Prophet Systems Inc. announces



Version 5

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- **Audio Source Management**
  Version 5 allows the D-J to specify which audio card a commercial or song will play out of ahead of time. It is easy to pre-position sliders and to crossfade items. Plus, Version 5 actually allows six stereo audio events to play simultaneously for each control room!
- **Fully Touch Screen Compatible**
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- **Expanded Button Bar**
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- **Auto Roll of Buttons**
  Auto roll allows the D-J to mark buttons that will playback one after the other automatically. Mark up to 24 buttons which will all play back in order.
- **Quick Record**
  Take phone calls, edit them with our wave form editor, and place the event on log...all in just seconds.
- **Holding Bin**
  The holding bin is temporary storage for items that the D-J can't get to immediately. He can move them to the holding bin for easy retrieval later in the shift.
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- Jeff Hutton, KLTI/KWMQ, Southwest City, MO, KTLQ/KEOK, Tahlequah, OK

Live Show Interface.

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- Norm Laramee, KKPT/KSYG/SRN, Little Rock Arkansas

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Circle (39) on Action Card

EAS Update

The national EAS

By Leonard Charles

Leonard Charles is chief engineer at WISC-TV in Madison, WI, and chairs the SBE National EAS Committee.

For years, many national broadcasting organizations have been jointly and voluntarily providing the first tier of the Emergency Broadcasting System (EBS). All of the major broadcast networks, wire services, common carriers and program suppliers were linked to the White House to receive an emergency message from the president and pass it along to their affiliates. Key affiliates within each system would authenticate the received message, encode it with the EBS 2-tone signal, and eventually alert the public.

This first level of the system was controlled by the Federal Emergency Management Agency (FEMA). As the FCC developed and wrote the new Emergency Alert System (EAS), it structured the top level around this same infrastructure. Originally called the *Emergency Action Notification* (EAN) network, FEMA replaced EAN last November with the *Primary Entry Point* (PEP) system of large-coverage broadcast stations. PEP has now become the first tier of the EBS and the new EAS.

The national message path

By now, you're probably familiar with the web concept of emergency-message relaying. The EAS web involves multiple paths from source to destination for emergency messages. Although this web usually describes local-area systems, the FCC hopes to create a web through the upper levels of the system as well. The upper-level web will be accomplished by specifying a priority order for the monitoring assignments of each State Emergency Communications Committee (SECC). (Each SECC is responsible for creating its state's emergency alerting plan). The goal is to create two paths into each state for national-level emergency messages.

In a national emergency, the president's message will reach the PEP stations as voice (only), traveling via undisclosed links. The PEP stations are responsible for encoding the message into EAS protocol. Each *State Primary* station will receive the nearest two PEP stations along with a feed from the state's Emergency Operations Center.

The messages then work their way through the multiple-state relay stations to *Local Primary-1* and *Local Primary-2* stations in each operational area. These stations will also be monitoring either the State Primary station directly or a different area's Local Primary station on the second decoder input. Each participating station in the Local Operational Area would then monitor the Local Primary-1 and the Local Primary-2 stations to complete the dual path to the end of the relay system.

This is a *main channel web* and its success depends on adequate over-the-air reception. If reception of the first-priority assignment is not possible, the FCC has second-through-fifth monitoring preferences specified for each level's participants. The web structure that will work in your state will be diagrammed in your state's EAS plan.

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Circle (33) on Action Card

Computer-based radio

Welcome to the station on a screen.

The gradual implementation of computer-based systems is well under way among today's radio stations. Beyond simply providing elegant solutions, the use of computers may turn out to be essential to the survival of radio broadcasting.

I remember taking a trip with my high-school Mathematics Club in the late 1950s to visit the IBM headquarters facilities in Poughkeepsie, NY. I was, in a word, fascinated. They let us "ask" the ENIAC computer questions, showed us a primitive language-translation program, and gave us two souvenirs: a non-working transistor encased in acrylic, and a sample of the core memory that we saw being hand-sewn into matrices by women at desks. I was hooked.

By Robert L. Deitsch

I knew I had seen the future. Later, working in radio, I saw IBM card sorters and piles of data cards being used to make broadcast station logs. The system printed on large, noisy line printers; it ate cards for lunch, or so it seemed. Jams were a regular part of computer operation. Not all that much has changed. Cardboard is no longer part of the computer's diet, but power glitches and system crashes continue to wreak havoc, at least on occasion.

Data processing remains extremely important within broadcast operations, but process control and system integration are slowly, yet inexorably, "evolutionizing" the business.

Starting at the hub

Today, the most important piece of computer-based gear — and thus the one that should be chosen most carefully — is the digital audio on-air delivery system. Especially for an on-air studio, thoughtful consideration should be given to the interface that the DJ/operator must use.

Depending on your staff and the amount of live local production at your station, you may or may not experience

a smooth transition from cart machines to a mouse or touchscreen architecture. Alternatives to the strictly PC-based user interface are available, and these should be explored if on-air operators are PC-averse. However, these alternatives may be more costly than PC-interface systems.

One of the limitations of DOS-based systems is the number of interrupts available. While these may be adequate to satisfy many stations' needs, some large or high-demand users may wish to explore UNIX-based or other (perhaps proprietary) systems. Beyond these larger questions are some other, less obvious matters. Consider the following assorted issues:

• A handy feature on some systems is the ability to call in via modem, check the system operation and update the system from any remote location (with password protection).

• For any system, training is an important issue. Users should be able to master any new system within a few hours, not weeks.

• When PCs are employed for user interfaces, simple cleanliness must be frequently addressed. This applies to mouse rollers and pads, trackballs and touchscreen CRTs. They must all be maintained (i.e., cleaned), and this is difficult, if not impossible, to do while the terminal is on-line. Therefore, a regular maintenance schedule that includes shutting the PC off for a brief period is essential. PCs that are used in off-air production facilities or offices generally require less-structured servicing.

Numerous, separate tasks

Newsrooms may also use computer-based systems for wire-capture, word processing and audio clips. Text material may be manipulated and edited on a PC, and audio sound bites can be managed on the same terminal, or on a separate unit/system. Either way, news clips (like other spots) are immediately available for air. If the facility produces multiple program streams (an increasingly common occurrence), these same clips can be shared by all studios and users (up to the capacity of the particular system). This eliminates the need for multiple copies. Editing in the system may even allow different tags to be run on a common spot body for use on different stations without duplicate recordings of the main piece.

Production studios use computer-based audio in an increasing number of ways. The most obvious is the digital audio workstation (DAW). While the PC and related systems dominate the on-air delivery side of the industry, DAWs are found on Macintosh, PC and proprietary platforms in nearly equal amounts.

Some production systems are easy to operate, but may also be less versatile. In addition, all proprietary and some PC- and Mac-based systems come as complete packages from their vendors, while other (lower-end) PC or Mac systems can be put together by the user from assorted components.

The on-air control room at WCSX, Detroit, uses PCs for data management and a Radio Systems DDS for audio delivery.

Just how the programs produced on the DAW are imported to the on-air delivery system is a critical point. In the most rudimentary arrangement, the finished spot is simply played back as analog, real-time audio from the DAW into the delivery system. A more elegant approach involves the use of AES/EBU for a real-time digital transfer between systems. The most sophisticated systems allow this transfer to be done in a file-based, rather than a real-time audio, operation using some sort of LAN (more on this later).

Traffic data must also be attached to completed spots when they are loaded into the on-air delivery system. Again, various levels of integration are possible, from a completely manual, separate data-entry process to a one-step process that attaches the traffic data to the audio in a single file transfer.

The interface of the on-air system to the administrative office is another "port" on the system. This is 2-way communication, allowing scheduling data to flow from the traffic/log entry point to the on-air operator (or automation controller), as well as confirming "as-run" data back in the opposite direction. A wide variety of system reports can then be generated from this collected data.

Separate software, and even hardware systems, can be used in combination by the sales and business departments. Eventually, however, a single, integrated system should support the needs of traffic and continuity along with payroll, general ledger, sales and ratings tracking. Electronic, networked availability puts the right information in the right hands quickly instead of being buried somewhere in an accordion-sized paper report. This data can also be transferred to laptop multimedia computers for A/V presentations by sales staff at their clients' offices.

Physical installation

Where the computer system's hardware actually sits at the station is another key decision. Many stations choose to keep their audio servers — or even *all*

of their CPUs — in the master control area (or some other dedicated computer room). QWERTY keyboards, monitors and other control surfaces are linked to these remote CPUs using VGA/keyboard/mouse extenders. Other stations keep their CPUs and/or servers in sound-isolating cabinets distributed throughout their control rooms.

Yet another approach uses laptop terminals (with network connections on PCMCIA cards) for smaller, quieter control and display. This avoids the problem of placing one or more CRTs — with their EMI and acoustically reflective surfaces — near an announcer's open microphone. (The smaller display size of laptops may cause some visibility problems, however, and touchscreen operation would not be possible.) Either of the latter approaches avoids the cost of VGA/control extenders, but they could require a more complex or less reliable network interconnection between computers than the centralized server/CPU method.

Speaking of networks, the LAN that is used to integrate these systems is critical to the whole station's reliable operation. Network architecture will vary among different stations, depending on your preferences and requirements. For example, you may choose (at least for now) to transfer administrative data on a simple LAN, but keep your audio on dedicated, real-time paths (either analog or AES/EBU). Or you may wish to integrate further and transfer audio in file-based fashion, as well. In the latter case, your network will have to support more peak bandwidth, so a client/server 100BaseT Ethernet system may be advisable. (This is particularly true for large facilities, and/or for shops where data compression is not applied to stored audio files.) For the data-only application, a 10BaseT Ethernet architecture or even a simple peer-to-peer system may be sufficient. Explore all of the possibilities, with emphasis on reliability and opportunity for future growth.

Note that data compression applies as much to networking as it does for storage. Just as data compression may allow four or more times as much storage on a given hard drive, it can also allow four or more times more peak traffic over a given network path.

But don't stop your evaluation at the calculator. Also consider the potential audio degradation that may occur with data compression systems, especially after multiple generations of compression are applied. Audition any system carefully (they are *not* all created equal), and subject it to multiple passes of any compression algorithm(s) you are considering. Some automation/delivery systems support multiple algorithms and may allow you to choose which one – if any – to use, on a cut-by-cut basis.

How the programs produced on a DAW are imported to the on-air delivery system is a critical point.

Another new area to consider is the integration of file-based (non-real time) digital audio program transmission networks. A growing number of stations receive spots and even new music releases via one or more of these networks, generally over ISDN or Switched-56 lines. Work is currently under way by some of these networks to streamline the delivery of audio cuts directly into various digital automation/delivery systems.

Production Studio No. 1 at WCSX, Detroit, shows the growing influence of computers in radio. It includes a digital audio workstation, a control terminal for the station's on-air delivery system, a digital audio sampler/synthesizer and ISDN-connected receivers for two file-based audio transmission networks.

In the meantime, it's up to the station to find the best way to transfer incoming spots from the network's terminal to the on-air equipment. Accompanying traffic/scheduling data from these networks also must be handled. Putting the network's audio terminal in the production studio and routing the data to the traffic office probably makes the most sense at present.

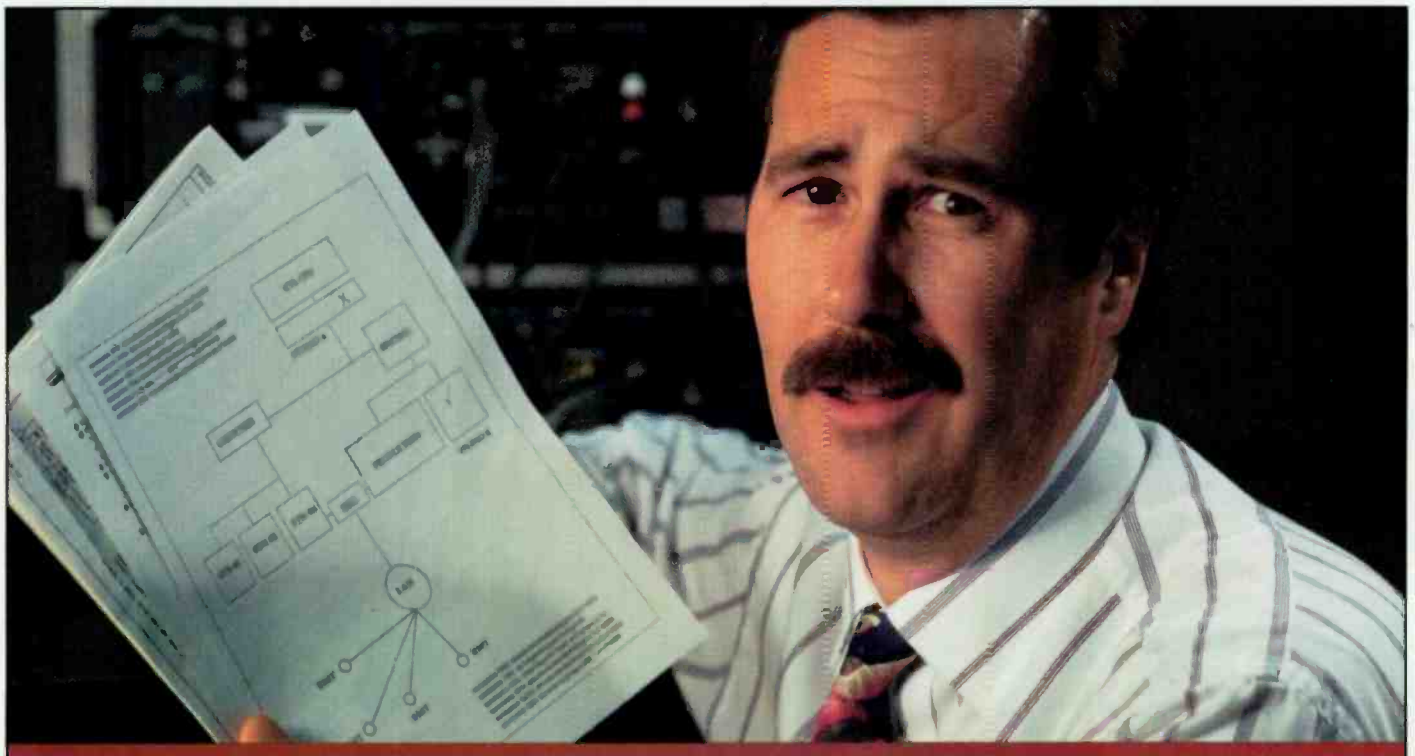
The hub of a station's operations will remain in a master control area. Any technically efficient broadcast facility must have one and maintain it as the common point for both audio and computer networks. It should be under tight environmental control, be highly secure and have sufficient UPS capability to assure that no power-related interruptions will affect any mission-critical operations.

A typical master control will also contain a bridge to the telephone company point of demarcation, the station's on-air audio processing and off-air monitoring, STL/TSL and RPU equipment, satellite receivers, building security-system monitoring and control, audio routing/switching, an intercom hub, a master clock system, an audio and perhaps a video monitoring hub for distribution throughout the station (including office areas), the facility's environmental control point, the data network hub (if separate from the audio computer system), the PBX or other station telephone equipment and voice-mail computers. (Some stations may receive or transmit enough satellite traffic to warrant a separate teleport control room.)

With the vast number of audio sources commonly required for on-air and production, an electronic router has become the only practical solution in many radio station environments. Routing may be controlled by a stand-alone switcher, or the router's control may be tied into the station's audio computer system, thereby allowing its functions to be automated in an integrated fashion.

One other item that may soon be found in many stations' master control rooms is an Internet server, for in-house management of the station's on-line presence. Right now, many stations use an out-of-house Internet Service Provider (ISP). In such cases, a modem-equipped computer in master control can be used to monitor this service.

Transmitter sites are another hotbed of computer- or microprocessor-controlled activity. Many of today's audio processors and transmitters can be computer controlled and/or monitored. The special advantages of such gear are stability, repeatability and potential for integrated control. For example, anyone who has tried to make a pair of redun-



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dant, complex audio chains sound identical knows how difficult and subjective the tuning process may become. Similar problems may have been experienced by stations that have tried to change their processing by dayparts, using racks full of conventional (manually controlled) equipment and patch cords. Application of computerized control in these and other similar air-chain situations quickly make the "old way" of doing things seem archaic.

Maintenance elements

To complete the package, a suite of computer-based test gear is recommended, including a serially controlled audio test system, a digital oscilloscope and a spectrum analyzer.

The engineering department's computer usage shouldn't end there, however. Computers can be used for design and documentation of all station facilities. A computer database for wiring makes searches, changes and printouts far easier. In the crush of the '90s, with more output sought from fewer people, it is extremely important to keep such records. They will save time in the long run and help minimize downtime and disruption of operations.

A PC monitors the HVAC system at the WCSX/WRIF facility in Detroit.

Computers can watch the HVAC system, monitoring all of the facility's zones and making automatic adjustments. Changes in the telephone system, such as mapping extension assignments and capabilities, can also be made in this way. Magnetically striped, individually coded security cards can be made in-house, and added or deleted when authorized personnel change: No more worries about who has keys after they complete an internship or take another job.

If some of these applications seem a bit "over the top," remember that what may be inappropriate for a single station could become sensible in a 6- or 8-station consolidated facility. As radio moves into the age of multicasting, many functions that were previously outsourced may come back in-house. At the same time, computing power continues to simultaneously grow and get cheaper. Therefore, re-evaluation of a facility's operations in this regard may be worthwhile every six months or so.

The road ahead

A business can be modeled as a complex interactive organism. It follows that proper system interaction can increase the quality and the productivity of the business. But because radio broadcasting is really a relatively small marketplace, it is unlikely that a single company can profitably develop and support a suite of specialized radio applications at a price acceptable to most managers.

Attempts toward this end have largely fallen short to date, due to the compromises inherent in any such "single-sourced" activity. Customization is not profitable; generalization usually is doomed to at least partial failure. The only real solution to ultimate integration may have to allow managers the freedom to choose among the best programs and systems in the marketplace

[solutions]

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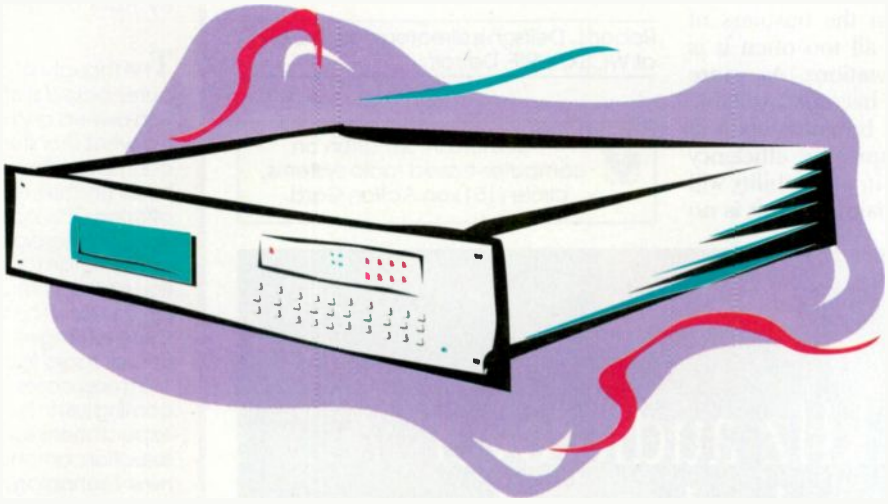

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and tie them together. A possible umbrella to accomplish this task could take the form of a "groupware" environment like Lotus *Notes*.

Broadcasters are in the business of communication, but all too often it is severely lacking at stations. As more leisure-time choices become available to audiences, radio broadcasters will have to react by improving efficiency and quality. Without it, profitability will not be achieved or maintained. It is no accident that the auto industry has learned this lesson. Product identity, brand name recognition and higher quality can combine to achieve these common goals. Sensible application of today's modern tools is essential to this end and will inevitably prove to be a worthy investment.

Robert L. Deitsch is director of engineering at WCSX/WRIF, Detroit.

Room design for computer-based stations

By Russ Berger

The thought of conversion to computer-based stations has many station owners and engineers wondering what architectural and acoustical impact this new technology will have on their facilities. Companies offering CPU-based systems for traffic, commercials, IDs, logs, mixing and program control, news production and communications are offering a vision of change—but how will these changes be physically realized at radio facilities?

In most cases, these changes are coming just in time to meet the rising expectations for quality sound and selection among listeners. But this new technology could expose latent problems in the station's existing environment — problems that, up until now, had gone unnoticed or were simply minor irritations. For example, with the current wire management system filled to capacity, how can new systems be installed? Will the current HVAC system be able to handle the new heat load? Is this new equipment more susceptible to power glitches? Will the technical power and grounding system have the capacity for these new loads? (*Is* there a technical power and grounding system?) For some older facilities or those built without proper planning, these concerns could represent costly problems to solve.

The new technology's impact on a facility can be broken into two main components: 1) infrastructure — building systems like HVAC and electrical; and 2) function—the traffic flow of people throughout the facility, usage of the facility spaces and technical performance.

Acoustic noise problems

The area most affected by changing equipment at any station is its infrastructure. New systems must be supplied with clean power and they must be cooled appropriately.

The impact on the function of the building depends on the configuration of the equipment. It appears that many manufacturers are moving toward a CPU-based control topology with digital signal processing (DSP). The control surfaces (keyboards and video monitors) should live in the control room. The computers with noisy fans need to be mounted outside of the room. In critical monitoring or on-air spaces, a background noise level that meets a noise criterion (NC) rating of NC-25 or better is not only achiev-

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able, it is mandatory.

A prime source of noise disturbance in today's facilities (whether computer-based or conventionally equipped) is the audio equipment itself: whining CPU fans, scraping tape reels, high-pitched flyback transformer noise from CRT monitors, cooling fans in amplifiers, hard-disk storage devices, grumbling cart machines and so on. If the noise levels are not low enough in the control room to allow the operator to accurately monitor the program's background noise, there is no way of knowing what is being broadcast. Even worse, in the "combo" environment used at most stations, some of this noisy hardware may sit just inches from an open microphone. Air-chain audio processing may make the subjective volume of these background noises even louder to the listener.

Formats emphasizing talk elements are probably the most sensitive to noise.

So, the bad news is that you have to get the noisy stuff out of the studios and control rooms. The good news is that you have probably been wanting to do that for a long time anyway, and computer-based systems may allow you to finally do it. One answer is to relocate the technical equipment outside of the control room and into a centralized space connected by a wire management system. Modern technical equipment rooms for radio, television and recording studios are all looking a lot more like the computer rooms of the late '70s. But, like those predecessors, digital equipment can be much less forgiving to power glitches and temperature fluctuations, so plan your infrastructure accordingly.

To adequately provide for digital technology, it is more the rule than the exception to find an uninterrupted power supply (UPS), backup generator and stand-alone HVAC system supporting the technical equipment. Small distributed UPS units often cause more problems than they solve by inducing RFI into low-level audio devices and cables. Note also that a centralized UPS battery room can't live just anywhere: There may be weight considerations that impact the structure of the facility, and the enclosure must be constructed to meet all local and national safety codes. A backup generator produces acoustical noise in addition to power, so its location also must be considered carefully. Issues regarding ease of maintenance, security, weather protection and fuel storage are critical to ensuring that your backup power is there when you need it.

Routing and storage

Although a computer-based work environment may route some data in a "virtual," rather than a dedicated way via LAN(s), the need for flexible wire management will not go away. Even with digital storage, control and processing, there will still be microphone-level signals in cables mixed with line-level audio, data, control, video and power cables. A well-planned wire management system will keep you ahead of the game.

Your choice of storage medium will also play a role in facility planning. Hard-disk, CD, MO and DAT are becoming the norm. Fortunately, these media can all live together quite happily in a centralized technical equipment room, virtually unattended. Long-term library and archival storage is another matter, however. For the foreseeable future, radio-facility archives will probably have to cope with a variety of removable media, each with a unique form factor.

Format issues

Facilities generating substantial local programming will feel

the biggest impact from computer-based technology. Formats emphasizing talk elements are probably the most sensitive to noise. The "silent" spaces between words, where the character of the room decays away into the noise floor, exposes the acoustical environment to rather unforgiving scrutiny. This is particularly true with multiple mics and guests without voice-talent training.

Remember that listeners unconsciously identify a room's size and shape by the character of its acoustical reflections. They also form an image in their mind of the talkers and the space they occupy. These low-level sonic cues are fragile and are easily obliterated by background noise.

A well-planned wire management system will keep you ahead of the game.

Talk programming is by no means the only format affected, however. Quiet rooms are needed for *any* open mic on air, whether it's combo music/talk, rip-and-read news or sophisticated programming, like radio drama or complex live-music production.

Finally, regardless of the form, philosophy or topology the equipment promotes, radio broadcasters still need a work environment that supports accurate listening. To match quality for the varying program streams that a single facility may support, all control rooms should provide some sort of sonic continuity. This means that listening rooms must have ample volume, appropriate physical shape, effective acoustical treatment, adequate sound isolation, quiet HVAC systems, convenient ergonomic layout and at least some elements of design that make it fun for people to come to work everyday.

Russ Berger is president of Russ Berger Design Group, Dallas.

For more information on room design for computer-based radio, circle (152) on Action Card.

NAB 96 preview

It's time for the tribe to gather once again at its annual industry pow-wow, NAB 96 in Las Vegas (April 14-18, 1996).

Most notable among the new wrinkles for this year is the equipment exhibition's growth beyond the confines of the Las Vegas Convention Center (LVCC). This year, exhibits will also be housed in the city's second major space at the Sands Expo Center. Shuttle buses will operate on the short route between the two facilities, just as they have at the other mega-conventions that Las Vegas hosts. Most of the exhibitors that radio broadcasters want to see will remain in the Radio Hall (North Hall) of the LVCC, however.

To keep your time at NAB well-spent, *BE Radio's* exhibitor listings (which begin on p. 43) include the entire Radio Hall, plus selected exhibitors of potential interest to radio broadcasters that are in the LVCC Main (South) Hall and the Sands Expo Center. *BE Radio's* exclusive pull-out map of the Radio Hall begins on p. 37. (All listings are accurate at press time.)

NAB 96 also includes no fewer than 11 different conferences. The radio track of the Broadcast Engineering Conference (celebrating its 50th anniversary this year, by the way) is listed in the adjacent table. Also noted in this table are several sessions from the Radio Management Conference and the Broadcasters' Law and Regulation conference, which may be of technical interest for managers and engineers.

As usual, a full slate of special events is scheduled at NAB 96. Among these are the Radio Opening Reception on Sunday, April 14, from 4:00 - 5:30 p.m.; the All-Industry Opening and Keynote Address by Rupert Murdoch on Monday, April 15, from 9:00 - 10:30 a.m.; the Radio Luncheon on Tuesday, April 16, from 12:00 - 1:30 p.m. (with keynote address by Charles Osgood of CBS Radio); the Engineering Luncheon on Wednesday, April 17, from 12:00 - 2:00 p.m. (with keynote address by Bruce Crockett, president and CEO of COMSAT); and the ever-popular Ham Radio Operators Reception, Wednesday, April 17, from 6:00 - 8:00 p.m.

There are no on-air DAB demos scheduled for this year's show, primarily because proponents will be preoccupied with field tests in San Francisco. (See "DAB Update," p. 58.) But DAB and other developing technologies, such as on-line radio, RBDS, EAS and high-speed FM subcarriers, will be hot topics at the show, nevertheless.

On-line issues will be specifically highlighted in a couple of new NAB 96 features: the *internet@NAB.96* exhibits, featuring more than 250 Internet-specific vendors, and the *What's New! What's Cool!* Internet and WWW demonstration/education theater, both at the Sands Expo Center. Free demos of on-line applications and technologies will run throughout the show at the theater, sponsored by Silicon Graphics and Sprint.

All on-site registration and most attendee services will also be handled at the Sands Expo Center this year, as will the MultiMedia World Conference and exhibits, and a new conference sponsored by AT&T on data networking and telecommunications. (Overall, about 160,000 of the 600,000 total square feet of NAB 96 space will be housed at the Sands.)

If you're heading to NAB 96, don't leave home without this issue of *BE Radio*. It's a must for every serious radio attendee at the convention. And if you don't make it to the show, be sure to check out the industry's most thorough post-NAB coverage in the May/June issue of *BE Radio*.

ENGINEERING SESSIONS

	Sun. 4/14	Mon. 4/15	Tues. 4/16	Wed. 4/17	Thur. 4/18
morning sessions (9:00am - 12:00pm)	DAB: PART 1 (9:30am)	DIGITAL AUDIO IMPLEMENTATION (10:30am)	HIGH-QUALITY RF FOR RADIO	RADIO & TV TECHNICAL REGULATORY ISSUES	RADIO ON-LINE: INTERNET APPLICATIONS
afternoon sessions (1:00 - 5:00pm)	DAB: PART 2	DATACASTING TECHNOLOGIES FOR RADIO	RADIO FACILITIES DESIGN: RADIO'S MISSING DIGITAL LINK	IMPROVING & CONTROLLING SIGNAL QUALITY (2:00pm)	

SELECTED MANAGEMENT SESSIONS

morning sessions (9:00am - 12:00pm)		RADIO & THE INTERNET (11:00am - 12:15pm)	DIGITAL DATA BROADCASTING (9:00am - 12:00pm)	NAB FUTURES SUMMIT (9:00 - 10:30am)	RADIO LICENSE RENEWAL (9:00am - 4:00pm) Separate registration required
		BROADCAST OWNERSHIP (10:30am - 12:00pm)		DAB: US vs. THEM (9:00 - 10:15am) BROADCASTERS IN CYBERSPACE (10:30am - 1:00pm)	
afternoon sessions (1:00 - 5:00pm)		NEW TECHNOLOGIES IN PLAIN ENGLISH (12:30 - 1:45pm)		COMPUTERS, RADIOLINK (1:00 - 2:15pm)	
		MAKING YOUR PRODUCTION DEPT. A PROFIT CENTER (2:00 - 3:15pm)	FCC CHAIRMAN'S FORUM (3:30 - 5:00pm)	AM/FM STATION UPGRADES (2:00 - 3:15pm) SUBCARRIERS (4:00 - 5:15pm)	

Exhibitor Highlights

Here is a complete listing of exhibitors showing products of interest to radio attendees at NAB 96 (as available at press time).

AAVS/Sencore S 2626
Radio automation, hard-disk-stored sound editing software.
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ABC Digital/Australian Broadcasting R 3717
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Accu-Weather L 8563
AccuNet On-Line weather information and graphics for your web site.
Circle (201) on Action Card

Acoustic Systems L 8075
Announcer facilities, voice-over booth.
Circle (202) on Action Card

Acoustical Solutions L 8349
Sound and noise control products; AlphaSorb wall panels, hanging baffles; Soundtex fabric wall covering; Alpha pyramid, wedge acoustical foams; Sonex acoustical foams; AlfaTec ceiling tiles; AudioSeal sound barrier, industrial blankets; modular broadcasting/recording booths.
Circle (203) on Action Card

Adams-Smith R 1814
Augan digital audio workstations.
Circle (204) on Action Card

ADC Telecommunications L10849
DV6300 single-channel digital transport system, featuring remote drop or add from DV6000/6010 and point-to-point; time-delayed patching; modular patchbay; FL2000 FO cable management system for smaller fiber networks; DV6000 16-channel 2.4Gb/s digital transport system.
Circle (205) on Action Card

ADM Systems L10318
Stereo audio consoles; stereo and mono DAs; stereo source selector; mix-minus IFB system; bar graph meters.
Circle (206) on Action Card

AEQ R 2617
Audio codec; hard-disk automation system; studio, portable audio mixers; multiconference telephone system; digital hybrids; frequency extender; telephone terminal equipment.
Circle (207) on Action Card

AEV Snc di Vaccari GEC R 3720
Virtual Radio radio automation system; Luxor stereo 3-D enhancer; Excalibur stereo console; UHR 9600 reporter telephone.
Circle (208) on Action Card

Alan Dick & Company L 9644
Visit us at LDL Communications; antennas for FM radio with base station antennas for wireless communications; transmitter combining units, RF switching frames, transmission line components; turnkey broadcast capability with LeBlanc transmitter marketing partner.
Circle (209) on Action Card

Alesis L 9374
Second-generation ADAT modular digital multitrack recorder; mixing consoles; monitor speakers.
Circle (210) on Action Card

Altronics Research R 3508
Model 3500W digital calorimetry for water-cooled dummy loads and heat exchangers; model 77300SW 300kW short-wave air-cooled load for external use.
Circle (211) on Action Card

AMCO Engineering L 6828
Expanded line of monitoring enclosure systems; enclosures for seismic requirements Zone 4.
Circle (212) on Action Card

AMEK Consoles L 6944
Consoles with 2-input paths, 4-band EQ per input module, multibus routing, aux sends, fader/mute automation, setup recall.
Circle (213) on Action Card

AMS Neve plc L 6819
Logic 2 large multiformat all-digital mixing console, optional Audio-File recorder/editor; Capricorn digital console for classic sound quality, operational flexibility, speed of large-scale multitrack recording, mixing, overdubbing; Logic 3 compact digital mixer companion to Audio File recorder/editor; 55 Series analog console, competitively priced, tailored to broadcaster's specific requirements.
Circle (214) on Action Card

Anchor Audio/ROH L 7980
Intercom and sound systems; 2-channel w red PORTACOM, Voyager PB-3000.
Circle (215) on Action Card

Andrew Corporation L10857
Dual HMD antenna; Alpac antenna & tower system; HS9HP HELIAX coaxial cable; 2.4m SNG antenna; type-approved earth station antennas; rectangular waveguide; pressurization equipment; terrestrial microwave antennas; rigid transmission line.
Circle (216) on Action Card

Antenna Concepts R 3711
VHF transmit antennas in slot, panel and corner designs; CP full-band FM panel transmit antennas; transportable omnidirectional VHF antennas.
Circle (217) on Action Card

Antenna Technology Corp./ATCi L 4955
Spectrum analyzer, satellite receiver, monitor; multibeam antennas; PROFLine electronics; voice and data systems;
Circle (218) on Action Card

Anthro Technology M 4036
Anthro Console designed to support workstations and other multimonitor systems.
Circle (219) on Action Card

Anvil Cases L 5315
Armor Lite, Speedster II equipment transport cases.
Circle (220) on Action Card

Aphex Systems R 1808
Tubessence 2-channel mic pre-amp; 722 Dominator includes defeatable pre-emphasis.
Circle (221) on Action Card

Apogee Electronics R 1200
AD-1000 20-bit A/D converter system; DA1000E-20 20-bit D/A converter; UV-1000 super CD encoding system.
Circle (222) on Action Card

Arrakis Systems R 2611
Radio digital workstations; Digilink upgrades.
Circle (223) on Action Card

ASACA ShibaSoku L10024
AM51A 2-channel audio generator/analyzer.
Circle (224) on Action Card

ASC Audio Video Corporation L 5353
Virtual Recorder (VR) line of digital disk recorders.
Circle (225) on Action Card

ATI Audio Technologies L 8460
Nanoamp series BGD200 2-channel VU/PPM meters with phase indicator; L200 2-channel line amplifier; MXS-100 3-input mic/line mixer, XPS-100, XPS-200 expanders; Vanguard series mixers; Nanoamp interfaces, battery packs, DC converters; Encor distribution, pre-amplifiers; MicroAmp series distribution, driver, power amplifier products.
Circle (226) on Action Card

Audi-Cord R 1817
Audio cart recorders/players, DL series and S series.
Circle (227) on Action Card

Audio Accessories L 5362-5461
Audio jack panels, jacks; prewired audio patch panels; patch cords, holders; Polysand; RS-422 patching; Edac connectors, accessories; nickel-plated patch cords.
Circle (228) on Action Card

Audio Developments R 2823
Meter bridges for stereo mic mixer modules; 4-output MS-compatible edit mixer; Portaflex ENG, location mixers; Flexilink system; Flex EQ constant-Q parametric EQ.
Circle (229) on Action Card

Audio Intervisual Design/Sanken L 9383-4
Sanken Audio Systems microphones CSS-5 stereo shotgun, COS-11 lavaliere, CU-41 double condenser; JB Technologies dB 3000 digital optimizer, AD122 A/D converter, DA122 D/A converter; Brainstorm Electronics time-code products: SA-1 analyzer, SR-3 repair kit, SR-15+ distripalizer, SR-26 dual distributor-reshaper, SR-1/SR-2 universal refresher, TB-4 remote talkback.
Circle (230) on Action Card

Audio Ltd. R 3309
Audio Ltd. diversity wireless microphone systems.
Circle (231) on Action Card

Audio Precision R 1405
System Two audio analyzer; APWIN Windows software for Systems One, Two; GPIB interface translator for System One; PCMCIA interface for Systems One, Two.
Circle (232) on Action Card

Audio Processing Technology Ltd. R 3702
apt-Q audio coding system (now in hardware form) for high-quality audio over ISDN or Switched-56; ADK 200 range of 16- and 20-bit PC audio cards for workstations and automation systems; updates to WorldNet range of codecs and peripherals.
Circle (233) on Action Card

Audio Services Corporation R 3700
Distributor for Stellavox, Fostex, Microtec-Gefell.
Circle (234) on Action Card

Audio-Technica US L 5646
UniTools remote-powered in-line microphone accessories; AT-7174 UHF 16-channel PLL-synthesized wireless system; ATW-1237 VHF wireless system with hand-held mic/transmitter including UniPoint condenser element; 1100 series VHF wireless systems; AT4041 transformerless studio capacitor mic; Quad Mic multi-element boundary mic; AT8446 pop filter.
Circle (235) on Action Card

Audiomation Systems/Sellmark R 1419
Distributor of audio products.
Circle (236) on Action Card

audiopak R 3409
Tape cartridges; lubricated audiotape formulas.
Circle (237) on Action Card

Auditronics R 3005
Audio mixers for radio on-air, news/production; IFB/mix-minus system; program management systems with control console, software and computer.
Circle (238) on Action Card

Autogram Corporation R 3405
R/TV series digitally controlled audio mixers; Pacemaker series with slider attenuator; AC/IC series with rotary attenuators; Mini-Mix 8-, 12-channel radio consoles; Autoclock time, temperature, count-up timer; RP series relay controllers, audio switchers; CYA-3 prioritized audio switcher; T-8 automatic tone generator.
Circle (239) on Action Card

A-Ware R 1023
MusicMaster/LT music scheduling system, CloseLine, Storage Library Editor, real-time studio interface; TrafficMaster.
Circle (240) on Action Card

Booth numbering follows this code:
R = Radio Hall (LVCC North Hall — see map, pp. 37-40)
L = Main Hall (LVCC South Hall)
S = NAB 96 exhibits at Sands Expo Center
M = Multimedia World exhibits at Sands Expo Center

BCS Broadcast Store S 2913, 6952
Broadcast equipment sales, brokerage.
Circle (241) on Action Card

BE Radio

***BE Radio* magazine** R 901
Stop by for sample copies and subscription information.
Circle (242) on Action Card

Belar Electronics Lab R 2408
Modulation monitors for radio; The Wizard digital FM analyzer; agile FM amp; digital FM stereo monitor/analyzer.
Circle (243) on Action Card

Belden Wire and Cable L 8883
High-flex AES/EBU digital audio interconnect cable; NEC-rated single-, double-pair digital audio interconnect cable; NEC CM-rated digital audio snakes.
Circle (244) on Action Card

Benchmark Media Systems R 2320
DAs, mic-pre DA, remote gain cards; router/switcher.
Circle (245) on Action Card

Best Power Technology S 1427-8
Featuring rack-mount Fortress and UNITY/I 3-phase system.
Circle (246) on Action Card

BEXT R 3511
SF800, SF1200 FM 800W, 1.2kW MOSFET amplifiers; front-panel programmable UHF/VHF exciters; VHF/UHF amplifiers to 40kW.
Circle (247) on Action Card

beyerdynamic L 6632
ZCI600 rack-mount computer monitoring system operating under Windows, offering complete reporting of U600, U700 wireless systems and features walk-test program for antenna location and user logging file; DT200 series headsets, headphones, on-air broadcast, location microphones and wireless systems.
Circle (248) on Action Card

Bird Electronic Corporation R 4011
RF measurement instruments, accessories.
Circle (249) on Action Card

Bradley Broadcast Sales R 1611
Distributors: Panascheme studio furniture, racks; Audioarts mixer; Telos, Gentner phone talk systems; Tascam portable DAT.
Circle (250) on Action Card

Broadcast Electronics R 2601
Alpha line solid-state 4kW FM transmitter; 1kW rack-mount AM transmitter; also displaying high-power FM transmitters; AirTrak and MixTrak consoles; AudioVAULT digital audio systems; programming services, consulting.
Circle (251) on Action Card

BROADCAST engineering

***Broadcast Engineering* magazine** L 5207, S 1965
Stop by either booth for sample copies and subscription information.
Circle (252) on Action Card

Broadcast Supply Worldwide/BSW R 1400
Distributors of audio, RF/radio products, including Telos, Arrakis, Audion Labs, Roland.
Circle (253) on Action Card

Broadcasters General Store L 8446, 1617
Distributor for DNF Industries; IQS; Sine Systems; American Recorder Technology.
Circle (254) on Action Card

Bryston R 1920
Audio monitor amplifiers.
Circle (255) on Action Card

Burk Technology R 2623
Audio test equipment; ARC series transmitter control; walk-away packages, ARC, AutoPilot software; stereo selector switch.
Circle (256) on Action Card

California Amplifier R 3526
RF amplifier products.
Circle (257) on Action Card

Calrec R 4013
Audio mixing consoles, including T-series digitally controlled for production and S series for production and dubbing; RQ series 1U rack-mounted signal processors.
Circle (258) on Action Card

Calzone Case L 8275
Equipment cases, including EZ-flaul; ESCORT mobile computer; ESCORT rack tower; floating/shock-mount rack; NEC-MT transport; LD-ATA, Convoy Lightweight, LD, Ultima LCD panel transport case; Executive lap-top attaché case.
Circle (259) on Action Card

Canare Cable L 5860
Cable & connectors; serial digital 75V coax; RCA-to-BNC recessed panel-mount 75V adapter; AES/EBU digital audio adapters; crimp-on F connectors.
Circle (260) on Action Card

CBSI Custom Business Systems R 3011
New and enhanced traffic and billing systems, Premier, Classic, Elite with DeltaFlex Traffic Engine; InterAcct accounting soft-

3rd Radio MONTREUX

June 6-9, 1996

3rd Montreux International Radio Symposium and Technical Exhibition

In association with

European Broadcasting Union

Association of European Radios

National Association of Broadcasters

Radio Advertising Bureau

3rd International Symposium on DAB 4-5 June, 1996

DAB Digital Audio Broadcasting

Following the first two editions in Montreux in 1992 and Toronto in 1994, the **3rd International Symposium on DAB** will take place in Montreux on **June 4-5**, preceding Radio Montreux.
Organised and coordinated by the EBU, the Symposium will focus on the latest developments of this technology.

MONTREUX INTERACTIVE MEDIA SERVICES

The First Montreux Interactive Media Services Symposium and Technical Exhibition will be launched concurrently with the Radio event, from June 6-9, 1996, bringing together under one roof all the players of the broadcasters' world active in the field of multimedia and interactive services.

P.O. Box 1451, Rue du Théâtre 5,
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For further details:
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NEW JUNE 6-9, 1996

June 6-8, 1996

DIGIMEDIA

DigiMedia, organised by the four founding institutions – International Telecommunication Union, the European Broadcasting Union, Audiovisual Eureka and the University of Geneva together with the Montreux Symposium Office – is moving from Geneva to **Montreux in June 1996**.

Philippe Coeytaux
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Circle (36) on Action Card

ware with general ledger, accounts payable and report generator.

Circle (261) on Action Card

CCA Electronics R 3505
FM100GS high-performance FM exciter; FM4000G, FM45,000G high-performance FM transmitters; AM 10,000F short-wave and medium-wave transmitters; announcing 3-year warranty plan.

Circle (262) on Action Card

Cellcast R 1524-5
Remote audio broadcasting using cellular phone technology; RBS-400 remote broadcast unit combines cellular transceiver, frequency extender, mixer, optional NiCad battery power or A/C power supply.

Circle (263) on Action Card

Central Tower R 1515
Towers, monopoles; structural engineering analysis; complete construction services, antenna, line installation; turnkey projects.

Circle (264) on Action Card

Circuit Research Labs R 2008
RDS/RBDS receiver for LED motion-sign control; DP-100 all-digital FM audio processor; SC-100 RDS/RBDS generator with paging; BAP2000 mono FM processor; Amigo AM, Amigo FM processors.

Circle (265) on Action Card

Clark Wire & Cable S 1414, 1404
Coax for serial digital signals; AES/EBU digital audio cable/snakes; Clark Ergonomic Crimp tools; Hannay reels; Service mult cables, remote composite cables.

Circle (266) on Action Card

Coaxial Dynamics R 3908
Equipment for measurement and termination of RF power and custom design of OEM RF filters and directional power detectors; new line of oil-/air-cooled loads.

Circle (267) on Action Card

Coffey Sound Service R 1621
Distributor for Audio Limited; Stelladat; Sennheiser; Denecke; HHB Portadat; US Broadcast; Soundcraft; Fostex; Oktava; Ecocharger.

Circle (268) on Action Card

Columbine Systems L 8521
Master control automation, multistation, multiregional capability; Program Scheduler; Asset Management; software for traffic, sales analysis, accounting, finance.

Circle (269) on Action Card

Communications & Power Industries L 7131
Ground-based satellite communication klystrons including extended frequency ranges and "Fast-Tune" versions.

Circle (270) on Action Card

CPI-Satcom Division (Varian MEP) L 7131
Solid-state power amplifiers; compact 300-400W medium-power amps; compact single drawer 600-700W power amps; V-Star II 200W hub-mount amps.

Circle (271) on Action Card

Communication Graphics R 3905-6
Screen-printed decals, bumper stickers.

Circle (272) on Action Card

Communications Data Services R 3307
RFCAD; International terrain data; Fryers Site Guide/CDS on-line services; North American terrain data covers U.S., Mexico, Canada.

Circle (273) on Action Card

Computer Concepts R 3017
DCS digital audio engine, providing instant access, intelligent features; Maestro command center for the digitally integrated radio station, a key to a paperless/tapeless studio; NewsRoom electronic news center captures text and audio with edit, package or play features; Studio Frame digital 8-24 track workstation; CartRack puts all "carts" on screen for instant air-play; VoiceTracker combines music and commercial library on a hard disk for live-sounding automated programming; LogMerge integrates station commercial and music logs into one program schedule.

Circle (274) on Action Card

Computer Engineering Associates L 8280
Computerized newsroom equipment, the CEA Newsroom System on a PC network with Windows.

Circle (275) on Action Card

Comrex L 7009
Nexus digital audio codecs, designed for ISDN remote broadcast use with Integral TA and NT-1; Codec Buddy remote audio mixer.

Circle (276) on Action Card

COMSAT Corporation L 6958
Satellite communications products, services.

Circle (277) on Action Card

ComStream Corporation S 2027
Intellicast and Promocast satellite data and audio receivers; DVB/DSS integrated set-top receiver/decoder for cable and DBS; ISO/MPEG Layer 2 digital audio receiver (for NPR system).

Circle (278) on Action Card

Connectronics L 8335
Parabolic reflector with accessories, shoulder straps, transport cases, sport handles, wind muff.

Circle (279) on Action Card

Continental Electronics R 2605
Complete line of AM, FM and DAB transmitters. Information on new products not available at press deadline. Please visit the Continental Electronics exhibit for data on new products.

Circle (280) on Action Card

Control Concepts/Leibert L10946
Isolatron Plus with complete monitoring facilities; IslaGuard, available with complete monitoring.

Circle (281) on Action Card

Cooper Sound Systems R 1901
CS-104 4-channel stereo audio mixer.

Circle (282) on Action Card

Countryman Associates L 8471
Microphone products.

Circle (283) on Action Card

Crouse-Klmzey Company R 1719
Audio distributors; Otari digital workstation; Denon CD player.

Circle (284) on Action Card

Crown International R 2523
Head-worn mic; full line of microphones, amplifier products.

Circle (285) on Action Card

CTE International R 2526
FM broadcast transmitter products, exciters, power amplifiers.

Circle (286) on Action Card

Cutting Edge Technologies R 4023
Enhancements to Unity range of radio processors.

Circle (287) on Action Card

BE Radio™
From the editors of Broadcast Engineering®

March/April 1996 Issue

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From the Editors of Broadcast Engineering®

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FOR ISSUE OF
MARCH/APRIL 1996
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6RB

FASTER ACTION!

If you have immediate interest in any products in this issue, write in the number(s) below and check all the appropriate boxes.

I am interested in these items	Immediate Need	Have Salesperson Call	Name Nearest Dealer	Send Literature	For Future Reference
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#					
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Circle reader service numbers below for more information

1	11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171
2	12	22	32	42	52	62	72	82	92	102	112	122	132	142	152	162	172
3	13	23	33	43	53	63	73	83	93	103	113	123	133	143	153	163	173
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8	18	28	38	48	58	68	78	88	98	108	118	128	138	148	158	168	178
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149	159	169	179
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180

PLEASE WRITE LEGIBLY FOR NUMBERS ABOVE 180

6RB				

Please complete entire form, fold and mail. Or FAX to: 913-967-1903.

1 **Do you wish to receive/continue to receive *BE Radio* FREE?** ❑ YES ❑ No

Signature required _____

Title _____ Date _____

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

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

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

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

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

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

D. Other (please specify):
_____

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

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

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

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

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

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

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

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

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Dalet Media System R 4007
Modular keyboards with hot keys, jog wheel, definable selection key; CD copy records from your CD-ROM drive to Dalet database; Call and Record for call-in news or weather updates direct into database; Power Sat uses satellite data channels to control remote sites; Surfer 8 integrated stereo 8-track digital editor.
Circle (288) on Action Card

Dan Dugan Sound Design R 1901
Model D-1 live microphone processor.
Circle (289) on Action Card

Datacount R 1526-7
Salescall prospect management system.
Circle (290) on Action Card

Dataworld R 1608
CD-ROM industry database software; detailed ethnic, demographic reporting via tabular and graphical/map formats; online database for instant access; Internet communications capability; ethnic/demographic shading overlays for any base map.
Circle (291) on Action Card

DB Elettronica R 3126
FM transmitters, translators.
Circle (292) on Action Card

Delco Wire & Cable S 2155
Wire, cable products.
Circle (293) on Action Card

Delta Electronics R 1602
Broadcast transmission monitoring products, splatter monitor, operating impedance bridge.
Circle (294) on Action Card

DENON R 1020
MD cart recorders; cassette deck; CD jukebox.
Circle (295) on Action Card

DGS Pro Audio R 1423
Channel Identification System for XLRs; and 1/4" plugs by Deltron; halogen-free installation cable by Gotham.
Circle (296) on Action Card

DIC Digital S 2941
Magnetic recording media.
Circle (297) on Action Card

Digidesign M 9338
Digital audio workstations.
Circle (298) on Action Card

Digital Courier International R 1926
Digital audio transmission/store-and-forward service via ISDN, using ISO/MPEG Layer 2 coding for 2-way distribution of commercials and music; Capella V2.0 codec on a PC card.
Circle (299) on Action Card

Digital DJ R 3326
High-speed FM subcarrier system, receivers and peripherals.
Circle (300) on Action Card

Dolby Labs L10552
DP503 digital audio encoder; model 740 Spectral processor; Dolby Fax; Dolby Surround; DSTL digital studio-to-transmitter link system; digital and analog sound-processing technology for professional audio recording.
Circle (301) on Action Card

Dorrough Electronics L10953
Big LED, giant Dorrough audio meters for scoring, rerecording and concert or location situations; multiband processors, stereo generators, A/V T/M devices; peak, average loudness meters; AES/EBU digital reading audio meters; analog loudness meters.
Circle (302) on Action Card

Doty Moore Services S 2832
Broadcast consultants.
Circle (303) on Action Card

Doug Vernier Broadcast Technologies R 4001
Broadcast consultants; FM Frequency Search. RF Hazard Prediction for Windows; INTERDLG contour mapping, FMCONT contour-to-contour FM channel search.
Circle (304) on Action Card

Econco Broadcast Service R 3911
High-quality rebuilt power tubes and klystrons for radio transmitters.
Circle (305) on Action Card

EDX Engineering R 1523
Compresensive RF system planning tool for Windows 95 with coverage and interference analysis, plotting of system planning maps showing terrain features, land use, roads, demographics; Signal software predicts signal propagation; MCS site-specific communication channel modeling; POP-90 performs population, demographic analysis; terrain elevation databases for North America and England.
Circle (306) on Action Card

Electronics Research - ERI R 3000
Lightning Dissipation Spur; low-power FM antenna; high gain PCS antenna; towers, monopoles; combiners, filters; FM antennas.
Circle (307) on Action Card

Elenos SRLW R 3502
HF-100C MOSFET amplifiers; FM tube amplifiers to 20kW; solid-state amplifiers to 1.2kW; FM exciters.
Circle (308) on Action Card

EMCOR Products/Crenlo L 9372
Modular equipment enclosure systems, console configurations; ai movement devices; custom fabrication capabilities.
Circle (309) on Action Card

ENCC Systems R 4105
DAD48Ex Digital Audio Delivery system and satellite-based DADSAT store/forward system.
Circle (310) on Action Card

Energy-Onix R 4100
Frequency agile, digital STL systems at two power levels; ECO and MK series grounded-grid triode FM transmitters covering

1kW to 50kW; SST solid-state FM transmitters 30-500W, Legend series FM transmitters 1-10kW; multiple preset dual-frequency short-wave transmitters.
Circle (311) on Action Card

ESE L 8434
ES-160A master clock with 1s/month accuracy; ES-245 quad 1x6 audio DA with individual gain pots; 4-inch display clocks, timers, slaves; master clock systems; audio/video DA family.
Circle (312) on Action Card

Euphonix R 3123
CS2000B on-air mixer with 12 mix-minus buses, stereo sub-groups, clear display; V2.5 software; MX464 master expander module; Clear R display for channel labeling with electronic alphanumeric readouts.
Circle (313) on Action Card

Eventide R 2020
Featuring Harmonizer effects processors; profanity delays; VR, VP series digital audio loggers.
Circle (314) on Action Card

E-Z UP International R 4014-5
Eclipse, Encore E-Z UP Instant shelters for shade on remote locations, catch attention as a trade show booth with highly visible silk-screened call letters; setup time in less than 60 seconds; 5x5 feet, 10x20 feet; accessories, sideways, rail skirts.
Circle (315) on Action Card

F

Fairlight ESP Pty Ltd. L 7668
DAD digital audio dubber; F.A.M.E. Fairlight audio mixer editor; MFX3 disk recorder/editor software, including Audio Base, high-speed networking, DMF file compatibility.
Circle (316) on Action Card

Fidelipac R 2405
Dynamax DCR1000 series digital cartridge machine with magneto-optical option; Dynamax MXE series consoles including three new optional modules.
Circle (317) on Action Card

Flash Technology R 1408
FTB 205 and FTB 224 dual and FTB 225 dual high-intensity obstruction lighting; FTB-310 and FTB 312 dual medium-intensity obstruction lighting.
Circle (318) on Action Card

Fostex R 3314, L 5544
Audio recorders in analog, DAT and multitrack formats; audio mixing systems; digital audio workstations.
Circle (319) on Action Card

G

Garner Industries L 6840
Recording-media degausser systems.
Circle (320) on Action Card

GEC-Marconi Communications Systems R 2002
Eureka 147 DAB transmitter system; FM transmitters; high-power MF and HF transmitter systems; MF and HF antennas.
Circle (321) on Action Card

Gefen Systems R 1520-1
M&E Pro, M&E Windows music and effects locator and audition database for CDs; TSE series monitor and keyboard extenders up to 500 feet away from controlled equipment.
Circle (322) on Action Card

Genelec S 1039
Model 1039 active main monitoring system with two 320-liter enclosures, two 7U racks to house amplification system, active crossovers, protective circuitry.
Circle (323) on Action Card

Gentner Communications R 2016
TS612 network interface connects multiple multiline talkshow systems together; GSC Gentner remote transmitter control; PTX portable transmitter for assistive listening.
Circle (324) on Action Card

GEPCO International L 7884
Gep-Flex audio cable, matte finish, extra flexible, CM-rated multipair audio cables.
Circle (325) on Action Card

Gorman-Redlich Manufacturing Company R 3323
EAS encoders, decoders; weather radios for NDAA weather alerts; digital antenna monitors for AM directional arrays.
Circle (326) on Action Card

Group One Ltd. R 3425
Focusrite Engineering Blue 230 dual/stereo broadcast compressor, limiter; Blue 245 20-bit A/D converter; Red 7 mono mic-pre-amp and dynamics module.
Circle (327) on Action Card

H

Halland Broadcast/Henry Engineering R 4108
HitDrive Service, music libraries preloaded on a hard drive; HitPick software for quick, easy selection among more than 4,000 titles.
Circle (328) on Action Card

Harris Broadcast Division R 3517, 5809
DAB 2000 transmitters with D-cast CDFDM encoder from ITIS; SuperCiter analog exciter; CD and Quest FM transmitters; Gates, DX AM transmitter series; 360 Systems Instant Replay hard-disk audio player; Sage Alerting ENDEC EAS system; DSE/DSR 1400 DVB satellite exciter; DIGIT FM exciter; DRC1000 digital audio console; Audion VoxPro sound editing system; Audio-Metrics studio furniture.
Circle (329) on Action Card

Harrison by GLW L 5318
Fault-tolerant system, non-functional host computer recognizes current status of console and updates automation computer accordingly; digital audio hardware and software to work with current Series Twelve and MPC control surfaces.
Circle (330) on Action Card

Henry Engineering R 4108
Stereomixer, 8-input stereo utility mixer for line sources.
Circle (331) on Action Card

HHB Communications Ltd. R 1424
PDR1000 PDRTADAT portable DAT recorder; PDR1000TC PDRTADAT with time-code; accessories; advanced media products; Cedar audio restoration equipment; Pioneer D9601 DAT recorder; ATC loudspeakers; Coles microphones.
Circle (332) on Action Card

Holaday Industries L 5219
Magnetic field, RF radiation hazard instruments; induced current meter; EMF instrumentation.
Circle (333) on Action Card

Hughey & Phillips Inc. R 3317
FAA-approved obstruction lighting, controllers and remote monitoring for tall towers.
Circle (334) on Action Card

I

IBM Telecommunications & Media L10338
Computer equipment, software.
Circle (335) on Action Card

IDB Communications S 2921
Satellite communications systems, the Flyaway Phone satellite terminal in a suitcase.
Circle (336) on Action Card

Illbruck R 2223
Acoustical material; Sonex Colortec, acoustical curtains.
Circle (337) on Action Card

IMC/AKAI Digital R 4031
S-series samplers; DR16 16-track recorder with VGA display.
Circle (338) on Action Card

Industrial Acoustic/IAC L10469
Acoustic, sound control products.
Circle (339) on Action Card

Inovonics R 1300
Second-generation FM processor, generator; digital synthesis FM stereo generator; AM modulation monitor; RBDS encoder, decoder with full computer interface.
Circle (340) on Action Card

International Datacasting Corporation R 2000
Reception equipment for satellite data transmission.
Circle (341) on Action Card

International Tapetronics/ITC R 2005
ISO/MPEG Layer 2 coding for DigiCenter digital audio management system; expanded integrated mixer with virtual console; enhanced traffic, music interfaces; Virtual Scheduler; WIN-ARM2 Windows control software for audio routing switcher.
Circle (342) on Action Card

Intertec Publishing Corporation R 901, L 5207, S 1965
Publishers of *BE Radio*, *Broadcast Engineering*, *World Broadcast News*, *Video Systems*, *Lighting Dimensions*, *Theatre Crafts International* (TCI), *Satellite Communications* and *RF Design* magazines; stop by booths for sample copies and subscription information.
Circle (343) on Action Card

Intraplex R 3900
AES/EBU I/O for digital STL; T-1 digital solutions for duopoly stations; model 4464 digital audio codec for remote broadcast, with ISO/MPEG Layer 2 and G.722 encoding/decoding, ISDN terminal adapter, BONDING IMUX and setup memory.
Circle (344) on Action Card

ITELCO spa L10724
1kW, 5kW fully solid-state FM transmitters.
Circle (345) on Action Card

J

Jampro Antennas L 5308
FM transmission system components; FM combiner; aperture/simulcast antennas; hybrids, harmonic filters; transmission line, patch panels; bandpass and notch filters.
Circle (346) on Action Card

Jensen Tools L 8344
Numerous tools and tool kits for audio technicians, broadcast engineers; various metering, signal source products, JTK-5000 computer maintenance kit; Fluke model 87 DMM.
Circle (347) on Action Card

JK Audio S 1026
RemoteMix telephone handset interface.
Circle (348) on Action Card

K

Kathrein-Werke KG L 8362
Antennas and accessories for FM broadcasting.
Circle (349) on Action Card

KD Kanopy R 4005-6
KD Majestic lightweight canopies for sporting or special events; fast setup; tops are water-resistant, fire-retardant, UV-guarded; customized graphics.
Circle (350) on Action Card

Keystone Communications L 5324
Production services.
Circle (351) on Action Card

Kintronic Laboratories R 1220
Single-pole, double-throw RF contactors.
Circle (352) on Action Card

Kline Towers L 7877
Design, fabrication and erection services of broadcast and special antenna support structures; prototype transmitter facility design by T.G. Crowder, AIA of Architektur, featuring latest advances in ice protection, component-style construction.
Circle (353) on Action Card

L

Larcan-TTC R 3311
FMS solid-state FM transmitters, 100W-12kW; XL100FM FM translator; model X 30W FM exciter.
Circle (354) on Action Card

LBA Technology R 1524-5
Folded unipole antenna; antenna tuning units; transmitter combiners; diplexers, triplexers; transportable antenna systems; RF components.
Circle (355) on Action Card

Leader Instruments L 8369
Test equipment.
Circle (356) on Action Card

NAB '96

Lectrosonics L 7865
UCR compact diversity wireless microphone receiver, powered from 9 or 12VDC; Quadbox 4-channel VHF/UHF wireless receiver assembly with RF and power distribution; Quad 195 4-channel UHF wireless receiver for UCR195 receivers; UDR 200B synthesized UHF receiver for studio or stage, frequency switchable over 25MHz range.
Circle (357) on Action Card

Leitch Inc. M 9349
VIA32 AES/EBU digital audio router; SMART Panel; DigiBus adaptive comb filter; DAs and frames; X^Plus analog video+audio routers; StillFile gateway object server; EDH mix box; XPRESS digital routers; RouterWorks; new LogoMotion features; routing scheduler; AES D/A converter; Media Port; EDHview software; audio signal monitor.
Circle (358) on Action Card

LEMO USA L 5560
High-quality circular connectors; fiber-optic hybrid connectors.
Circle (359) on Action Card

Lexicon L 7116
PCM-90 and PCM-80 digital signal processors.
Circle (360) on Action Card

LIGHTING DIMENSIONS
Lighting Dimensions magazine
L 5207, S 1965
Stop by either booth for sample copies and subscription information.
Circle (361) on Action Card

Lightning Eliminators & Consultants L 8343
Dissipation Array System; SBT Spline Ball Terminal; Chem-

Rods grounding; CLP coaxial line protector; advanced surge protectors.
Circle (362) on Action Card

Lightwave Systems L10938
DC(x) series analog video, audio routers; Fibox series data I/O modules, Fibox and IMS series fiber-optic transmission systems.
Circle (363) on Action Card

Link Communications SA R 2617
Studio interview console; broadcast audio mixing console; 5kW FM transmitter using solid-state technology.
Circle (364) on Action Card

LNR Communications R 3708
Safari digital flyaway satellite system with mobile voice communications; LVE-14 low-profile Ku-band video exciter with enhanced front-panel capabilities; upgrades to LVM series exciters, designed to be used in both fixed and mobile SNV uplink applications.
Circle (365) on Action Card

Logitek R 1802
VU-Trax audio meter bridge with up to 24 high-resolution audio bar graph meters in a 2RU box or self-contained overbridge enclosure; Super-VU audio meters available with combination analog and digital inputs.
Circle (366) on Action Card

LPB R 2520
Signature III, series 7000 stereo consoles; low-power AM transmitters for unlicensed limited-area broadcast; carrier current systems; radiating coaxial cable, limited-area FM systems.
Circle (367) on Action Card

Mackie Designs S 1245
New MicroSeries 1202-VLZ, MS1402-VLZ and CR1604-VLZ portable mixing consoles; Ultramix Universal Automation system for automating any mixer via Macintosh computer control.
Circle (368) on Action Card

Magnum Tower R 2923-4
Manufactured radio and communications towers.
Circle (369) on Action Card

The Management R 3523
SuperLog Ver. 5 with extended-line order scheduling, enhanced automation links, variable agency rates, sales tax, commission structures; Music Log Ver. 5.1 with extended music playlist generation, playlist and database output, rotators within categories; AXS hard-disk audio storage and retrieval systems, Advanced Feature Package (AFP), touchscreen and button box controls; DLR Digital Longform Recorder system.
Circle (370) on Action Card

Marconi Communications Systems R 2002
Test, measurement equipment; radio transmitters.
Circle (371) on Action Card

Mark IV Audio Group/Electro-Voice L 8026
Model 635L long-handled version of 635A mic; RE1000 condenser mic; RE200 probe condenser mic; C02 mini lavaliere omni-directional mic.
Circle (372) on Action Card

Mark IV Audio Group/Klark Teknik L 8026
300, 400 series equalizers; 500 series compressors, gates; 700 series digital delays; 800 series cross-over; DN 3600 stereo programmable graphic equalizer; DN 3696 remote controller for DN3600; DN 6000 1/3- or 1/6-octave RTA with RT 60, LET or LEQ, printer port; DN 728 RM remote-control option for DN728.
Circle (373) on Action Card

Mark IV Audio Group/MIDAS L 8026
XL-200 console with 4-band parametric EQ, 8 aux, 8 mute, 8 VCA, 12x8 matrix; XL4 console with 4-band parametric EQ, 16 mono + 4 stereo aux, 8 mute, 10 VCA, 24x8 matrix and SMPTE-based automation; XL-42 two channels for mic or line, 4-band parametric EQ, pan, level, stackable.
Circle (374) on Action Card

Mark IV Audio Group/Vega Wireless L 8026
Wireless microphone systems, intercom components.
Circle (375) on Action Card

Marti Electronics R 3305-6
Frequency-agile RPU transmitters, receivers; FM demodulator; SMARTI telephone frequency extender.
Circle (376) on Action Card

McCurdy Radio Industries L 6612
DCS 3000 serial digital and Microcompact digital intercoms; M/2000 automation system; McCart digital audio storage, multichannel playback; UMD-32 3-color 32-character undermonitor display; ATS-100 audio test set; AT2656 stereo audio monitor; UIO-80 serial/parallel machine control interface; series 9000 A/V DAs, accessories.
Circle (377) on Action Card

Micron Audio Products L 8331
Wireless microphone systems, TRAM lavaliere microphones; SQN location mixers.
Circle (378) on Action Card

Micropolis M 4762
RAID subsystems; AV enhanced disk drives.
Circle (379) on Action Card

Microsoft Corporation L10349
PC computer software.
Circle (380) on Action Card

Modulation Sciences R 1517-18
PCG-11 Sidekick Pro Channel audio generator transmits IFB on Pro Channel and eliminates cellular phone charges; PRO-11 PROceiver with antenna diversity input for audio, data-selective calling, compatibility with Comrex, Clear-Com, et al.
Circle (381) on Action Card

Mohawk/CDT Broadcast Cables L 6862
Digital audio cable.
Circle (382) on Action Card

Moseley Associates R 2316
Starlink 9000 digital STL for RF and T1; RPU links; transmitter remote controls; multichannel aural STL; digital encoder and decoder with ISO/MPEG, ADPCM or 16-bit linear audio.
Circle (383) on Action Card

Musicam USA R 3020
Formerly Corporate Computer Systems. CDQPrima digital audio codecs with ISO/MPEG Layer 2 and G.722 coding, for single and multiline ISDN use, including remote machine-control features.
Circle (384) on Action Card

MYAT L 5301
Rigid coaxial transmission line components and accessories, 7/8" to 9 3/16".
Circle (385) on Action Card

Nady Systems L 6941
Wireless mic systems using VHF and UHF frequencies.
Circle (386) on Action Card

Nagra Kudelski SA L 6804
ARES-C solid-state recorder using PCMCIA cards in 3kg portable package, recording time to 40 minutes mono on 20MB card, editing features and G.722 or Musicam ISO/MPEG compression; Nagra-D 4-channel digital audio recorder with open-reel 1/4-inch tape, helical rotary heads, 24-bit sampling with headroom for 16-bit dynamics; LYSIS-integrated system and broadcast architecture with hardware, software for sound/news editing, scheduling, broadcasting, statistics, administration.
Circle (387) on Action Card

Nautel R 1923
FM10 solid-state 10kW FM transmitter with NE50 digital FM exciter and AES/EBU digital interface; FM4 economical 4kW solid-state FM transmitter using NE50 digital FM exciter; XL12 12kW and XL60 60kW solid-state AM transmitters; ND5 economical 5kW solid-state AM transmitter.
Circle (388) on Action Card

NDG Phoenix L 6362
Operations management software; LMS v1.6 upgrade to library management system.
Circle (389) on Action Card

Neotek R 1819
Featuring the •lan, •lite and Esprit audio mixing consoles; Sytek microphone pre-amps.
Circle (390) on Action Card

Neutrik USA R 1600
Rapid Test RT-1M multitone audio analyzer for simultaneous measurement of frequency response, distortion and noise with channels from single 1-second multitone burst.
Circle (391) on Action Card

Nigel B Furniture S 2031
Monitor suspension system; mobile workstations; free CAD software.
Circle (392) on Action Card

Norsat International R 1417-8
VM62 multistandard 300-800MHz agile modulator for private

cable system headends; Windows-based GUI control software for multistandard COD private cable headend; data grade PLL LNB, available in variety of frequencies, for digital audio/video applications.

Circle (393) on Action Card

NPR Satellite Services R 3914
Satellite transmission services for radio broadcasting.
Circle (394) on Action Card

NSN Network Service R 1513
SpotBoxx all-digital store-and-forward network localization system; InSat Internet partnership program.
Circle (395) on Action Card

NVISION L11021
9000 series networked control panels; low-power version of NV3512 synchronous router; synchronous versions of NV1308/3064 AES routers.
Circle (396) on Action Card

O

OMB America R 2626
Radio transmitters.
Circle (397) on Action Card

Omnitronix R 1426
Solid-state AM broadcast transmitters rated 500W, 1kW, 25kW; solid-state tropical-band SW transmitter.
Circle (398) on Action Card

OpAmp Labs L 8283
Amplifiers (A/V, DA, mic, EQ, line, VCA, power); switchers (routing, assign, matrix); press boxes; audio transformers; oscillators, power supplies; custom subsystems.
Circle (399) on Action Card

Orban/Harmon Pro Audio R 2011
Optimod-FM 2200 low-cost FM digital audio processor, with eight programmable presets, 2-band processing with HF enhancement, peak overmodulation prevention, digital stereo encoder/generator; analog I/O, AES/EBU I/O option; DSE-7000 workstation upgrade features new DSP hardware and Ver. 6.0 software for real-time, 24-bit internal effects with 4-band parametric EQ, Optimod compression, Lexicon reverb.
Circle (400) on Action Card

Otari L11029
Audio mixers and recording equipment; digitally controlled consoles, broadcast consoles and CD changer; minidisc recorder and RADAR random access digital audio recorder.
Circle (401) on Action Card

P

Pacific Recorders & Engineering R 2031
See Pacific Research & Engineering.

Pacific Radio Electronics L 5662
Distributor for Belden, Gepco, Kings, Stanton, VAC, SDG, RDL product lines.
Circle (402) on Action Card

Pacific Research & Engineering R 2301
ADX Ensemble, ADX Eight digital audio workstations; BMX III air console; AMX stereo production console; RMX radiomixer; Productionmixer production multitrack console; custom cabinetry; sound design, installation; StereoMixer compact console.
Circle (403) on Action Card

Penny & Giles R 2323
Signal controls, faders, linear, rotary motorized series; T-bar controls; precision controllers.
Circle (404) on Action Card

Penta Laboratories S 2370
Electron transmission tubes for radio broadcast.
Circle (405) on Action Card

Phasetek Inc. R 4102
Manufacturers of AM antenna phasing equipment, antenna-tuning units, RF components and RF inductors.
Circle (406) on Action Card

Pioneer New Media Technologies L10457
CAC-V5000 500 CD audio disc changer; DVD technology demo.
Circle (407) on Action Card

Potomac Instruments R 1917
Field-intensity meters; audio test equipment; antenna monitors; transmitter remote-control equipment.
Circle (408) on Action Card

Pro-Bel Ltd. L 8269
5015 digital audio compressor/limiter tailors signal charac-

teristics to suit program material; TM32 series routers, analog and digital systems to 32x32; XD digital routers to 360Mb/s serial digital, synchronous AES/EBU digital audio; TX-220 digital master control switcher; compass playout and SNAP multichannel playout automation systems; MAPP disk-server media manager system; Proclon workbench PC control system.

Circle (409) on Action Card

Prodelin Corporation R 2326
RF transmission feedline products.
Circle (410) on Action Card

Professional Label Inc. L 6262
Label Producer for Windows; DAT labels; new label colors; CD labeling; status label sheets.
Circle (411) on Action Card

Professional Sound Corporation R 1411-2
PSC Power Station rechargeable battery pack; phone hybrid, phone tap; Press Bridge; Press Train; RF multiradio mic antenna DA; M4A+ portable audio mixer; VDB carbon fiber boom poles.
Circle (412) on Action Card

Prophet Systems R 3705
Radio automation systems.
Circle (413) on Action Card

Pulizzi Engineering L 8067
IPC 3200 series power control and conditioning system with local or remote control via RS-232 port; triple noise protection, EMI/RFI filtering, spike and surge protection.
Circle (414) on Action Card

QEI R 1811
Cat-Link digital STL/TSL; FMQ and Quantum series high-power FM transmitters; Quantum E series low-power transmitters; models 695, 675B FM exciters; 710A digital stereo generator; 691 FM modulation monitor.
Circle (415) on Action Card

Radio Computing Services R 1206
TalkBack talkshow software with call sequencer and storage system for host's text and audio files; Radio In A Box full automation with "real feel" voice tracking, edit facilities, "living log" loaded with custom music; ProSonix full-featured digital multitrack audio editor; NewsLink computerized newsroom with text and digital audio editing, archiving, E-mail, embedded actualities within news copy; Master Control, SongTrack, RCS Traffic, Linker, Pro-Rate.
Circle (416) on Action Card

Radio Design Labs R 3423
Stick-On additions: ST-CX1S subwoofer, ST-CX1S woofer, ST-CX1F full range crossovers; ST-NG1 noise generator; ST-STM2X switched mic pre-amp; Rack-Up additions; RU-OSC4A sequencing oscillator; RU-SX4 balanced audio switch; RU-SC1 serial converter; RCS4 remote channel selector; RU-VCA1, RU-VCA1D digitally controlled attenuators; RLC2 remote level control; RU-SQ6 power up/down sequencer; TX-1W music-on-hold amplifier.
Circle (417) on Action Card

Radio Systems R 3008
Audio mixers; telephone interfaces; digital and analog clocks; audio DAs; DDS digital delivery system.
Circle (418) on Action Card

Radiomation R 1026
Traffic system, complete new revisions; on-air live assist with 17 enhancements; News with new presentation options; M.I.S. new report formats; modules for booking, scheduling, billing, receivables, music rotation; Windows-based.
Circle (419) on Action Card

RAM Broadcast R 3514
Audio consoles, including SS9500 series and SS9320XL series.
Circle (420) on Action Card

Ramsa Audio/Panasonic L10000
Professional audio mixers, monitors; DAT systems with RS-422 control and instant-start; wireless microphones.
Circle (421) on Action Card

RCI Systems Inc. S 2823
A/V wall plates, panels; active/passive audio mult boxes; cable tester; custom silk-screening services.
Circle (422) on Action Card

R-Columbia Products L 6844
World Class Intercom/talkback system, expandable from 4-400 stations; telephone coupler interface ties any intercom system to telco lines; ultralight boom-mic headset; 2-channel beltpack remote intercom station; wireless intercom headphone with 1-mile range.
Circle (423) on Action Card

RE America S 1627
RE660 series ISO/MPEG Layer 2 audio codecs; RE8930 linear PCM audio/data/voice codec; RE532/RE533 RDS/RBDS encoders for FM broadcast, paging.
Circle (424) on Action Card

Register Data Systems R 3300
Phantom, PhantomLite digital audio automation systems; RDS System Six, System Seven traffic and billing systems; RDS Traffic for Windows.
Circle (425) on Action Card

RF design

***RF Design* magazine** L 5207, S 1965
Stop by either booth for sample copies and subscription information.
Circle (426) on Action Card

RF Plante Ind Com R 1626
AM, FM transmitter systems.
Circle (427) on Action Card

Richardson Electronics L 7004
Power transmitting tubes.
Circle (428) on Action Card

Rohn L10310
Turnkey installation worldwide service; steel ISO container shelters completely outfitted.
Circle (429) on Action Card

Roland Corporation R 1215
Audio workstations; audio announcement recorder; anti-feedback processor; 3-D sound processor.
Circle (430) on Action Card

Rorke Data S 2322
Max-Array 16 and 32GB PCI storage arrays; rack-array rack-mounted PCI arrays; recordable-CD for SGI, MAC, Windows.
Circle (431) on Action Card

Rules Service Company R 4000
FCC rules, regulations published monthly in loose-leaf and computer formats; copyright, patent, trademark rules.
Circle (432) on Action Card

Rycote Mic Windshields R 1818
Wind attenuation devices over foam windscreens; system consists of windshield, suspension, high wind cover and windjammer for 10dB greater protection; Softies slip-on covers.
Circle (433) on Action Card

SADiE R 1223
Octavia modular digital editor; SADiE mobile field recorder; Sascia ATM networking; SADiE 3 workstation software; SADiE portable digital editor.
Circle (434) on Action Card

Sandar Electronics R 3324
Audio router 32x32 in 3RU; 16x16 and 32x32 140 and 270Mb/s routers; systems to 300MHz bandwidth; audio conference system; software for PC router control.
Circle (435) on Action Card

Sanken/Developing Technologies L 9383-4
CSS-5 shotgun stereo microphone; COS-11 lavaliere microphone.
Circle (436) on Action Card

SATELLITE COMMUNICATIONS

***Satellite Communications* magazine** L 5207, S 1965
Stop by either booth for sample copies and subscription information.
Circle (437) on Action Card

SCA Data Systems R 3408
Subcarrier transmission products; ethnic broadcasting receiver; high-speed data and audio system; RDS, phase-locked paging and superhigh-speed generators.
Circle (438) on Action Card

Scala Electronic L 8362
Antennas and accessories for FM broadcasting.
Circle (439) on Action Card

ScheduALL by Visual Inc. L11071
ScheduAll facility management for Windows with facility scheduling, personnel management, project management, bidding, library/labeling, invoicing and production reporting modules.
Circle (440) on Action Card

Scientific-Atlanta L 5812
Satellite communications equipment, earth station antennas, antenna controllers.
Circle (441) on Action Card

Scott Studios R 3500
Music and commercials for radio with touchscreen control of hard-drive system.
Circle (442) on Action Card

Sennheiser Electric L 6948
MKE104 cardioid lavaliere microphone with removable capsule and accessories; DAS4015 portable antenna/power distribution system for multichannel wireless microphone receivers.
Circle (443) on Action Card

Shively Labs L 5304
Low- to high-power FM antennas.
Circle (444) on Action Card

Shure Brothers L 5312
SCM 810 automatic mixer; SCM 800 manual mixer; LX wireless microphone systems; Beta series wired microphones.
Circle (445) on Action Card

Siemens Audio Inc. L 6819
Neve audio mixing systems; Mitsubishi digital audio recorders; AMS mics, automated mixers, workstations; Siemens analog and digital routers.
Circle (446) on Action Card

Sierra Automated Systems R 4026
SAS 64000 audio routing switcher, high-performance microprocessor-based audio switching system from broadcast installations, using LSI technology for extreme high density of 256x256 crosspoints per frame.
Circle (447) on Action Card

Sira Sistemi Radio srl L 8362
Antennas and accessories for FM broadcasting.
Circle (448) on Action Card

Smarts Broadcast Systems R 4002
Radio automation systems.
Circle (449) on Action Card

Solid State Logic R 2311
Numerous software and hardware upgrades for Axiom digital production system, with integral multitrack hard-disk DiskTrack recorder/editor; SL 9000 J series mixer, with new audio circuitry and automation capability up to 240 faders and 1,320 switches; Axiom Preparation Station; OmniMix Surround Sound A/V system; Scenaria A/V production system; SL 8000 GB on-air production and multitrack mixing console.
Circle (450) on Action Card

Solidyne R 2825
Distributor, audio products
Circle (451) on Action Card

Sonic Science R 1202
Sound effects retrieval systems.
Circle (452) on Action Card

Sonic Solutions R 1623
Wide range of Mac-based digital audio workstations; CD recording equipment; SS-105 premastering system; audio utility NN-100 NoNoise sound restoration system.
Circle (453) on Action Card

Sony Electronics/ Business & Professional L 5828
MD recorder/players; CD players and jukeboxes; digital audio recorders in DAT and Hi-8 modular multitrack formats; wired and wireless microphones; wide range of analog and digital audio mixers; audio processors; headphones; SMS-10P monitor speaker with integral amplifier.
Circle (454) on Action Card

Sony Recording Media L 5828
DARS-MP metal particle audiotape for DTRS format.
Circle (455) on Action Card

Sound Technology L 8431
Audio system analyzers.
Circle (456) on Action Card

Soundscape Digital Technology M 4760
Hard-disk recording systems with all standard DAW functions.
Circle (457) on Action Card

Sprague Magnetics R 1721
Tape head, DAT head reconditioning; hard, floppy and optical drive repairs; computer/audio DAT drive repair; computer and audio accessories.
Circle (458) on Action Card

Staco Energy Products R 2325
Voltage regulators, power conditioners, UPS systems; SVR series single-phase voltage regulators rated 2.5-15kVA, single-knob voltage setting with microprocessor control; redesigned AVR, MVR regulators, PLC, MLC power conditioners; UPS series True-On-Line 10kVA single-phase, 12-75kVA 3-phase.
Circle (459) on Action Card

Stainless L 5212
Complete tower design, fabrication, erection modification and maintenance; inspections and structural analysis of existing towers, full-service field operations for antenna installations, repairs, regular tower maintenance.
Circle (460) on Action Card

Storeel L10303
Room Stretcher tape storage line for maximum density storage for small formats; Rail Rider system provides single-entry access in narrow depths; Stor-Max system for double-entry access in lengths from 3-18' without raised flooring or motors.
Circle (461) on Action Card

Studer L 7116
D940 digital mixer; D424-2 M-O recorder; D19 series; D741 CD recorder; A-980 analog mixer; MADI router.

Studer Editech L 7116
PostTrio digital audio workstation.
Circle (462) on Action Card

Studio Technologies R 3308
StudioComm central controller, control console, accessories; model 750 audio mixer; Studio Tools DAW accessories; DAs; IFB Plus series cuing systems.
Circle (463) on Action Card

Superior Electric R 3912
Electronic, electrical control equipment; power protection equipment; uninterruptible power supplies, power conditioners, transient suppressers, RFI filters; voltage regulators; AC disturbance monitors.
Circle (464) on Action Card

Superscope Technologies/MarantzR 2927
CDR620 compact disc recorder; IS5022, IS5021 digital sound processors; PMD350 combination CD player/tape deck; portable audio presentation products.
Circle (465) on Action Card

Svetlana Electron Devices R 1123
Quality power tubes manufactured in Russia's largest power tube factory; numerous 3CX, 4CX, 5CX series products and a growing list of other devices.
Circle (466) on Action Card

Swintek Enterprises L 5228
Intercom products; full-duplex transceiver; base, 20-channel full-duplex remote systems.
Circle (467) on Action Card

Switchcraft R 3320
Audio patch panels; TTPP96 jack panel; MT52 patch panel.
Circle (468) on Action Card

SWR Inc. L 5328
RF feedline products; broadband FM antennas; field engineering service.
Circle (469) on Action Card

Symetrix R 1511
610 broadcast audio delay designed for live or taped talk shows; mic processors.
Circle (470) on Action Card

Synclavier R 3417
Digital audio production equipment.
Circle (471) on Action Card

Systembase Ltd. R 3907
C300Xr ISDN audio codec with integral ISDN terminal adapter, keypad, VFD display in 1RU enclosure; uses apt-X 100 coding to provide 7kHz mono link on single B-channel.
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Systems Wireless L 7983
Representatives for Clear-Com, Premier, Lectrosonics; wireless mics, headsets, IFB and Clear-Com intercom systems; Lectrosonics UHF synthesized wireless mic; triversity system by Premier.
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Tally Display Corporation L11078, S 1615
Up/down timer/counter; Slim Line LED displays; L-bracket for Slim Line displays; face place for rack-mount LED displays.
Circle (474) on Action Card

TASCAM L 8226
M-2600 Mk II and M-5000 audio consoles; DA-88 digital multitrack, DA-30 Mk II DAT, DA-P1 portable DAT recorders.
Circle (475) on Action Card

Techni-Tool L 7870-1
Source for Tektronix, Fluke products; also fiber optics, field service, rework, connect, interconnect equipment; service chemicals, service control.
Circle (476) on Action Card

Tektronix L 9313
AM700 audio measurement set with color display.
Circle (477) on Action Card

Telecast Fiber Systems L 5856
Digital fiber-optic audio/comm/control snake.
Circle (478) on Action Card

Telex Communications L10863
RTS ADAM CS digital matrix frame for small facilities and mobile vans; RTS KP-12 key panel; RTS 803 master station; Windows key panel; ENG500/UT 500; line monitor speakers; beltpacks; wireless mic systems; antenna splitters.
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Telos Systems R 4023
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TEM/Tecnologie Eletronniche Milano R 3419
Introducing solid-state UHF/VHF amplifiers rated 30W-1kW; SlimLine analog microwave links for all frequency bands; portable links for all microwave bands; solid-state FM transmitters rated 20W-1kW.
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TFT Inc. R 3002
EAS 911 emergency alert system encoder/decoder with 2 audio inputs, RS-232 digital I/O; EAS 941 remote control/status board for multiple studio control of EAS 911; EAS 940 program/transmitter interrupt unit; EAS 930 multimodule receiver with chassis, power supply AM/FM/7-channel NOAA weather radio receiver modules; Model 8900 Reciter STL receiver exciter.
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TCI
Theatre Crafts International (TCI) magazine L 5207, S 1965
Stop by either booth for sample copies and subscription information.
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Thomcast France L 7109
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Thomson Tubes Electroniques L 5331
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360 Systems R 1605
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TimeLine R 1226
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TM Century R 1800
Radio station automation; Digital Commercial System with hard-disk storage.
Circle (488) on Action Card

TWR Lighting R 3903
Tower lighting products.
Circle (489) on Action Card

United Ad Label L 7975
Tape labels; inkjet printer-compatible labels; audio cassette and CD packaging.
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U S Tape & Label R 1717
Labels, promotional products.
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Utility Tower R 1900
Tower products and services for AM, FM, microwave and other communications.
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VidCAD Documentation Programs L 8476
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Videoquip Research R 3823
Signal routing switchers, distribution products.
Circle (494) on Action Card

Video Systems magazine L 5207, S 1965
Stop by either booth for sample copies and subscription information.
Circle (495) on Action Card

Ward-Beck Systems L10300
Renaissance series radio consoles; M405P portable extended-range VU meter; D8212 audio DAs.
Circle (496) on Action Card

Wheatstone Corporation R 1211
Audio mixing consoles: A-300, A-500, A-6000 master control systems; D-500 for on-air radio applications; SP-4 production console; SP-8; R-60, R-16 on-air radio consoles; MR-40 production console; 8400 stereo DA.
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Whirlwind/US Audio L 5541
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Will-Burt L 8580
Electromechanical telescoping masts with height to 38 feet; NightScan Chief elevated lighting system for nighttime operation.
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Winsted Corporation M 6825, M 4027
Digital Desks for workstations with corner consoles, low-boy racks under the work surface; plexiglas doors for economy racks; fabric side panels and tops.
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Wireworks L 8443
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Wohler Technologies L 8566
AES/EBU-to-analog converters for rack-mount monitor speaker systems; alarm system identifying error condition and location; analog and AES digital level meters; analog and digital audio router.
Circle (502) on Action Card

World Broadcast News magazine L 5207, S 1965
Stop by either booth for sample copies and subscription information.
Circle (503) on Action Card

Yamaha Music R 1805
Analog and digital audio mixers; DMC 1000 digital automated recording console; YPDR 601 compact disc recorder.
Circle (504) on Action Card

ZERO Stantron L 6336
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DAB update

By Skip Pizzi, radio editor

Upcoming field tests could be IBOC's last stand.

Although it may not seem so to most American broadcasters, a lot has been happening along the path toward digital radio broadcasting — both in the United States and abroad. In the U.S., not all developments have been positive, indicating that the domestic market probably has a long way to go before DAB is implemented.

Digital radio broadcasting still lurks enticingly on the U.S. radio horizon, but true advancement of the medium has been frustrated recently. Laboratory tests of proposed DAB formats — conducted by the Digital Audio Radio (DAR) Subcommittee of the Electronic Industries Association/Consumer Electronics Manufacturers Association (EIA/CEMA) and the DAB subcommittee of the National Radio Systems Committee (NRSC) — turned up substantial technical problems in many systems. Coupled with continuing spectrum conflicts, *all* of the proponents face difficulties of one form or another. As a result, upcoming field tests of these formats, originally scheduled to begin last summer, have been delayed and reconsidered.

In-band issues

Probably the most disappointing outcome of the DAB lab tests was the interference performance of in-band systems. All FM in-band systems showed poorly in terms of first- and second-adjacent channel interference, in the analog-to-digital and digital-to-analog directions. Even though the formats conform to the FM channel's RF-mask, these interference problems apparently result from the wide bandwidth requirements of in-band digital signals. In particular, the so-called "saddlebag" approach of in-band on-channel (IBOC) systems loads significant energy into the outermost edges of the FM channel.

These results indicate that with current technology, an FM station's in-band digital coverage would be hard pressed to match its analog coverage, and more important, that in-band digital signals may cause new interference to existing analog stations. It also means that in-band DAB would be even more interference-limited than its analog predecessor in densely populated zones.

Furthermore, IBOC systems also showed a distressing propensity to interfere with their host analog stations on some receivers, and some subcarrier performance on the host stations (especially 92kHz high-speed systems) was degraded. Interference with adjacent-station subcarriers was also noted.

Given the priority assigned by all proponents to mitigation of FM multipath effects, the IBOC systems showed surprisingly poor performance in the presence of lab-simulated multipath conditions. Apparently, among those most surprised were some of the proponents themselves because the EIA/NRSC results differed significantly from their own tests and theoretical projections. But the lab results remained consistent over a wide variety of multipath types and repeated testing. Nevertheless, some proponents expect this to be an area of profound difference between the lab and field tests.

Laboratory tests of proposed formats turned up substantial technical problems in many systems.

While the AT&T in-band adjacent-channel (IBAC) system fared better against multipath, it is unlikely that sufficient spectrum will be available for its full implementation in the most crowded markets.

Signal re-acquisition time was also a problem on several systems, including all IBOC formats (AM and FM). Worst-case acquisition times of more than nine seconds were reported.

Finally, although the Eureka 147 L-band system was not affected by the technical problems that the in-band formats experienced, its advantages are moot as long as it suffers from a need for new spectrum that is not available in the United States.

Preparing for field tests

Preparations continue at press time for on-air comparative field testing of the formats in San Francisco. A number of factors have contributed to delays in this phase of testing, including corporate distractions of several proponents involved in recent mergers and splits. However, the effects seem temporary, with movement continuing from all proponents toward field testing this year.

All of the necessary authorizations for the San Francisco tests have been obtained or are expected without difficulty. The most problematic was the temporary license for L-band Eureka testing on 1,472MHz (due to opposition of the NTIA), but an adequate authorization was granted early this year.

The in-band FM systems and Eureka 147 signals will all originate from the same transmitter site on Mt. Beacon, while the IBOC-AM signal will be carried on a 5kW (omni day, 2-tower DA night) AM station at a different site. The VOA/JPL signal will originate from a NASA TDRS satellite, as in its earlier demonstrations.

A controversial element of the tests

involves the Eureka 147's formats use of multiple transmitter sites. In addition to its main 20kW ERP signal on Mt. Beacon, a second *single-frequency network* (SFN) co-channel transmitter of the same power will be located on Mt. San Bruno, and a 7.6kW *gap-filler* will operate from Roundtop Mountain on the other side of San Francisco Bay. (The SFN transmitter is fed via microwave link from the same modulator as the main transmitter, with the main signal delayed for synchronization with the SFN. The gap-filler is a simple off-air, unsynchronized co-channel repeater.) The experimental designation of KEIA has been given to the Eureka field-test system.

KEIA is also used as a designator for the other experimental terrestrial DAB station, a 5kW FM channel at 96.9MHz used for the AT&T IBAC system.

The testing subcommittees have also developed a special vehicle for mobile reception during the field tests. A new van was purchased, and its entire electrical system replaced so that it can provide well-regulated 120VAC power to receiving and recording equipment. It will carry all formats' receivers throughout the tests, which at press time were still being installed in the vehicle. One element of delay was caused by some of the IBOC receivers' non-frequency-agile design. Therefore, final assembly of the receivers was not possible until it was certain which host stations would be used for IBOC signals.

Test structure changes?

Some proponents have blamed their lab-test difficulties on implementation, rather than design problems. In addition, some proponents have improved the implementation and/or design of their systems since the last opportunity for update submissions to the lab-testing phase. But for proper correlation of results, the EIA/NRSC has insisted that the same systems tested in the lab be tested in the field, so the field tests will use what some proponents view as outdated or non-optimized hardware. In fact, AT&T has requested that its IBOC format be withdrawn from the upcoming field tests and resubmitted later with modifications.

To accommodate this, the subcommittees have proposed a separate, second phase of field testing that would allow modified systems to be examined. These updated systems would subsequently have to undergo the same set of lab tests applied to the earlier formats. Besides the extra time required for these two additional testing rounds, funding also becomes an issue. The cost of the tests has been split by EIA/CEMA, NAB and proponents. (Proponents submitting more than one system pay proportionally larger shares.) If current proponents drop out of the first field-testing round, the remaining proponents (and the EIA/CEMA and NAB) will each be required to pick up a larger share of the estimated $500,000 tab for the tests.

An even greater cost impact could be felt in a second round of field tests, where fewer proponents are expected to participate. Finally, it is not known how much a second round of *lab* tests might cost, because the previous lab (at NASA Lewis Research Center in Cleveland) has been dismantled, and the same site may not be available again. An alternate facility might cost substantially more, and the fewer participants would again inflate the cost per proponent. Final decisions on these matters are pending at press time.

Meanwhile, back at the FCC

On a separate track, there has been some movement on satellite DAB at the FCC. Under Gen. Docket 90-357, staff action on *Satellite Digital Audio Radio Service* (Satellite DARS) has been taking place, and a Report and Order is expected in the next few months. Issues under discussion are reportedly whether any of the four proponents is eligible for a Pioneer's Preference, and whether to auction rather than grant the 50MHz of S-band spectrum (2,310-2,360MHz) to applicants for the service.

If the commission decides to auction the spectrum, however, it will almost certainly require a re-opening of applications for prospective licensees. This is because the current four proponents could all be accommodated within the existing allocation. For an auction to raise any money, competitive bidding for scarce spectrum is required, which is currently not the case for DARS. (In contrast, a single DBS-TV slot auction recently raised a winning bid of $682 million.)

The FCC has also granted *CD Radio* a 319-D waiver, which allows the DARS proponent to spend up to $10 million toward construction of its $200+ million, 2-satellite system prior to licensing. The waiver explicitly places all risk on the proponent, and in no way guarantees subsequent approval. Meanwhile, the FCC is also considering a probable revision of its DBS (Part 25) rules that will eliminate all such future pre-construction bans, allowing any proponent to proceed toward some level of satellite system construction at their own risk prior to spectrum awards. These actions are intended to shorten the time between authorization and service start-up for DBS systems.

On the international scene, however, a tempest is brewing that may affect practically all North American DBS radio service. The NTIA has issued extremely restrictive protection requirements for the 1,452-1,492MHz portion of the L-band that Canada will use for DAB. (The United States uses these frequencies for aeronautical testing.) Meeting these restrictions will be difficult for Canadian terrestrial service (especially along its southern border, where most of its population lives), but it will make future Canadian DBS radio service planned for the band impossible. In response, Canada has issued equally restrictive requirements for the 2,310-2,360MHz DARS band (which Canada will use for *its* aeronautical testing). Meeting the Canadian requirements will, in turn, be nearly impossible for U.S. DBS radio, so a stance of "mutually assured interference" has apparently been reached; negotiations are expected to continue.

What's next?

A potentially big year lies ahead for DAB. Adjustments notwithstanding, some form of field testing of U.S. DAB formats will take place. In its wake, the concept of in-band DAB may stand or fall. The FCC will probably issue rules for Satellite DAB, which may resonate strongly in future years. And significant DAB activity will continue abroad, where DAB is gaining momentum in terrestrial and satellite forms.

By this time next year, there should be a much clearer view of what tomorrow holds for American radio broadcasting.

For further information on DAB issues, check the following World Wide Web sites:

RADIO-L (a moderated DAB discussion group and resource):
http://www.magi.com/moted/dr

EIA/CEMA:
http://www.eia.org/cema

Eureka 147:
http://www.dlr.de/DAB/

USA Digital Radio:
http://www.usadr.com

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3CX15,000A3	4CX10,000D	SV811-10
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— KRKZ/KWKW Radio, Oklahoma

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Ask Dr. Radio

Mario Hieb, chief engineer at KXRK-FM, Salt Lake City, asks:

The characteristic impedance of a transmission line is generally a function of physical properties such as dielectric constant, resistance, conductor spacing, etc. Why then does free space, a virtual vacuum, have a finite characteristic impedance of 376.731Ω?

Grant Bingeman, P.E., senior engineer at Continental Electronics, Dallas, replies:

Strictly speaking, there is no such thing as the characteristic impedance of free space. The 377Ω is actually the *intrinsic* impedance, which is different from the characteristic or *surge* impedance we use with transmission lines.

The common symbol for characteristic impedance is Z_o, but intrinsic impedance is sometimes called Z_d. It's just a matter of definitions, where Z_d is the ratio of the electric to magnetic fields in a plane wave, and Z_o is the ratio of voltage to current on a properly terminated (or infinitely long) transmission line. There are also several different versions of intrinsic impedance, called *wave impedances*, which depend on which geometry components of E and H you're interested in.

More on multipath

Editor's note: In last issue's "Ask Dr. Radio" column (Jan./Feb. 1996, p. 42), Geoff Mendenhall's response generated several requests for more details on transmitter tuning for minimizing multipath effects. Here's a postscript from Geoff:

RE: Tuning for best FM modulation performance

Tuning for minimum synchronous AM is a good starting point, but it is desirable to finish tuning at the symmetrical group delay point. Fine tuning the input and output for minimum even order harmonic distortion will optimize the group delay (time) response.

Tuning the transmitter for minimum even order harmonic distortion will result in a symmetrical group delay response and optimum FM modulation performance. This can be accomplished by: 1) observing the even order harmonics in the demodulated baseband with a spectrum analyzer; or 2) placing an audio bandpass filter (tuned to the second harmonic of the audio modulating frequency) on the input of the audio distortion analyzer.

Most FM stations have an FM stereo modulation monitor with a 19kHz bandpass filter and metering circuitry that is normally used to measure the 19kHz pilot tone injection level. This monitor function can also be used to tune for symmetrical group delay if the transmitter is 100% modulated with a single 9.5kHz monaural tone *without 19kHz pilot*. The second harmonic distortion produced by transmitter amplifier(s) mistuning will fall within the 19kHz bandpass of the monitor's pilot injection level metering and will appear as if there was a pilot tone present. Tuning the transmitter power amplifier(s) for a minimum pilot injection level indication will null the second and other even order harmonics of the 9.5kHz modulating tone resulting in symmetrical group delay of the sidebands.

Be certain that the FM demodulator has good linearity and does not introduce distortion products that would cause the broadcast engineer to mistune the transmitter to compensate for the distortion introduced by the demodulator. Modulation monitors that use a pulse-counting discriminator are usually the most dependable for this measurement.

Geoff Mendenhall
Vice president and
radio product-line manager,
Harris Corporation/BroadcastDivision
Quincy, IL

Enlighten the masses

RE: *Editorial*, Jan./Feb. 1996 (p. 4)

Twenty-twenty vision in a rearward direction is most generally accurate. As usual, we have been caught with our heads in the clouds watching the dominos fall all around us and thinking "It won't happen to my wonderful radio station." As anyone who even so much as looks at the trades understands, Ma Bell (actually her many offspring) wants a piece of the action. Not only a piece, but all of it.

We, in what is the current field of broadcasting, need to be trumpeting what we do best. That is to provide *FREE* (very important word) *SERVICE* (another important word) to the communities in which we are licensed. This is what makes us unique and valuable to our listeners.

It is lots of fun to "surf the net" or to "channel surf" on cable, but that sport is not free. Of course, the fine folks at the phone and cable companies have absolutely no intention of making their services free to you. Not only will you pay for service, but you will have to pay to see their "fine sponsors" also. (Have you looked at the net lately?)

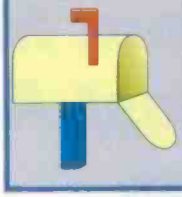
It is almost too late to take up the cause. However, the fat lady has yet to sing, so until she does, it is time for us to do some big-time lobbying of our own. We need to have our personnel speaking to every service club, every church group, every conceivable gathering possible, and then urge our listeners to write, or better yet, call their duly elected congressman and tell them to rethink their desire to auction the spectrum to over-the-air broadcasters. If we go away, they will lose the last free service they will ever have, as far as media is concerned (papers cost money, so does phone and cable).

Besides, is there really anyone out there that believes that all that money raised from the "auction" will go to debt retirement? If so, call me about a bridge.

Mike Seaver
KHQA
Quincy, IL

Reader Feedback:

Send your letters to the editor or questions for Dr. Radio to:



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Business:

RF Specialties of Washington, Seattle, has opened an on-line catalog on the World Wide Web at http://www.rfspec.com where users can download the latest version of the company's "RFS.exe" technical freeware. Users can also search a product index by manufacturer or product category and the site offers on-line product brochures and price lists, as well.

The Federal Communications Commission has granted Type Certification to TFT, Santa Clara, CA, for its Emergency Alert System (EAS) 911 EAS encoder/decoder. To receive a free handbook on the unit, contact: TFT, 3090 Oakmead Village Dr., Santa Clara, CA; telephone (408)727-7272; fax (408)727-5942; E-mail TFTInc@aol.com

Digital Courier International (DCI) and Premiere Radio Networks Inc. (PRNI) signed an agreement to distribute all 10 of PRNI's comedy networks via the DCI network.

New World Wide Web sites have been established by Sennheiser Electronic Corporation and Neumann USA at http://www.sennheiserusa.com and http://www.neumannusa.com, respectively. Site visitors can locate product descriptions, as well as information on frequency response curves and polar patterns.

Smart-Radio components for high-quality radio with text capability for PCs are available from Philips Semiconductors. With Smart-Radio built into multimedia PCs, computer users can receive a variety of text and other broadcast data from radio stations using the Radio Broadcast Data System (RBDS) standard that can be displayed on the computer screen.

Pacific Recorders & Engineering Corporation updated its name to Pacific Research & Engineering Corporation. The change reflects the company's evolvement from a major supplier of recording and other audio equipment to a company focused on the development and manufacture of high-technology products targeted toward the broadcast industry.

ABC Radio Networks Satellite Division, Tulsa, is converting five of its 24-hour analog music channel formats to SpaceCom Systems' FM Squared digital audio transmission technology. The conversion will use the SpaceNet III satellite.

Aphex Systems, Sun Valley, has been awarded a patent for its Tubessence vacuum tube circuit technology. The patent applies to the technology, as well as the products employing the technology.

NPR has made Studio 4A in its Washington, DC, recording facilities available for hire to create live broadcasts, call-in shows or music recordings at reasonable rates. NPR engineers are also available for recording services and consultation. For more information, see NPR's Technical Services home page at http://www.npt.org/rgi/index.html or call (212)414-2482. Meanwhile, JBL has announced that the NPR broadcast center is fully equipped with JBL Professional monitors, due in part to an equipment grant from Harman International.

Telecom bill eases ownership restrictions

Radio was the big winner in the rewrite of telecommunications law enacted earlier this year. While television and telcos also gained ground, the law adds new constraints (such as the V-chip and on-line content regulation) to those industries. Radio received no new negatives and at least one big positive, the liberalization of multiple ownership rules.

Although the new law does not completely lift multiple-ownership limits (as earlier drafts of the legislation had allowed), it creates a 4-tiered structure that liberalizes current rules for any size market (see Table). Previous regulations had allowed a licensee to operate a maximum of four stations in a market, with a maximum of two stations in any service (AM or FM).

Radio-TV and radio-newspaper cross-ownership was not liberalized in the new law, but national radio station ownership limits are completely lifted. (Previous national ownership had been capped at 20 AM plus 20 FM stations.) Industry analysts expect this to set off a flurry of transactions and station values are expected to rise. The consolidation trend, already strong among radio stations, is expected to kick into a higher gear, with some analysts forecasting that the majority of U.S. stations will be part of "superduopolies" by decade's end.

Radio station license-renewal procedures are also streamlined by the rewrite, and license terms change from seven years to eight.

Market Size	Max. Stations	Max. AM/FM
45 or more stations	8	5
30-44 stations	7	4
15-29 stations	6	4
14 or fewer	5	3 (not more than 50% of stations in market)

Broadcasters wasted no time in taking advantage of the revised rules. At press time, licensees in five markets already have reached the new ceilings: Denver (Jacor, 4 FM + 4 AM); Spokane, WA (Triathlon, 4 FM + 3 AM); Rochester, NY (American Radio Systems, 4 FM + 3 AM); Albuquerque, NM (Citadel, 4 FM + 3 AM); and Wichita, KS (Triathlon, 3 FM + 3 AM).

Groups formed to ease ISDN setup

In an attempt to help reduce problems reported by ISDN customers in establishing new service, two groups have been formed by major telco industry companies. The groups, one spearheaded by AT&T Network Systems and the other by BellSouth, will attempt to simplify the service-ordering and configuration difficulties that plague ISDN users when connecting their hardware to the new digital telco lines.

The groups will focus on both service-ordering procedures and the development of "plug-and-play" compatibility in future ISDN terminal equipment. The two groups claim to be coordinating their efforts with each other and with the North American ISDN Users Forum (NIUF), a consortium formed in 1988 under the auspices of the U.S. government's National Institute of Standards and Technology. NIUF's lack of progress in resolving these issues was cited by both of the new groups as a motivating factor in their formation.

News:

Correction

In the Jan./Feb. issue, the caption to Figure 1 in "New Developments in Transmission" was incorrect. The correct caption is: *Block diagram of the Harris DIGIT, an example of digital FM exciter design.*

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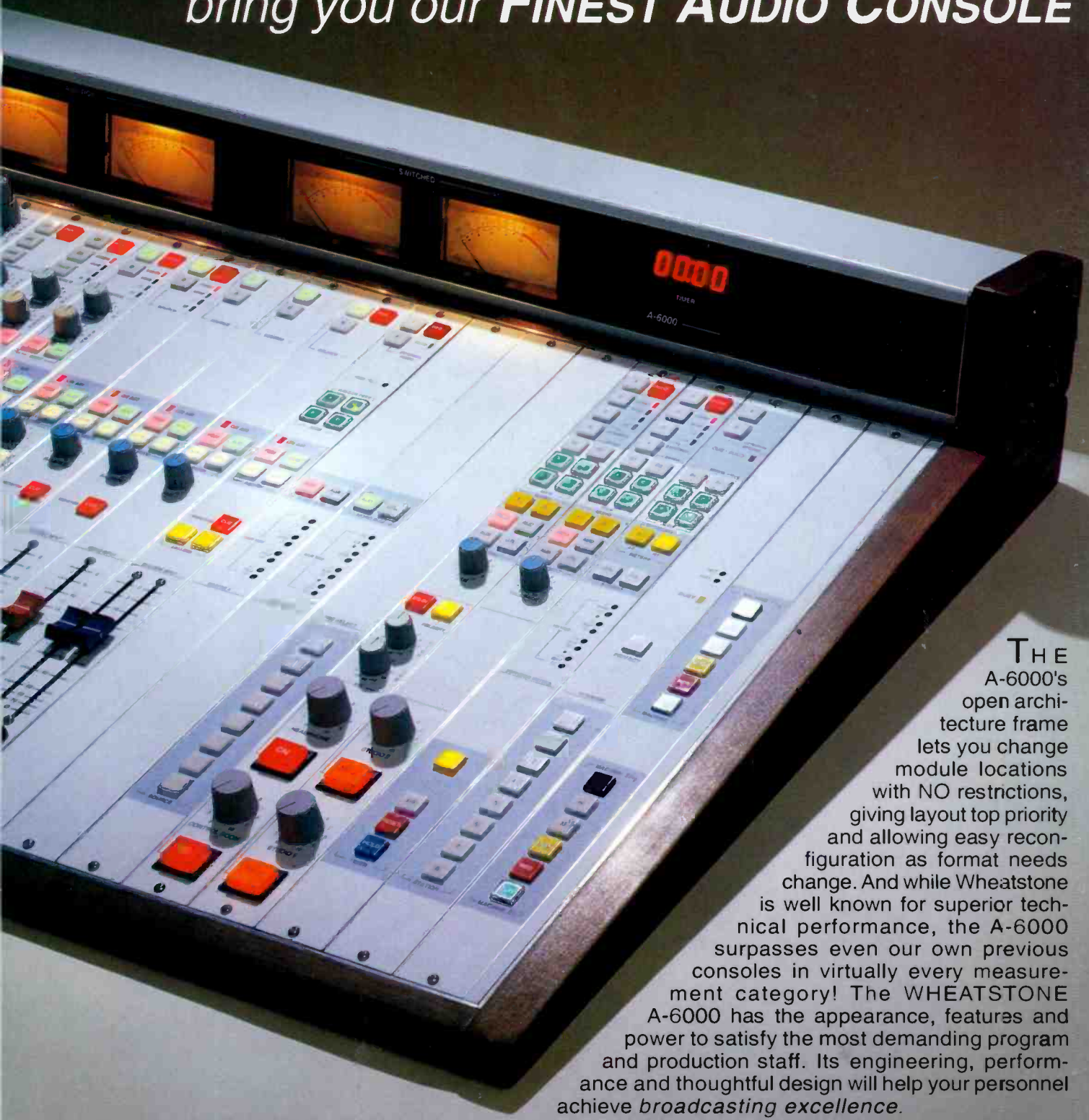

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