BE Radio™

July/August 1995/$5.00
An INTERTEC Publication

A sister publication of BROADCAST ENGINEERING

In This Issue:

- Implementing automation
- DAB update
- Tapeless technology survey

EVERYBODY TELLS US THAT BROADCAST ENGINEERS ARE VERY CONSERVATIVE. OKAY. READ THIS AD NOW AND THEN BUY A CR-1604 IN FIVE YEARS.

We understand why broadcast engineers have a wait-and-see attitude about new products. Your station (and job) depend on rock-solid reliability and performance you can count on.

We'd like to introduce you to Mackie Designs. Over the last six years, we've gained a serious reputation for building high-value, trouble-free mic/line mixers with legendary headroom, ultra-low noise and unique features.

Mixers so good that they're regularly used to create major label compact discs, feature movie soundtracks, and more commercial production work than you can shake an RE 20 at. For example, our CR-1604 16-ch. mic/line mixers are used nightly on the Tonight Show, Conan O'Brian and David Letterman Shows[1].

As for use at broadcast facilities, well, we're not total newcomers. Over 70 U.S. radio stations already have Mackie mic/line mixers in place.

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

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

[1] Mention in this ad denotes documented useage only. Mention is not intended to infer endorsement by any of the television shows listed.

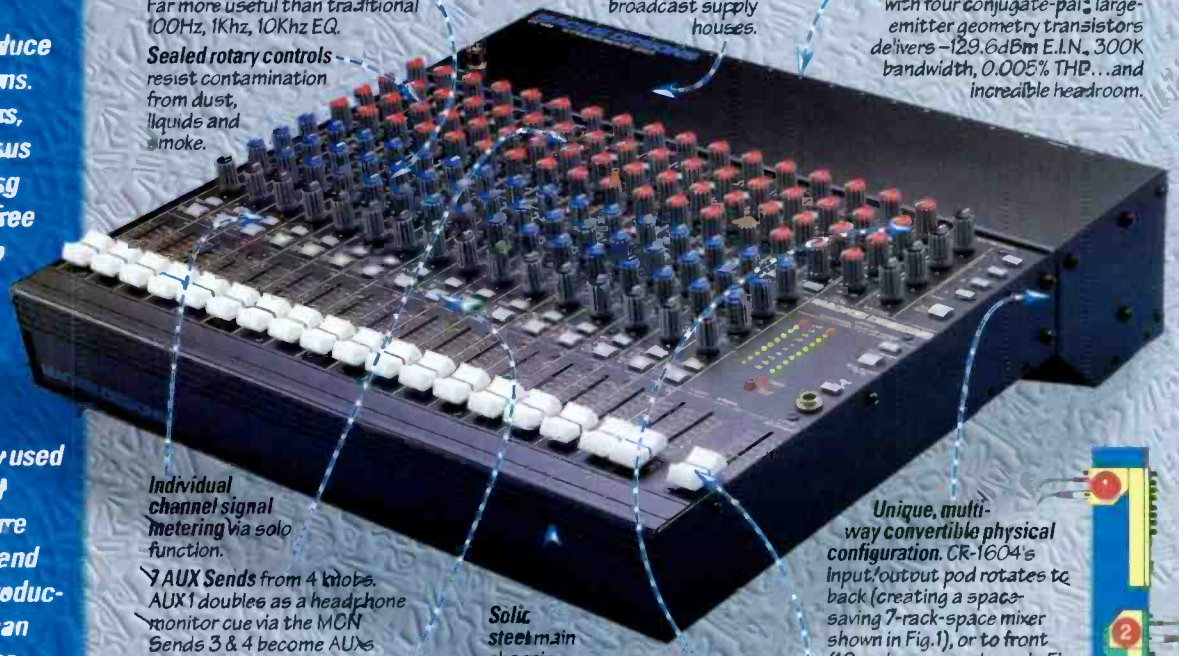
[2] Price is slightly higher in Canada.

3-band equalization done right: ±15dB at 80Hz, ±12dB at 2.5kHz (perfect for voices), ±15dB at 12kHz. Far more useful than traditional 100Hz, 1Khz, 10Khz EQ.

Sealed rotary controls resist contamination from dust, liquids and smoke.

The Mackie Designs 16x2 **CR-1604 Mic/Line Mixer.** Suggested retail price, $1035[2]. Available at America's top broadcast supply houses.

Six recording studio-grade microphone preamps with +48VDC phantom power. Discrete circuitry with four conjugate-pair large-emitter geometry transistors delivers –129.6dBm E.I.N., 300K bandwidth, 0.005% THD...and incredible headroom.



Individual channel signal metering via solo function.

4 AUX Sends from 4 knobs. AUX1 doubles as a headphone monitor cue via the MON. Sends 3 & 4 become AUX 5 & 6 via the SHIFT button.

Two extra buses. Mute buttons route the channels' signals to an extra stereo bus called A.T 3/4. Route it to the headphones, for monitoring advance audio cues. Preview a signal that hasn't been brought up in the mix yet ... then add it by unmuting the channel.

UnityPlus gain structure gives high headroom and low noise at the same time. Set the fader to center-detent Unity Gain, press channel solo to monitor the channel via the CR-1604's LED meters, adjust the input trim ONCE, and you're ready. Because there's 20dB MORE gain available on the fader, you won't need to constantly re-adjust the trim.

Maximum RF protection. Both mixers use metal jacks and washers plus a shunting capacitor to de-rail RF before it gets to any circuit traces.

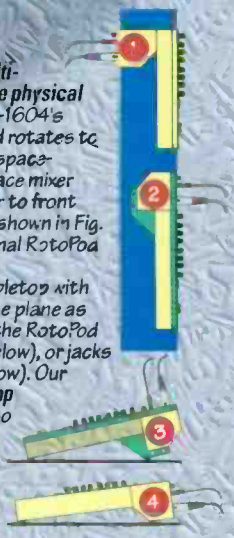
Rugged design and construction. All of our compact mixers have mil-spec, double-sided, thru-hole-plated fiberglass circuit boards (horizontally-mounted on brass stand-offs for impact-resistance), double-parallel-wired faders for 2-times redundancy, and electronic protection against power surges, impedance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

Solid steel main chassis.

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

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

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



Better-than-digital specs and headroom. Both the 16-ch. CR-1604 and 12-ch. MS1202 have a dynamic range of 108dB and an internal S/N ratio of –116dB. You're getting a mixer that can handle the output of digital workstations, CDs and DAT tapes without overload.

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

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Harris Platinum FM Transmitters aren't falling. But their prices *are*.

If you haven't priced a Harris Platinum FM Transmitter lately, you're in for a pleasant surprise.

Not only has Harris lowered the price on these ultra-redundant all-solid state transmitters, but now ***every*** PT-CD FM transmitter includes Harris' DIGIT digital FM exciter as well!

DIGIT, the world's first and only FM exciter capable of accepting a studio digital signal, is available with either a digital or an analog input module.

**Digital Signal Processing*

The digital input incorporates a DSP* stereo generator for unsurpassed stereo performance and separation and a Digital Composite Limiter with "look-ahead" circuitry to predict and eliminate overmodulation peaks before they occur.

Even if you don't have a digital signal to your transmitter, you can get DIGIT's benefits by using the analog input now and upgrading to a digital input when you are ready.

Beyond Harris' Clearly Digital sound, a PT-CD transmitter will give you hot-pluggable RF modules with an MTBF exceeding 240,000 hours; no IPA module; VSWR foldback, and more.

Let us surprise you. To learn more about Harris PT-CD Transmitters, please contact us:

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Fax 217-224-1439

International:
Tel 217-222-8290
Fax 217-224-2764

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ON THE COVER: Jacor Communications produces its syndicated "Gary Burbank Show" at WLW, Cincinnati using the DDS Digital Delivery System from Radio Systems. (Photo courtesy of Harris Allied.)

This month...

Departments...

Two Proven Methods To Attract More Listeners.

[Shock Jock*: About $500,000]

[OPTIMOD 9100: About $5,000]

That's the price of succeeding in AM radio these days: you can buy a big expensive star to reach a larger audience, or put an OPTIMOD-AM at the transmitter. Both give you the strength to be different, even double your audience size. But by "maximizing" your power with the 9100, you also get the closest thing to FM sound with unmatched efficiency.

True, extending your reach while saving on power isn't nearly as much fun as hiring a big, loud star*. But which sounds better to *you*: a bigger mouth, or a bigger bank account?

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Editorial:

Quantity vs. quality

As the industry awaits the results of the first DAB tests (see "News," p.42 and "DAB Update," p.30), it's a good time to contemplate the actual launch of DAB service in the United States.

The question that many seem afraid to ask is, "Will DAB catch on?" The phenomenal success of the CD has given rise to a pervasive assumption that consumers will embrace DAB with similar fervor. Yet, if history is any indicator, DAB may be a tougher sell than that. Its success will be influenced by how the new service is marketed and implemented. The most pivotal issue here will be whether DAB is presented as simply a qualitative improvement (as it is generally construed today), or whether it will also offer quantitative change (i.e., the addition of new services).

Remember what happened with the introduction of FM service? AM radio stations were offered the opportunity to obtain an FM license, and most did, using the new channels for hi-fi simulcasts of their AM station's programming. As numerous studies have cited, FM receivers began to sell in small amounts but flattened out fairly quickly at a low penetration level. This situation continued until the FCC ordered stations to begin separately programming their FM stations. Before long, FM receiver sales soared as listeners realized they were missing out on new program services if they didn't have an FM-capable radio. The FM penetration level jumped dramatically – a classic "hockey-stick" growth curve (a long flat line followed by a sharp upturn).

Cable television followed a similar path. When all it offered was another (potentially higher-fidelity) route to the same destination available by previous means, it received only marginal acceptance in most areas. But when HBO, Ted Turner et al started offering programs only available by cable, up went the hockey stick again. Clearly, quantitative media growth attracts the consumer far more than qualitative improvement alone. This is an important lesson for broadcasters to learn as they ponder the inauguration of DAB.

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Of course, for AM broadcasters, even a quality-only change could have nearly the affect of a quantitative change because it would bring these stations' signals to the large portion of the listening audience that never visits the AM band. But at least for FM broadcasters, initial analog/DAB simulcasting could be followed by separate programming of selected dayparts, until the analog and digital program streams are completely independent. This strategy could assure and accelerate consumer acceptance of DAB.

Furthermore, if an in-band, on-channel (IBOC) DAB format is selected, both quantity and quality of radio stations' services can be improved without any allocation of any additional spectrum – certainly a change that's in the public interest, but with private value to the broadcaster as well. Remember that many new competitors to radio are or will be multichannel services. Shouldn't broadcasters have a way to compete with these new players in a progressive and positive manner (as opposed to simply the circle-the-wagons, defensive strategy of mergers and duopolies)? TV broadcasters are confronting this very issue right now with their new digital channels – although their environment does not include the spectral and economic elegance of an IBOC approach.

Some broadcasters are nervous about further fragmenting the already crowded market. But others are realizing – primarily from their experiences with successful duopolies – that having two small slices of the pie can be better than one big one, especially if they are of different "flavors" (formats) and are both equally appealing to their respective audiences.

Others have questioned the fairness of giving any new channels that technological progress creates to those who already have licenses to existing channels. Shouldn't any new channels be opened up for competitive bidding by all interested parties, in the tradition of American broadcast regulation? Countering this are the AM-to-FM licensing precedent mentioned above and the possibility of IBOC. Using the concept of "spectral real estate," it can be argued that these licensees are being granted no new spectrum, and that they have a right to use their existing spectrum for additional services that adhere to certain technical standards, just as FM broadcasters have always been able to do with subcarriers.

DAB is an important concept that both the American public and U.S. broadcasters deserve. But unless the consumer deems it truly a worthwhile improvement, DAB may never reach the critical mass it requires to succeed. So start thinking about what second service you'd like to put on your DAB signal. And get a move on – there are only 48 hours in a (programming) day.

By Skip Pizzi, radio editor

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Replace the clutter on your audio test bench with the Portable One *Plus* from Audio Precision. With one instrument you can make 12 different audio measurements. All in a test set designed from the start with 2 channel level, crosstalk and phase measurement capability.

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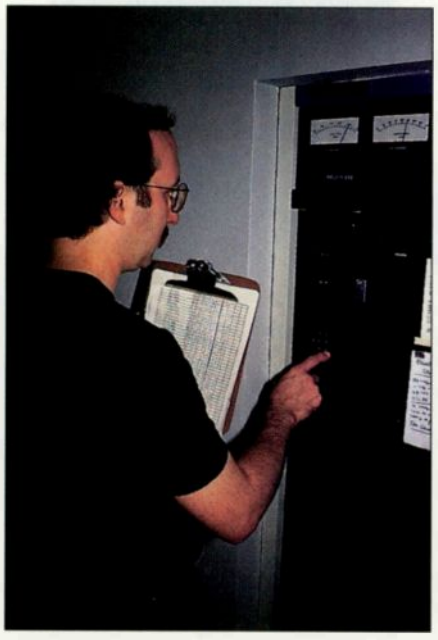
Contract Engineering:

Protecting yourself

By William Fawcett



In the last 20 years, a lot of contract engineers and their firms have come and gone. This has been partly due to the maturing of the industry, but most came from the basic business structure that these engineers built for themselves.

When the FCC first deregulated broadcasting, many former full-time station employees became *jack-leg* engineers. Operating out of a van or a spare bedroom, they took on multiple clients, often subsisting on inflated retainer fees. More often than not, these folks went out of business, typically because they underpriced their services and could not survive on what they made. The rates seemed good compared to salaries, but they failed to take overhead into account.

In case you're unfamiliar with the term, a jack-leg is a contractor who operates outside of normal business procedures. Business licenses, insurance, capital investment and company organization are not important to the jack-leg. Because of this, overhead is reduced and rates are correspondingly lower, often equal to prevailing hourly wages for similar work as an employee. All of this seems attractive to the purchaser of the services – until a problem occurs.

Some contractors mistakenly think that because they are billing such low rates, they will be treated the same as an employee if an accident occurs. However, the law makes a clear distinction between an employee and a contractor, and if the matter comes before a court of law, there is generally no question that the contractor will be personally liable for any damages that the client sustains.

If the jack-leg takes on an assistant, the matter becomes more complicated. Not only is the contracting firm liable for the proprietor's actions, but it may also be liable for injuries sustained on the job by the assistant. A jack-leg using another jack-leg as an "employee" is, therefore, the worst possible paradigm. The contractor is then exposed on two fronts – both to clients and employees.

The broadcast environment is full of potential problems: accidental damage to expensive equipment, construction-related injuries, electrocution (of either technical personnel or station employees) and environmental concerns like PCBs or RFR. Add to that the potential damages due to incorrect advice ("omissions and errors") and consequential damages, such as lost air time. To avoid a nightmare for the rest of your life, you need some business tools that can be used to build a solid and substantial operating environment.

Organization

Numerous articles have listed the various corporate options available: sole proprietorship, partnership, limited partnership, professional corporation (P.C.) and corporation, to name a few. To be more straightforward, my advice is *incorporate*. Unless you are a registered P.E., the P.C. option is probably not even available. The rest may leave too much of your personal wealth exposed if something major ever occurs. Incorporation provides a certain amount of isolation and may have significant tax benefits as well. For my business, I chose a *regular* corporation over the *subchapter S* structure, but that was a tax decision. Incorporation also simplifies insurance issues as well, because there is no fuzzy area between business and personal vehicles.

You'll also find that incorporation lends a certain amount of respectability to the firm, attracts business and helps in obtaining dealer discounts and credit from vendors. It is not an expensive prospect. My state (Virginia) corporation fees run about $75 a year, and the initial legal fees were not prohibitive.

Contracts

Ironically, the work of most contract engineers is *not* specified under a contract (like building a house) but instead is provided as *time and materials* work. The contract involved typically states what special terms and conditions will apply to the hiring agreement in general, including liability issues.

Here are some pointers pertaining to those terms and conditions regarding liability. Contracts are state specific and laws do vary. So always pay an attorney to review any proposed general or specific contract. Even the contract's typography may be codified. In Virginia, for instance, the words "NO WARRANTY AS TO FITNESS OR MERCHANTABILITY IS GIVEN" are required to be capitalized. Many of these provisions are right out of the *Uniform Commercial Code* (UCC). If you ignore the UCC, you will probably lose in court.

Spell out your basic warranty for service of customer-supplied equipment (mine reads "NO WARRANTY WHATSOEVER...") and also your warranty for any equipment that you manufacture or provide.

Certifications

Be cautious when making tower inspections, RFR certifications for renewal or quarterly PCB inspections. Any documents should plainly state that the certification is simply a report of what was actually noted and no guarantee against the existence of problems.

Avoid rendering opinions. That is the work of a registered professional engineer, which usually comes at quite a high price. After all, you shouldn't take on several million dollars worth of liability for simply stating that you saw no leaks on any capacitors – at least not for the paltry sum that you're probably paid for that 15-minute task.

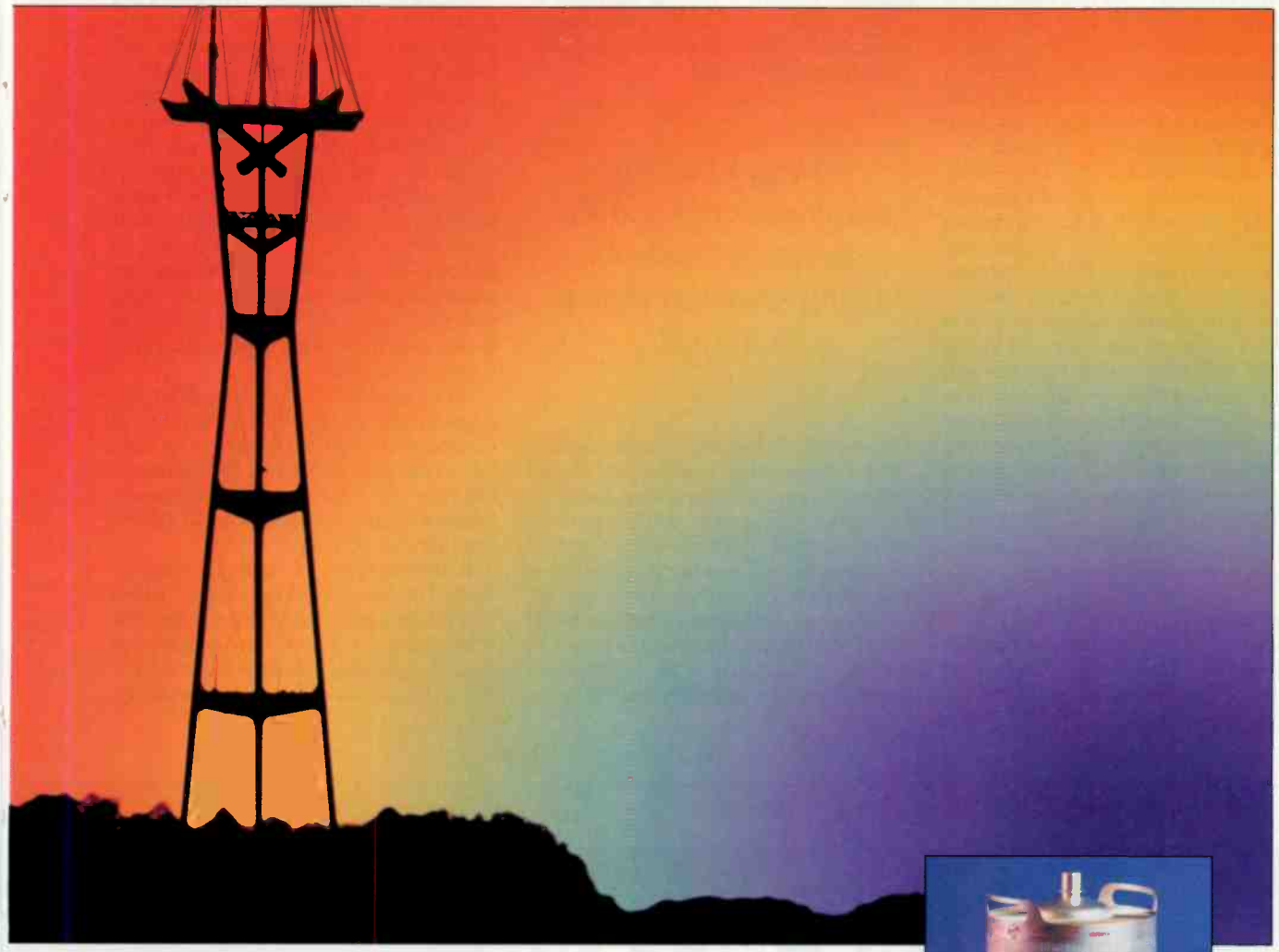
Retainers

A good operating principle is to charge fair rates for services actually rendered. Others use retainers and offer reduced hourly rates. This could cause some problems, though, such as the following:

What do you do if two or three of your stations are all down at the same time? What if you're injured or a family member needs to

William Fawcett is president of Mountain Valley Broadcast Service, a contract engineering firm in Harrisonburg, VA. Respond via the *BE Radio* FAXback line at 913-967-1905 or via E-mail to beradio@intertec.com or by CompuServe at 74672,3124.

Spanning the Spectrum



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EIMAC has delivered generation after generation of leadership products. Tubes from watts to megawatts. Cavities from megahertz to gigahertz. And a wide range of accessories. A full spectrum of solutions. Supporting a broad selection of radio and television products.

We deliver quality and dependability. Not only is every EIMAC tube subject to the strictest manufacturing standards, it's also warrantied 100% free of defects. The result: dramatically reduced transmitter downtime and operating overhead. We also provide rapid, expert customer service and support to assure success in your efforts.

From design to final product, we're there for you. EIMAC is flexible enough to handle special orders. And big enough to handle large requirements. Whatever you need, we can provide it now and – we guarantee – for years to come.

Perhaps the best proof of this promise is our past – more than 60 years of keeping you on the air, around the world, across the spectrum.

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go to the hospital? Can you offer 100% assurance that you will be readily available at all times? No, you can't, but a retainer often says just that. You can make plenty of money off a normal rate schedule, and you don't need the legal hassles that accompany a retainer.

For similar reasons, consider avoidance of contracting as a *Chief Operator*. Otherwise, you will likely have to hire a replacement when you're unavailable. Let the station GM be Chief Operator and delegate technical tasks to you.

Now this doesn't mean that you shouldn't offer an assurance of being "on-call." Tell your clients that you will provide the best coverage humanly possible and invite them to check your references. As an entrepreneur, you should know that if you don't offer swift service, someone else will. Backup employees help, but sooner or later you will be taxed to the limit. Your actions will speak louder than any words. Avoid retainers.

Registration and licensing

Again, laws vary from state to state for registration and licensing, but following established business convention always strengthens your position in court. Corporations need to be registered. A sales tax license is often required, which will also help you buy goods wholesale. Some localities require a general business license. Lastly, trade licenses (contractor registration) are often overlooked but nonetheless important.

> If you have any employees beyond the owner, a Worker's Compensation policy is a must.

There usually is a certain dollar amount on a contract that you cannot exceed without registration. Broadcast engineering services are usually subject to these rules, especially if the work goes beyond adjustments and repairs. If you provide construction-type activity or major installation of equipment, you probably need to be registered, as well. For example, my firm is registered as an electrical, an electronic and a general contractor.

Insurance

Insurance regulations are also state specific, but if you have any employees beyond the owner or principal officers, a Worker's Compensation (WC) policy is a must. This policy frequently will provide protection for employer's liability as well. Even if you are the only employee, a policy offers great benefit and is required by many larger clients and state agencies as a condition of contract. If you have employees and you cannot provide evidence of coverage, your clients will likely be billed an additional amount by their insurance providers to cover you on their policies. These additional charges are usually based on the client's total billing with the carrier, not just their payroll, so it is of significant advantage to the client if you are covered.

WC is usually based on a fixed fee plus a percentage of payroll. The amount of coverage required is usually set by state labor regulations. A small firm with one full-time employee and a few part-timers might typically pay $800 to $1,000 a year for this coverage.

Rates are based on your job descriptions. The assessment for clerical help is much lower than field-service engineers. One problem you may have is that most lists of applicable job categories will not list a broadcast field-service engineer.

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Computer Concepts puts you in charge of the station of your dreams. You knew that someday everyone in the station could be in constant communication. You knew that someday the burden of producing your program would be reduced to less than half. And you knew that it was only a matter of time until all your station's audio could be *instantly* previewed and monitored by all with ease. **The wait is over.**

Get In Shape Now For World Media Expo

For starters, we recommend a good diet, weight training, and jogging 5 to 10 miles a day. Prepare to experience some real excitement. Total digital integration by Computer Concepts changes everything.

Your radio station will never be the same. Like other digital systems, Computer Concepts clears up cart-clutter and improves sound quality. But that's where the similarity ceases.

Computer Concepts is the easiest to use of any digital system anywhere. From the very first day our practical system will win raves from your staff.

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Contract Engineering: Protecting yourself

Unless you do a lot of heavy tower rigging, don't pick the *tower rigger* category – the rates are expensive. Look for job categories whose potential for injury are similar. Telephone and computer-wiring installer and TV repairman/home-antenna installer are two categories that seem to meet the need. Be forthcoming with your agent, and make sure he or she understands exactly what you do. You don't want a claim rejected because you were doing work that did not match the information supplied.

Another important insurance policy is a commercial general liability policy. Again, this may (and should) be required by many clients. A typical coverage amount is $500,000, usually costing a small firm about $800 per year. This may include a small property insurance policy that is often bundled with the overall coverage. Typically, rates are based on a fixed fee plus a percentage of payroll or, in some cases, on gross income.

> The general liability policy is your protection against accidental damage to your clients' equipment or property.

The general liability policy is your protection against accidental damage to your clients' equipment or property, such as a transmitter fire that burns the whole facility down or your van backing into a guy anchor. The policy should also include *omissions and errors coverage*, which protects you if you make a mistake when rendering an opinion to the client. For example, you tell your client that a 2-bay antenna, which will barely fit on the tower you specified, will allow the client to achieve the required ERP with the new transmitter you specified operating at 100% power. Later you find out that you used the gain figure from a 3-bay antenna – oops!

General liability coverage also affords protection if you have an accident that injures or kills someone outside your firm. Of course, you need to take safeguards and follow good work-site practices. No policy can replace common sense. Nevertheless, tools do get dropped from towers, and paraphrasing the bumper sticker, accidents happen.

Once you have these insurance policies in effect, your agent will be able to supply certificates of insurance to clients who make such a request. This service is free and can often be done within hours via fax.

These practices can greatly enhance your firm's reputation. More important, they minimize the risk of personal financial devastation that could follow a major accident. If you have employees, it's also the right thing to do.

So how does this affect your competitive position? First, it gives you a leg up on the competition. Sure, you have to charge a bit more, but you become a reputable business, not a fly-by-night outfit. The practices noted above could increase your overhead by $3,000 annually. Assuming 300 working days per year, you can cover this by increasing your rates $10 per day. Or better yet, increase them by $30 per day, and pocket the rest. The clients that complain the most are the ones with the least resources should a lawsuit ever occur, and that makes you a target. The better clients (those who pay their bills on time) will usually favor a firm that operates according to standard business conventions.

Safe

LAYER III

- Both the superior audio of Layer III and compatibility with installed Layer II-only codecs. Zephyr costs about the same as Layer II-only equipment.
- Only Layer III permits mono 15kHz operation on a single ISDN "B" channel or one Switched 56 line. This can greatly reduce your transmission costs.
- Clean, uncluttered front panel for simple operation. Full metering, call-duration timer, headphone jack, and mic/line inputs.
- Split channel mode allows individual mono signals to be transmitted to separate sites.
- RS-232 bi-directional data at 9600 baud for communications and control.
- Four end-to-end "contact-closures" for remote machine operation.
- The ideal solution for remote broadcasts, ad hoc networks, voiceovers, distribution of commercials, backup to satellite and microwave links, and mony other applications.

Bad weather. Finicky players. Losing streaks.

When it comes to sports, you can't control everything. But with Zephyr, you *can* guarantee that every game you broadcast will sound great.

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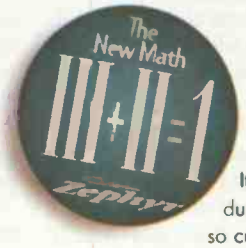

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Circle (8) on Reply Card

Managing Technology:

Owner upkeep

By Terry Baun

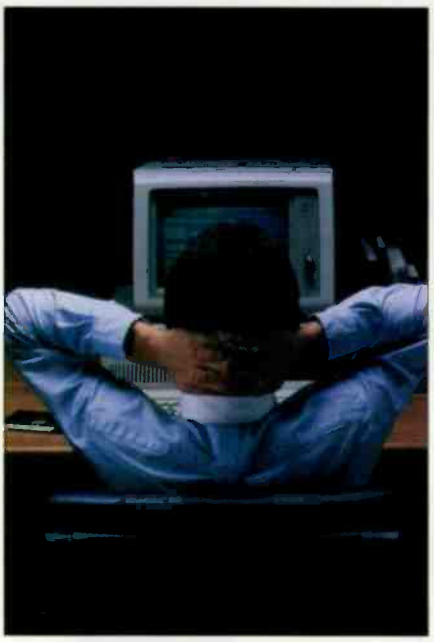
When things break, they need to be fixed. At a radio station, when those problems threaten the continued business operation of the facility, the need for quick repair is critical. But how will this happen in an industry where the trend is toward further downsizing and outsourcing of technical support?

Many station owners/managers face this dilemma every day as they struggle to maintain quality and service without the aid of full-time, on-site technical support. What follows are some tips to help managers understand and prioritize technical repairs. These tips will also assist part-time and contract engineers in making the broadcast facility run as smoothly as possible.

Entropy strikes (again)

First, every manager needs to know the two *Immutable Laws of Maintenance*:

1. Everything will eventually fail.
2. Everything that fails can be repaired if enough effort, money and time are provided.



Although it may seem discouraging, any hardware item is subject to the law of entropy, which implies that by its very existence in the temporal plane, it is less new – and, therefore, more used – every second. Even the most well-kept equipment will eventually fail. An aggressive maintenance program can help to forestall unexpected failures by replacing critical parts as needed, but the best possible planning cannot predict the metal fatigue and molecular wear processes that will finally bring a machine down.

Of course, each and every part in a machine could be replaced on a scheduled basis (similar to the maintenance plans for commercial airliners), but the cost in labor and parts would certainly be prohibitive in a broadcast operation.

The real solution lies in determining how serious a particular problem is. Failures that result only in inconvenience or delay for station personnel can probably wait until the next regular maintenance visit by technical support personnel (and they don't merit a 3 a.m. wake-up call to your tech support personnel). Problems that halt the operation of your business will, of course, require a more timely response.

How critical is the problem?

One good way to determine the seriousness of a problem is to look at it from the perspective of those who pay *your* bills. If your customers (your audience and your advertising clientele) are not materially affected by a malfunction, perhaps it is not a real "4-alarm" emergency.

For example, if a tape cart recorder loses the ability to splice-find and erase carts, that function can still be performed manually with absolutely no effect on your customers. However, if the record section of your one and only cart recorder fails, you lose the ability to generate revenue through production of commercial messages – a problem that will most certainly affect your advertising clientele, your audience and your bottom line.

See Table 1 for a look at three major areas of concern for a typical radio station, with some common problems listed in order of importance.

Trouble-reporting systems are essential

It is critical to have a reliable and usable system in place for reporting technical problems. Many stations have had success with multisheet, carbonless trouble report forms, with the original going to the engineering department, a second copy posted right on the troublesome machine and the third copy to the station manager. A stack or pad of these forms should be kept in each studio and transmitter site and at the front desk.

Once you as a manager receive your copy of a trouble report, your task is to prioritize it and determine if it requires immediate attention or if it can wait for the next scheduled visit by technical support. Separate the reports into two file folders. Then, within those two folders, put the reports in the order in which those problems need to be fixed. This creates a system that will help you save time and money. It will make the site visits by the technical support staff much more productive because there will be a concise list of problems, prioritized by you, to be addressed at every visit.

When the problem is fixed, the original trouble report should be signed and dated, with details of the repair noted right on the form. The trouble report sheet can then be filed with the corresponding equipment instruction manual in the station's technical files to provide a complete service record for each piece of equipment.

This system can eliminate the need for a separate file for repairs and modifications, and it encourages documentation and record-keeping because it's a one-step process.

Maintenance by non-engineers

Because technical support involves maintenance and repair, some stations have assigned some light maintenance tasks to non-technical personnel, saving the more difficult tasks and repair duties for site visits by station technical support.

Most of the simpler tasks are basic housekeeping functions, which, when performed consistently, can result in increased on-line time and smoother operation for the station. Here are a couple of areas where operations staff can help:

1. Transmitter:

• *Keep it clean.* If you can change a furnace filter, you can change a transmitter filter. Ask your engineer to buy extra filters and

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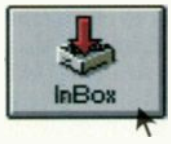

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change or vacuum them on a regular basis. This can usually be done while the transmitter remains on the air.

• *Keep it cool.* If your transmitter is on-site, check the room periodically to be sure the cooling system is operating. If you have a remote transmitter site, have your engineer install a temperature monitor and tie it to an alarm function on your remote control. Or use a separate dial-out phone system at the transmitter site that can alert you to unusually high ambient temperatures. Remember that when the weather is hottest, your cooling system is the most stressed and likely to fail. Therefore, be especially vigilant during heat wave conditions.

• *Keep it lit.* Transmitters have pilot and indicator lamps for a reason: to help you diagnose the proper operation of the system. If your transmitter has replaceable lamps, find out where the spares are kept and ask your engineer to show you how to change them. There is nothing worse than trying to troubleshoot a problem without trust in the indicating instruments.

2. Studio equipment (similar concepts apply):

• *Keep it clean.* Know how to clean tape heads, pinchrollers and idlers. Also, know how to use CD lens cleaners, DAT cleaning tapes and floppy-drive cleaning diskettes.

• *Keep it cool.* Most tape-based audio equipment uses the motor housing as a fan. If dust is allowed to collect around the machine, it will get sucked in and collect on the interior of the machine, diminishing cooling. Regular housekeeping around and behind all equipment (including computers) will keep dust out and enable proper cooling. Don't stack equipment on top of cart or DAT machines, and ensure that custom equipment enclosures provide adequate air circulation.

• *Keep it lit.* Know how to change lamps in audio source equipment and consoles. Some consoles require special tools for lamp removal or insertion, so be sure to get training in this before attempting it – and be sure that your engineer clearly labels the replacement lamps. Many bulbs look identical, and installation of the wrong one may damage equipment logic circuits. And don't forget the phone system. You can't answer the phone if you don't know which line is ringing.

The station doesn't sound right

Another type of problem that often occurs is one in which someone reports that the station just doesn't sound right on the air. On-air quality issues like these are perhaps the most difficult to verify, not only because our aural memory is limited, but also because there are so many variables to be considered – from the source audio on disk or tape to the propagation characteristics of the ionosphere.

However, there are some things you can do to help narrow down a suspected problem if you have done some homework ahead of time. Have your engineer make a reference dub from a CD when the studio and air chain is in tip-top condition. You can then use that reference to play back in the studio (or over the air) when you have a concern about deterioration in system performance. If you file the CD you dubbed, you can also re-record it to test your studio recorders against the earlier standard.

Do all of your quality control monitoring at a fixed location, such as your at-home receiver, but definitely *not* at the station, your office or your car. You need a neutral, less pressure-laden location. If you still hear something amiss, you need to do more investigating.

Back at the station, compare the *Program* and *Air* signals at the console. The difference between the two is the contribution of all audio processing, transmission and reception variables. If the program signal is OK but the air signal is not, the problem exists somewhere after the output of the console. Check to see if your audio processing equipment has been changed or adjusted. It's a good idea to write down all the processor settings (you can even draw a picture of the knob positions) so that you can quickly check to see if something has been changed. If you have an AM station, modulator tubes in the transmitter may be suspect. Ask when they were last changed or checked. Check the source of the off-air monitor (usually the station modulation monitor) to see if it is behaving normally. Station monitoring systems can deteriorate, too.

There also is a strong temptation to deal with a problem by random knob-twisting. Don't do it unless you *know* what you are adjusting.

If you still feel there is a problem and you find no obvious cause, it is time for a call to the engineer. Remember, though, that our memory of how things are supposed to sound can be deceptive.

This is an area where you really need to talk with your engineering support provider. A lot of technical assistance can be given over the phone to managers who have a basic understanding of the radio station and a disinclination to panic.

Radio broadcast managers can play an important part in the technical support functions of their facilities. Those who are interested and aware cannot only provide a first line of technical support, but if so inclined, can actually analyze and prioritize repairs so that the station's engineering support can be made even more effective. By establishing a working partnership with your engineer, you will find that just a phone call can often result in fixing (or at least bypassing) minor problems. In addition, your confidence level in your facility, your staff and yourself will increase, which is truly a bottom-line benefit for all parties concerned.

1. Safety issues
- *Tower lighting and control system;*
- *Public safety:* RF exposure, tower equipment, fences and security, line pressurization equipment;
- *Operator safety:* exposed wiring, inoperative transmitter interlocks, broken equipment resulting in potential operator injury, such as sharp edges, exposed or damaged power cords, floor/aisle obstructions.

2. Station-operation issues
- *FCC violations:* typically resulting from over- or underpower operation, failure to switch modes (AM stations) or transmitter malfunctions causing generation of out-of-band or spurious signals;
- *Failure of major program delivery systems:* main studio console, audio processing, production facilities, satellite networks, hard-disk audio networks;
- *Failure of program delivery subsystems:* cart machines, CD players, microphones, phone patches.

3. Business-operation issues
- *Failure of major business systems:* computer network, phone systems, fax;
- *Environmental/utility systems:* plumbing, HVAC, electrical problems.

Table 1. Prioritizing of problems is an important management function in today's radio station. These common problems are listed in a prioritized order.

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"The RE2000 has a richness of sound I have experienced only along the lines of a tube mic"— David Esch, Eschicago

"The perfect mic for recording any acoustic string instrument."—
John Beland, Flying Burrito Brothers

"The RE2000 has the warmth of a tube mic—extremely quiet and sensitive, allowing me to pickup low-level material without adding noise."—
Scott Weber, Buena Vista Sound, Walt Disney Studios

"The RE2000 has a crisp, clean and quiet response. I used less EQ to achieve what I look for. What goes in...comes out! It's also extremely versatile...from vocals to acoustic guitars to trumpets and violins."—
Tom Cusic, TM Century, Dallas, TX

"I think it's one of the most versatile I've ever used."— Roy Thomas Baker, Producer

In fact, all of these professionals asked one remarkably familiar question:

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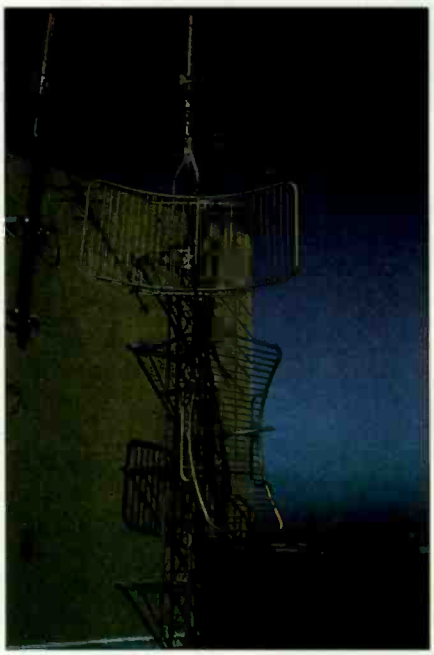
RF Engineering:

The folded unipole, part 1

By John Battison, P.E.

Originally developed for military use, the *folded unipole* has been in broadcast use since the 1950s. Credit for its application in AM broadcasting should go to the late John Mullaney, P.E., who did a great deal of work on the military versions and then translated it into the civilian radio industry. Measurements made by Mullaney in the early 1950s showed that the current distribution in a folded unipole is the same as in a vertical antenna. This opened the door for its use in broadcast applications and made it easily acceptable to the FCC.

Long before the folded unipole, the *shunt-fed* antenna was being used successfully by AM broadcasters, and it remained popular until recently. It was suitable for daytime-only operations, but the shunt wire's rather unpredictable radiation caused the FCC to deny its application for nighttime use or directional arrays. But the advantages of shunt feeding stimulated research into the *folded dipole*, and this in turn led to the folded unipole. This antenna can be substituted in a series-fed directional array or a single-radiator system without excessive FCC paperwork.



Advantages of folded unipole design

The folded unipole is a vertical antenna with a grounded base that is driven by a drop wire (or wires), but it exhibits the electrical characteristics of a much taller, series-fed antenna. This is why the folded unipole first came into use for very low-frequency (VLF) applications, where it is impractical to erect an antenna of a suitable physical length. In many cases, one-eighth-wavelength or less was the maximum physical height available for VLF antennas, with resulting low efficiency and poor operating characteristics. Use of the folded unipole produced the equivalent of a one-quarter-wave in some cases.

Apart from the benefits of reduced tower height and cost, the other advantage of the folded unipole comes in the area of grounding. Grounded antennas generally suffer far less lightning damage, and many other antennas can be hung on the tower without the need for quarter-wave sections or isocouplers to pass the base insulator. Lighting chokes or Austin transformers are not needed, and the other antennas can be added or removed without problems or the need to perform antenna base-impedance measurements and the associated FCC paperwork.

Electrically, several benefits accrue from the use of a folded unipole. The attainable radiation resistance is higher than that of an equivalent height series-fed antenna. Bandwidth is normally greater than that obtainable from the usual series-fed antenna. Base impedance can be adjusted as desired within wide limits, while with a series-fed antenna the base impedance is determined mainly by its dimensions and characteristic impedance.

In addition, the folded unipole seems to be more stable in bad weather conditions, and in many cases, conversion of an old series-fed antenna can result in greater signal strength and higher field intensities. This feature has made it popular with broadcasters who have old and deteriorated ground systems. The actual RF radiated depends on the antenna's overall height, nevertheless, it seems to work well with a poor ground system.

> The folded unipole exhibits the electrical characteristics of a much taller, series-fed antenna.

If you compare the performance of an old series-fed antenna having a damaged ground system with a properly tuned folded unipole, you will find the latter's radiation efficiency is much greater. This is because less current flows (lower I^2R loss occurs) in the ground part of the series-fed system. (The current division in the antenna is determined by the respective impedances of the line and the antenna.) If you were to compare a properly maintained series-fed antenna and a folded unipole, the field strengths would probably be the same.

When a station converts to a folded unipole, it often receives reports of "much louder signals." This is probably due to the restoration of original radiation efficiency plus the typical increase in bandwidth that occurs. The latter improves audio quality, which particularly contributes to making the signal subjectively louder.

Applications and caveats

The folded unipole is an amazing piece of hardware when properly used. Its major application is to increase the effective height of short AM radiators. It is probably most effective in improving radiation from towers that stand about 40° to 60° tall. Second, it enables the installation of FM, TV or other antennas on an AM tower.

But there are certain limitations on folded unipoles that are used in taller towers to eliminate isocouplers or quarter-wave sections. Just because you can obtain an operating resistance of 50Ω doesn't mean that you have an efficient radiator. Although tall towers can be used as folded unipoles, certain precautions have to be taken. The most important issue is detuning the upper part of the tower so it does not radiate out-of-phase AM signals and produce poor radiation characteristics.

It is not generally advisable to use the

Continued on page 19

John Battison, *BE Radio*'s consultant on antennas and radiation, owns John H. Battison and Associates, a consulting engineering company in Loudonville, OH. Respond via the *BE Radio* FAXback line at 913-967-1905 or via E-mail to beradio@Intertec.com or by CompuServe at 74672,3124.

Continued from page 16

folded unipole on towers over about 130° high unless two folded sections are used. If this is not done, efficiency and field strength will be considerably lower than expected. One method of upper-tower detuning is to ground the top of the first skirt about a quarter way up the tower, and then construct a second skirt on the upper section of the tower. The top of the skirt should be grounded to the tower and the lower end connected via a tuning capacitor to the tower. The process is basically experimental unless you have access to *Unipol*, a computer program developed by Dr. J. Raines at Mullaney Engineering.

Taller towers also allow the possibility of ice accumulation on drop wires and their brackets. If ice forms on the drop wires, tuning will probably change and raise the VSWR as the base operating-impedance changes. This may detune the transmitter and can lead to problems, especially for unattended transmitters.

When a station converts to a folded unipole, it often receives reports of much louder signals.

Elements of folded unipole design

Basically, the folded unipole consists of three or six wires (the FCC requires a minimum of three) suspended from the top or near the top of the antenna tower. These wires are generally known as a *skirt*, and they are suspended from brackets or arms secured to the tower. If an FM or TV antenna is to be mounted on the tower, the unipole skirt should not pass over these antennas, but should start below them.

Spacing of the skirt from the tower is not critical, although it has an effect on the bandwidth. Spacing should range from 12 inches to 24 inches from the tower. Bandwidth also is affected by the number of drop wires, usually improving as the number of wires increases (up to six).

The skirt wires must be carefully connected to the tower via the bracket arms. All paint must be removed from the tower, and the arms must be clean. It is best to weld or braze brackets to the tower if possible. The wires themselves also must have electrically perfect connections to their arms.

Skirt wires can be placed either in line with the tower leg or in front of the tower face. The actual position can have considerable effect on the antenna's operation. It is usually better to hang the wires off the leg rather than the tower face. This results in a lower Q and better bandwidth, with a lower reactance at the feed point.

In the next issue we'll consider the installation of folded unipoles.

For more information on folded unipoles, circle (101) on Reply Card.

FCC Update:

Environmental rule compliance

By Harry C. Martin

The license renewal cycle has begun for radio stations. Renewal applications for stations in Virginia, West Virginia, Maryland and Washington, DC, were due by June 1, and renewals for stations in North Carolina and South Carolina were due by Aug. 1, 1995. By April 1, 1998, radio stations in all 50 states will have submitted their renewal applications.

Question six of FCC Form 303-S, the form used for radio renewals, asks each applicant to check the appropriate box to indicate whether operation of its station may have a significant environmental impact as defined by Section 1.1307 of the FCC's rules. Information relevant to assessing whether operation of the station may have a significant environmental impact is included in the FCC's renewal instruction booklet, which will be mailed to licensees several months before the renewal filing deadline. Also included are worksheets and tables that enable certain categories of stations to determine whether their facilities meet the specific requirements of Section 1.1307, including those for radio frequency radiation (RFR).

Generally, the RF worksheets can only be used by stations located on: 1) a single-use tower; 2) a single tower with multiple AM, FM (including translators and boosters) and TV (including translators, boosters and LPTV) users; or 3) a multiple tower AM array (provided no other stations are co-located within the array). Additionally, eligibility for AM stations is limited to those stations that restrict access by use of a fence.

If a station meets the eligibility requirements for use of the RF radiation worksheets and can determine from the worksheets that its facilities will not have a significant environmental impact, it may submit the following as the explanation to support the "no" response to renewal form question six:

"I have examined the commission's environmental requirements in 47 C.F.R. Section 1.1.307 as outlined in Appendix C to the License Renewal Booklet. Based on my completion of the worksheets therein, I have determined that operation of my facilities will not have a significant environmental impact as defined by Section 1.1307, which includes consideration of the exposure of workers or the general public to levels of radio frequency radiation exceeding identified guidelines issued by the American National Standards Institute."

After using the worksheets, stations finding that their RF levels will exceed the guidelines may still find their levels acceptable based on a more detailed evaluation of a number of variables, for example, using antenna radiation patterns or measurement data. In such cases, the station should submit a statement explaining why its facilities do not exceed the RF radiation exposure guidelines at locations where humans are likely to be present or describing measures or circumstances that will prevent or discourage humans from entering those areas where the RF radiation exceeds the guidelines, such as fencing or remote location. To make such a special showing, a station will need OST Bulletin 65 titled "Evaluation Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation." Copies of the bulletin may be obtained from the commission's Public Service Division by calling 202-418-0200.

Stations that are not eligible to use the RF radiation worksheets will need to use more complex calculations or measurements to demonstrate compliance. For this reason, an applicant who is not eligible to use the RF worksheets is advised to consider seeking the assistance of a qualified consulting engineer.

If such a station elects not to seek the assistance of a qualified consulting engineer before reaching a determination with respect to its facilities, it should review the Environmental/RF Overview and the "General Environmental Worksheet" contained in the FCC's renewal instruction booklet. It should also review OST Bulletin 65 in order to properly evaluate the facility for compliance with the RF guidelines. The bulletin provides information and assistance on the RF guidelines, prediction methods, measurement procedures and instrumentation, methods for controlling exposure and reference material. In that regard, the station may provide data that demonstrates compliance with RF radiation guidelines in support of its response to question six.

Stations that determine, either through the use of the worksheets or based on their own calculations, that operation of the facility may have a significant environmental impact must submit an environmental assessment as an exhibit to the renewal application. The components of an environmental assessment have also been included in the renewal booklet.

Emergency Alert System reminder

Replacement of the Emergency Broadcast System (EBS) with the new Emergency Alert System (EAS) is being implemented on the following timetable:

- July 1, 1995: All stations were required to have modified their existing EBS decoders to handle the shortened 8-second, 2-tone alerting signal. Also, transmission of the shortened 2-tone signal was permitted.
- July 1, 1996: All stations are required to have replaced their EBS equipment with EAS equipment.
- July 1, 1997: The 2-tone signal may be transmitted only as part of a monthly EAS test or in an actual emergency.

Dateline

On Oct. 1, 1995, license renewal applications are due for radio stations in Florida, Puerto Rico and the Virgin Islands. On Oct. 10, 1995, all stations must place in their public files their listings of the community issues and responsive programming during the period of July 1 through Sept. 30, 1995.

Harry C. Martin is an attorney with Reddy, Begley, Martin & McCormick, Washington, DC. Respond via the *BE Radio* FAXback line at 913-967-1905 or via E-mail to beradio@intertec.com or by CompuServe at 74672,3124.

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Circle (21) on Reply Card

EAS Update

System overview, part 1

By Paul Montoya

A colleague recently mentioned that he was glad the "BS" has been taken out of EBS. Many others share his sentiments in one form or another. General managers and owners will be happy that their listeners won't be driven away by 22 seconds of obnoxious tones. Engineers will be happy that they don't have to maintain a system that never worked well.

The first phase of the new Emergency Alert System (EAS) that replaces EBS is already being implemented. (See "Counterpoint on EAS," May/June 1995.) These new regulations are now incorporated into Part 11 of the FCC rules. Before delving in to the new system, however, a bit of history is in order.

How we got here

Most will recall that the present 2-tone EBS system was established in the early 1970s. At the time, this approach provided the most robust way to transmit signals without false triggering. EBS relies on stations passing information from one to another to get the message to the public. This system breaks down quite often due to a station not passing on information or because of physical barriers and distances between stations. By the mid-1980s, problems with this system moved broadcasters and the FCC to consider alternatives to EBS. A few of those activities ultimately had input to the new EAS. Here are some examples:

> If the system works well at the local level, then the state and national plans should fall easily into place.

In Colorado, the Colorado Broadcasters Association put together a task force to explore delivery of alerting signals around the state. This was a challenge because of the state's topography. The task force came up with a plan using multiple means for point-to-point communications between broadcasters, including microwave and satellite. This *web* approach became the basis of distribution for the new EAS system.

Meanwhile, in the Los Angeles area, another engineering group put together a plan for distributing more detailed information about disasters to news departments around the area. Using *packet radio*, they developed a reliable method of delivering long-form, coded information around the service area.

The National Weather Service also needed a way to reach specific areas through its VHF-based NOAA Weather Radio. Through basic coded information, it came up with a protocol to notify specific populations with multiple alert levels. The system, called *Weather-Radio Specific Area Message Encoder* (WRSAME), serves as the basis for the data protocol found in the new EAS system.

In 1993, the FCC began testing new systems with the cooperation of state emergency communications groups in Colorado and Maryland. Testing took about a year with the participation of many potential equipment suppliers, emergency managers and broadcasters.

The FCC then proposed rule changes for the EBS system, and after processing comments, it issued a Report and Order outlining the new rules in December 1994. Although there probably will be some adjustments to these new rules, a new emergency alerting system has been enacted.

Implementation is the key

Given the level of effort put into the development of EAS by equipment suppliers, ad hoc committees in different states and the FCC, the new system should work well for many years to come if implemented properly. But that's a big "if." Its most important component is not at the federal or even the state level, but on the local level. This is where EAS will be used most. If the system works well at the local level, then the state and national plans should fall into place easily.

In upcoming issues, this column will consider the components of EAS and the planning required to put together a working system. Procedural changes and equipment availability will also be covered along with estimates of the costs involved. How EAS will be integrated into any new unattended operations and rules the FCC is considering will also be covered. Finally, the column will include reports from state emergency communication committees and the SBE's EAS committee, which are exploring implementation of EAS and educating broadcasters as to its use.

The new EAS should be a system that broadcasters will want to participate in if it's put together properly. Broadcasters are always looking for (and spending money on) new information sources to provide to their audiences. In this respect, a well-implemented EAS can become a valuable resource for the broadcaster rather than simply a new regulatory burden from the FCC.

In the next issue, this column will explore how the web system works and why this is such an important part of the new EAS.

Editor's note: *BE Radio* has received reports of difficulties in modifying existing EBS receivers for shorter tones in addition to reports of false activations by standard program material on modified decoders. If you have any evidence of such problems, *BE Radio* wants to know. Contact the editor via the *BE Radio* FAXback line at 913-967-1905 or via E-mail at beradio@intertec.com or by CompuServe at 74672,3124.

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Here's how it works: Six buttons on the left of the 17" computer touchscreen play what's on your program log. Scheduled spots, promos, PSAs and live copy come in automatically from your Scott System Production Bank and your traffic and copy computers. You see legible labels for everything, showing full names, intro times, lengths, endings, announcer initials, outcues, posts, years, tempos and trivia. Your jocks can rearrange anything easily by touching arrows (at mid-screen), or opening windows with the entire day's log and lists of all your recordings.

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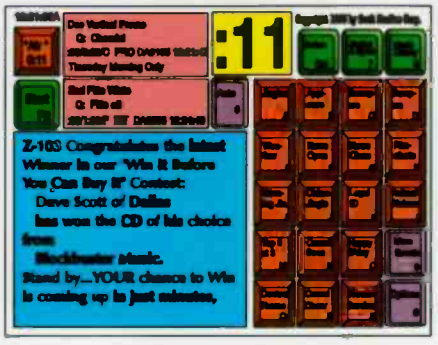

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Our most popular option is 9 gigabyte disks with ***1,000 songs*** pre-dubbed for ***free!*** The audio quality of digital music from the Scott System hard drive meets or beats the best CDs.

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Scott Systems' graphic waveform editors work wonders with phone calls in the air studio and creative spots and promos in production.

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The Scott System ***leads the industry*** with the biggest broadcast groups like Shamrock, Alliance, Salem, Saga, Liggett, Regent, Tichenor, Heftel, Waterman, Max, Atlantic, and Rawlco in Canada. Our major markets include Detroit, D.C., Dallas, Miami-Ft. Lauderdale, San Diego, Denver, Oklahoma City, San Antonio, Greensboro, and others large and small from Bangor to Bakersfield.

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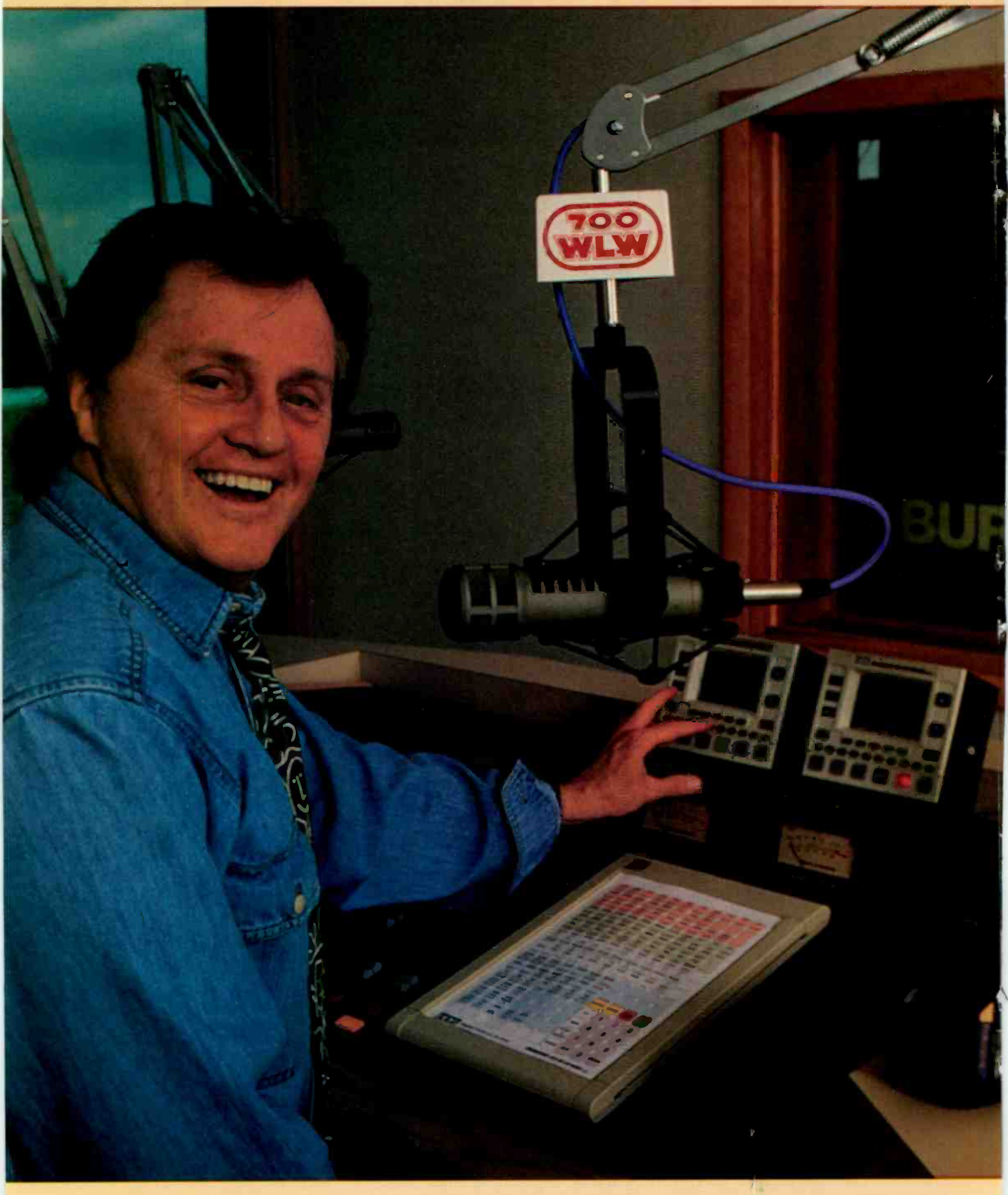
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WLW

Implementing automation

By Kirk Harnack

Proper choice and installation are the keys to success.

Today's radio automation systems are reliable and user-friendly, but not every system is suited for every radio station. Even the most appropriate automation system is prone to failure if it isn't properly set up and maintained. The system also must accommodate the future growth and changes that will inevitably occur.

So, you're thinking of automating your radio station. The sales reps who used to sell transmitters, cart machines or audio consoles are now pitching computers. And with all the hype, you think this computer automation thing could work, but you're not sure. The radio stations given as references in the sales brochures certainly seem happy with their systems.

Still, you figure there must be stations that don't like their automation systems – they're not working right or they're too difficult to use. Then you remember that wall of reel decks, carousels and go carts, and time-announce machines that always seemed to give the wrong time. And you recall the elbow grease, headaches and even the motor oil it took to keep those mechanical monsters moving. You have to ask yourself, "Is automation really for me?"

Today's PC-based automation systems are a far cry from the crude assemblages of 10, 20 and 30 years ago. Indeed, this year's systems are much improved over their predecessors of just three years ago. The radio automation industry is reaching a point where most of the systems on the market deliver reliable and convenient operation.

A few years back, software bugs and hardware glitches posed a real threat to the smooth and reliable operation of computer-automated stations. While still an important consideration, buyers are now more assured of glitch-free performance than ever before from all systems on the market. Reliable hardware platforms and in-depth software experience by the various system manufacturers are reducing the number of worries when selecting an automation system. But it's still important to make sure that you're getting the right system and setting it up the right way. Table 1 on p. 26 summarizes a process that should help you choose and assemble the best system for your station.

> Choosing a PC-based automation system should involve input from every department in a radio station.

Choosing a system

Programming, engineering, air talent, sales, traffic/billing and management will all reap tremendous benefits from an appropriate, properly installed and well-programmed system. Likewise, many or all of the station's departments will be burdened by a system that is poorly considered or improperly set up.

First, determine what you want automation to do for your station. Consider your on-air product and how you want your station to sound. With proper planning and the right hardware and software, your automation system can make your station sound however you want it to.

The most important issues

in selecting a PC-based automation system today are suitability to the station's operating style, flexibility in changing styles or modes of operation, size of audio storage space and, most important, ease of use by the on-air and programming staffs.

One of the most obvious differences among PC-automated stations is the smoothness – or lack of smoothness – in executing the station's format. Whether it's local talk, CD-based music or satellite-delivered programming, smooth execution of the format makes a big difference in the perceived quality of the station as a whole.

Most of the computer automation systems on the market are capable of rendering a well-timed and smoothly flowing finished product. In fact, the difference between a well-executed format and a jerky one is usually due to setup and programming of the automation system by the station operators. For this reason, it's a good idea to listen to other automated stations in and out of your market. If possible, visit those stations and take note of how their automation systems work. You'll likely find that some brands of systems are easier to program than others.

Some manufacturers will point you toward installations or stations that they are particularly proud of. These resources can be extremely valuable. As a programmer, engineer or manager, you can ask questions and get advice from these experienced automation users to determine how best to implement a digital system at your own facility.

With regard to programming and on-air sound, ask yourself these questions:

- Do I want to run straight automation all the time or do I want to have certain shifts run by live announcers?
- Will I use CDs for music sources or will all music be recorded onto computer hard drives?
- Do you want the system to handle automatic recording of network commercials or programs? Can the automation system easily handle such tasks? Can it do so without tying up other capabilities?
- Can I preview certain program elements that are scheduled to play later to make sure that they sound good?
- Can I record voice track intros or outros and preview how they will sound in context with program material during a single session?
- How does the production studio tie into the system? Can I edit and produce spots on the automation system or do I need a separate digital audio workstation? Can I produce spots elsewhere and easily transfer finished spots into the system?

The on-air combo studio for country-formatted WOHT-FM and WDTL-FM in Cleveland, MS, uses a Computer Concepts DCS (monitor at upper right, controlling hard-disk spot storage) with a TM Century UDS (controlling Sony CD jukeboxes at left). Each station uses the studio for separate live or live-assist dayparts. During dayparts when both stations are fully automated (mid days and overnights), the studio is used for production.

The answers to these questions can help you make your "first cut" from the list of available automation systems.

Further investigation

Depending on your needs, this list may now be fairly small or still quite lengthy. If your station is small, with simple computer automation needs, there are plenty of manufacturers that can help you. All of these manufacturers and integrators can assemble a small system for satellite-programmed or small live-assist radio stations. Some of these manufacturers specialize in small one- or two-user systems.

The smallest systems have only one computer with one or two workstations. A workstation in such a system may simply consist of a second monitor, mouse and keyboard attached to the computer. These are the least-expensive systems and for simple satellite-based automation, they are adequate. The smallest systems are easy to outgrow, of course, if the station's format or operational complexity changes.

For larger stations, the list of appropriate automation systems becomes

Continued on page 28

- Determine what you want automation to do for your station.
- Define your station's goals for automated operation.
- Listen to automated stations. Note how some sound mechanical while others flow smoothly and have a live sound to them.
- Talk to automation manufacturers and their cutting-edge clients. They are a good resource for discovering what automation systems can and cannot do.
- Thoroughly investigate the various systems on the market. Compare their features as well as their operational "feel."
- Consider various networking topologies.
- Obtain input from management, sales, engineering and programming departments regarding system selection.
- Select a system.
- Plan the system's implementation and installation carefully.
- Install the system neatly and provide good documentation.
- Train users. Consider using factory training, especially if most of the station staff has limited computer experience.
- Fine-tune the operations. Expect early problems.
- Maintain the system and its software.
- Subscribe to software updates.
- Stay in touch with the manufacturer.

Table 1. A step-by-step approach to implementing automation.

Automating multiple stations

By Skip Pizzi, radio editor

Automation can make it possible and cost-effective to operate multiple radio stations from a single facility or even from a single studio.

An increasing number of systems can handle simultaneous playback and record/playback operations for multiple program streams. Alternatively, two or more separate systems can operate independently or be linked to a single file server for sharing common elements, such as spots or newscasts.

Although the automation systems for these multiple services should share a common computer platform type, the associated hardware need not be identical. For example, one computer could be used for a satellite-delivered format while another computer in the same facility could be used for a locally programmed format with CD jukeboxes and hard-disk storage.

The multitasking required by such multiple operations implies that only the fastest platforms should be used. Setup and maintenance of the system should also be handled only by the most experienced personnel. LAN bandwidth is another issue to consider. Although typical 10Base-T Ethernet can be adequate, the number of audio programs flowing simultaneously through the LAN will be limited. A faster LAN, such as 100Base-T or a proprietary audio workstation network, might be warranted.

Data compression plays an important role here, as well. Not only does it conserve storage space on disk for digital audio programs, it can also allow more programs to travel on a LAN at the same time due to their reduced bandwidth requirements.

Plan ahead

It may be difficult (though not impossible) to upgrade an existing, single-station automation system to multistation operation. Therefore, when shopping for an automation system that will handle multiple stations — or may have to in the future — look no further than the industry's top performers, and shoot high when specifying the hardware.

Four Canadian radio stations (CJOR/CKOR/CHOR/CJMG-FM, Penticton, BC) are controlled from a single studio in this Media Touch Systems' networked installation. The stations all have shared touchscreen access to spots and 5,000 music cuts stored on hard disk.

Recent trends toward consolidation are likely to continue and even increase given the imminent regulatory changes that will likely eliminate duopoly and ownership limits. The multistation automation system may, therefore, become a veritable staple in the radio engineering diet. But whether you eat them for breakfast or they eat your lunch will depend on how well you have specified and managed the system(s).

For this reason, any broadcaster considering the economies of multistation automation must realize that the savings come mostly from consolidated physical space, reduced overhead and non-duplication of hardware — not necessarily from operations personnel. The care and feeding of the automation system is a critical function, requiring specialized skills and deep understanding of general computer hardware and specific automation software. This is true even in a single-station application, but increases geometrically with multistation situations.

Meanwhile, a number of clever new automation applications are allowing single or multistation automation systems to sound increasingly less automated. One example is customized weather announcements using your choice of voice talent. Based on techniques similar to a telco's automated directory assistance system, a script list is provided for the air talent containing all the possible words and numbers needed for a weather report. The talent records these tracks (typically with several inflections for each), which are then indexed and stored on a computer's hard disk. On a regular basis, the computer calls a weather service and downloads the current area weather conditions as an ASCII text file, then scans the file data and assembles the corresponding voice tracks into a digital audio file, ready for airplay when the automation system calls for it. The same ASCII data can be used to assemble different weather reports for multiple stations, each using different voices.

Riding herd

Because monitoring multiple stations simultaneously is difficult, silence sensors are highly recommended for each channel in a multistation facility. Expected regulatory changes in unattended operations also will make such alarms welcome, encouraging many stations to consider the installation of some "intelligent" unattended functions. Beyond fulfilling the mandatory regulations, such systems can be programmed to call out and alert one or more staffers when any channel experiences more than a few seconds of dead air, or any critical component of the automation system is experiencing a fault. Different problems can be directed to different staffers, if appropriate.

Given the trend toward computerization of radio operations, another item that may become popular in the station of tomorrow is the remote CPU. A number of manufacturers offer packages that allow a computer keyboard, mouse and monitor to be placed at some distance from its associated CPU.

This offers two advantages to radio stations. First, it allows you to put the CPU's noisy fans and disk drives away from any open microphones. Live-assist applications will typically require a combo operator to have the computer adjacent to his/her operating position and announce-microphone, but only the screen and a control surface need to be there — not the CPU. Second, at an automated multistation facility, these CPU extenders can be routed to a switch, allowing a single keyboard/mouse/monitor to be used for controlling and monitoring several different CPUs. An operator can use this switch to select between CPUs, thus monitoring several separate computer automation systems or terminal points on a LAN from a single workstation.

With appropriate equipment such as this, operated by knowledgeable and well-trained personnel, radio stations can continue to find more efficient and cost-effective ways to serve their audiences and clients with automated systems.

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smaller. Designing, building and integrating large, real-time operating systems for complex radio operations is a daunting task. It's more important than ever to carefully check a manufacturer's track record with other installations and users prior to considering them.

Regardless of size, making an informed decision on an automation system is critical. You'll be using your automation system in one form or another for several years. Choosing the right one is at least as important as selecting the best transmitter, telephone system or music scheduling software for your station.

Network topologies

Any digital automation system that uses more than one computer will most likely involve a local area network (LAN). Networking allows computers with different functions to communicate with each other and share information. For example, the computer for traffic and billing can be networked to the main automation computer so that the next day's program log can be instantly loaded for airplay. Then the traffic and billing computer can retrieve the previous day's *as-aired* schedule for reconciliation with the original log.

Two major types of computer networks are: *peer-to-peer* and *client-server*. Either is preferable, but as a general rule, a peer-to-peer network (such as *Windows for Work Groups* or *LANtastic*) is better for small installations, while a client-server approach (such as *Novell*) is more appropriate for larger systems.

Both topologies work well with most automation systems currently on the market. For best performance, however, both require careful attention to cabling practice and layout. Be sure to consult with the manufacturer and install cabling and connectors *exactly* as specified.

Comparing features and "feel"

Competition and market shakeout are starting to create a sense of uniformity among automation systems. For example, if one automation system offers a new feature that automatically prints a report of outdated commercials, several other systems are sure to follow suit quickly. This healthy competition results in a substantial amount of similarity across otherwise diverse-looking systems.

Yet one important factor that sets each automation system apart is its overall look and feel to the user. While all of today's systems are becoming more user-friendly, some are still well ahead of others in this respect. Individual user preferences also may vary widely on this point.

Many users prefer the consistent menus and graphical environment of Microsoft Windows. However, Windows has traditionally been a difficult environment for computer programmers to use for the real-time applications required by on-air operations. Until recently, DOS and UNIX-based software packages could outperform Windows-based programs for such applications. Now, with the fast 486 and Pentium computers commonly available, there is virtually no gap in performance between Windows-based systems and others. A decision as to which environment is better can be based upon which feels better to the station's users.

Don't just evaluate the *playback* performance of the system. One of the most influential characteristics to an automation system's overall user friendliness is how it *records*. Recording can be handled in a manual mode (with an operator dubbing spots on the hard disk, for example) or in an automatic manner (such as taking in scheduled satellite feeds).

Operationally, note that when converting from manual to fully automated operations, *every* jingle, ID and voice announcement will have to be prerecorded and programmed for playback.

For fullest flexibility, the automation system will control a number of outboard devices during playback and recording operations. These can include CD players/jukeboxes, audio switchers, satellite receivers, DAT recorders and much more. In some cases, the interface will involve simple closures or relays. In other cases, intelligent control and status reporting can be included via RS-232, RS-422 or RS-485 interfacing.

Selecting a system

As mentioned earlier, the selection process for an automation system should involve several radio station departments. Sales and traffic departments should look at the systems to determine compatibility with existing station software. For example, if the sales department uses TAPSCAN or other qualitative data analysis program, can the current "avails" be obtained from either the automation system or from the traffic software? Likewise, the traffic department should check with its software provider to determine compatibility with any automation systems under consideration.

At WMC-AM in Memphis, an ENCO Systems' DAD486x network is used for live-assist daytime operation and overnight automation of the station's news/talk format. Seven DAD486x workstations and two file servers are linked via LAN, with separate monitors used for audio (touchscreen at right) and text (at center) displays. In this talk studio, a third monitor (at left) displays queued caller data.

The programming department's needs will also greatly influence the system purchase decision. Some computer automation systems can interface with various wire services (such as AP or ZAPNews), as well as with the National Weather Service wire. Hardware issues are also involved. For example, the program director at a live-assist station may want to have a system with separate monitor screens in the control room – one for playlist information and the other for text to be read on-air. (Stations that are automated full-time won't need an extra screen for on-air text.)

The heaviest burden in automation system selection usually goes to the engineering department. It's vital that the engineer understands the myriad func-

tions and options offered by the various manufacturers. He or she must determine their viability and importance for the station's operation. The engineer must also be aware of any installation challenges that the station's particular facility will cause (high RF environments, long cable runs, powering problems and so on). It's certainly best to discuss these issues not only with the manufacturer but with other users of the same system.

A station's engineer or consultant can also query potential vendors about the automation system's operation at the hardware level. These issues include considerations such as RAID hard-disk arrays, drive mirroring and redundant network supervision.

Reliability

It's important that station management and programming departments be made aware of the various options and costs of different levels of redundancy in the system. Some stations are willing to tolerate a certain amount of downtime, while others are willing to pay whatever is necessary to ensure 100% reliability from the system. No matter what redundant precautions are purchased or waived, station management should know clearly what level of protection they will have.

To determine the range of possibilities in this regard, a few more questions to manufacturers regarding file maintenance and hard-disk management are in order:

- What hard-drive redundancy is available and at what cost?
- How can data backups be performed? Can they be done automatically?
- How reliable are the computers being used? Do they employ industrial-grade cases and power supplies or standard office designs?
- What about file maintenance and management?
- Are there convenient screens to manage existing and outdated audio cuts? Can they be deleted automatically after a kill date?
- What about orphaned audio cuts that are no longer used but are taking up hard-disk space?
- Is there a routine for defragmenting the hard drive? Is one necessary or does the system's software handle that on an ongoing basis?

Installing the system

Installing a distributed system, such as a computer-based automation system, often involves apparent conflicts between a fixed wiring and installation scheme and a flexible one that allows for easy future expansion and change. The two approaches can be jointly accommodated, however.

First, begin your planning well ahead of the installation. If the installation is large, have plenty of space available for the system's server computer(s), hubs and their associated cabling. Plan to put centralized equipment in a computer-friendly environment. This implies filtered air in a room that can be kept at a comfortable temperature. If you'll be depending on your automation system (and who doesn't) be sure to include a UPS in your system. Treat the automation as a *mission-critical* system. The additional cost for a few extra precautions is small compared to the trouble they can prevent.

If the system to be installed involves more than two or three workstations or LAN nodes, the advice or services of a LAN expert should be sought. This is someone who has expertise in the *physical layer* of a LAN who will be more familiar with wiring practices, cable management and hardware options than many radio station engineers.

Most radio automation systems include one or more custom-built interface boxes, usually provided by the system manufacturer. For a neat and serviceable installation, it is important that the connections to these boxes be brought out to punch blocks, barrier strips or some other mass-termination system. After initial installation, there are almost always changes in the system setup. Failure to wire such interface boxes out to a flexible terminating system will usually result in an unruly mess of wires.

Remember, the system installation is probably going to last for several years. Design and wire the system so that changes in audio sources, control relays and even station formats can be accommodated easily.

Documenting the system installation is also vital. The simplest form is self-documentation, where wires and cables are clearly and effectively labeled according to function and destination. Additional documentation can take the form of written pages with wire lists, including wire type, source, destination and purpose.

Fine-tuning the system

The initial installation and programming of a modern computer-based automation system will normally see several changes and refinements before everyone is happy. Often, a new version of software that includes bug fixes becomes available between the time your system is shipped and the time it's commissioned on-air.

Additionally, your station may have particular operational needs that were unforeseen at order time. A good manufacturer will work with stations to fine-tune or even offer new or updated software modules to fulfill specific requirements. Therefore, if the system doesn't work exactly to your expectations upon initial installation, work with the manufacturer to resolve any difficulties. This process of learning and expressing specific needs is normal upon initial installations. Within a few days or weeks, you'll likely have a system that performs well and probably does more than you thought it would.

Nevertheless, at most stations a new computer-based automation system represents a large change in operating procedure for staff. For this reason, it's usually sensible to take advantage of any operator training that the manufacturer offers. Today's automation software offers such a variety of programming options that users who are self-taught may miss out on many of the software's operational features.

After the system is up and running, it's important to keep a good relationship with the manufacturer, for short and long-term viability. No matter how good your system may be at the outset, most automation suppliers continually work to improve the software, fixing problems and adding options their users ask for. Make sure your system supplier knows you're out there. If the manufacturer offers a support program by subscription, it's generally wise to avail yourself of it. The cost is usually minimal compared to the potential cost of being disconnected from support and technical help when you need it.

Step carefully

Many stations will be purchasing digital automation systems in the near future. Whether the system will replace older automation, run a new station or serve as a digital storage system for a live radio facility, careful attention to features, feel and long-term support are crucial to making the best decision. Be sure to include all interested department heads in the decision process. An integrated automation system will tie your staff and their functions together as never before.

Kirk Harnack is president of Harnack Engineering, Inc., an international broadcast contract engineering firm. Respond via the *BE Radio* FAXback line at 913-967-1905 or via E-mail to beradio@interfec.com or by CompuServe at 74672,3124.

For more information on automation systems, circle (100) on Reply Card. See also "Playback Automation," p. 89 of the *BE Buyers Guide*.

Feature:

DAB update

The dawn of digital radio approaches — slowly.

As the rest of the audio world – professional and consumer – makes steady progress toward all things digital, radio broadcasting's digital conversion seems to be lagging behind. Yet quite a bit is going on behind the scenes, and the pace is quickening. Ready or not, some fundamental changes are in store for radio broadcasters.

By Skip Pizzi, radio editor

Digital radio broadcasting continues to inch toward reality in the United States, while in other parts of the world it's moving a bit faster – but in somewhat divergent directions. The last years of this century will likely become the birthing period for new digital radio services around the globe.

In the United States, an evaluation of proposed DAB formats is moving from a lab test to a field test phase. The EIA and the National Radio Systems Committee (NRSC) have been conducting joint laboratory tests at NASA's Lewis Research Center in Cleveland since April 1994. (See "Re: Radio," March and November 1994.) The results of this first phase of testing will be presented in late August.

Meanwhile, a second phase of over-the-air tests are scheduled to begin later this summer in San Francisco, with final results expected by year's end. Delays in this complex process would surprise no one, however, and the final recommendations of the testing committees may not appear until mid-1996 or later. These recommendations will be presented to the industry, the public and the FCC, which may elect to use them in its rulemaking procedures for DAB.

At NAB 95, USA Digital Radio presented mobile demonstrations of IBOC AM and FM formats. (Photo courtesy of CBS Radio.)

Testing difficulties

The EIA/NRSC testing has been complicated by the variety of proposed formats. These include satellite and terrestrial formats, new-band and in-band systems, and in-band operation in the AM and FM bands. (See Figure 1.) Some proponents have submitted multiple systems or modes of operation (see Table 1), and improvements added by proponents during the extended process have required some re-testing at the lab.

> The NTIA has asked the FCC to deny permission to test the Eureka 147 system at L-band.

The current tests include objective measurements and subjective listening tests. For the latter, digital recordings were made in the lab under impaired and unimpaired conditions. These recordings were sent to the Communications Research Center in Ottawa, Ontario, Canada, where a well-established listening test site exists. Expert listeners from the United States and elsewhere were used for these tests, the results of which will be included in the August report.

Some concern about the validity and methodology of the tests has surfaced, particularly over the multipath prediction models used. The EIA/NRSC has expanded the multipath analysis in its tests, considering both Rayleigh and Doppler-type fading, but confirmation of the lab's multipath evaluations will not come until the field tests are completed.

Even then, the results may be inconclusive. It is not clear that a single winner will emerge from the process. This is due to the "apples and oranges" variety of formats noted earlier, plus the fact that the NRSC is charged with the IBOC format tests while the EIA handles the other formats. Members of both groups have pledged to unify the style of their reports, but this does not guarantee a singular result.

Another problem involves the experimental licensing required to perform the field tests. FCC authorization has already been granted for the IBAC format, and IBOC authorizations are expected soon. But the National Telecommunications Information Agency (NTIA) has asked the FCC to deny the EIA/NRSC permission to test the Eureka 147 system at L-band (1,452-1,492MHz) because this

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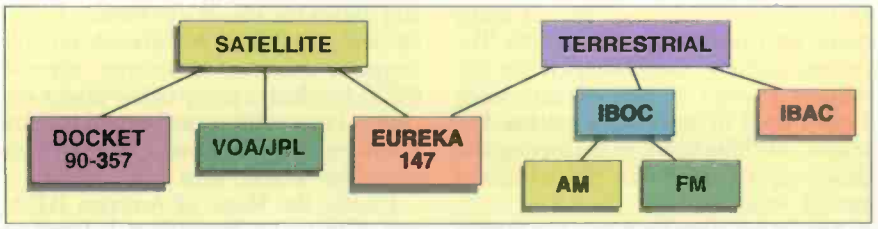


Figure 1. Format types currently under consideration for DAB. (Docket 90-357 refers to proprietary systems proposed by DBS-R service-providers currently under consideration by the FCC for S-band DAB allocations.)

Continued from page 30

band is not authorized for DAB use in the United States. The NTIA was instrumental in keeping the U.S. delegation from supporting a worldwide standard L-band DAB allocation at the 1992 World Administrative Radio Conference (WARC-92), where international new-band DAB spectrum decisions were made. Instead, the United States chose a 2,310-2,360MHz allocation – the so-called *low S-band* – for new DAB uses.

Among the EIA/NRSC proponents, only the VOA/JPL system uses the S-band. Although Eureka 147 can apparently work in the S-band, the format was submitted to the EIA/NRSC tests only in an L-band mode. Evidently, this was a calculated risk on the proponent's part, with the following strategy: If the tests confirm that Eureka 147 at L-band outperforms in-band systems, then perhaps U.S. regulators would be forced to rethink their prohibition of L-band DAB. Depending on the test results, this L-band-only testing of Eureka 147 could thereby complicate subsequent decision-making.

International disunity

Canada and a few European countries are testing or implementing Eureka 147 in the L-band. The Canadian equivalent of the FCC recently proposed the issuance of 3-year experimental L-band licenses to any Canadian AM or FM broadcaster that wished to simulcast its signal. Other entities could also apply for remaining spectrum, if any. Eventually, terrestrial and satellite signals will share the Canadian DAB band.

Most of Europe also plans to use Eureka 147, but on various frequencies in the VHF- or UHF-TV bands rather than at L-band and for exclusively terrestrial DAB. This includes the United Kingdom, where the BBC has put DAB on a fast track. Among other European countries, only France is solidly backing L-band, with Germany considering it along with VHF.

Meanwhile, European satellite-DAB applications have been relegated to backburner status given the European continent's relatively small size, high population density, multiple languages, lower mobile use of radio (only 20% mobile listening) and less advantageous northerly location for geosynchronous satellites. This has focused DAB developers in each country toward terrestrial services, where less expensive and unilateral approaches can be accommodated in each country.

Such divergence among European DAB applications shows that international DAB disharmony is not limited to the "U.S. vs. the world." Although the United States is the only nation considering an in-band approach, a multiband radio similar to HF receivers could be required for true universal reception capability, even in Europe alone.

Furthermore, if the United States settles upon an in-band standard, some other countries (particularly those with a strong private broadcasting community) may subsequently move to embrace it. A good example is Mexico, which had at first joined the Eureka 147/L-band camp, but later retracted itself to a wait-and-see mode. In-band systems would be affected somewhat differently in Europe, however, where tighter AM and FM channel-spacing rules exist.

> International DAB disharmony is not limited to the "U.S. vs. the world."

U.S. system specifics

As Table 1 indicates, in-band types are the most prevalent among proposed systems for U.S. use. One of AT&T's systems is an *in-band adjacent-channel* (IBAC) approach, which proposes to use low-power digital signals in taboo (typically second-adjacent) FM-band channels. It uses a single carrier and provides high-quality stereo audio using AT&T's *Perceptual Audio Coding* (PAC) bit-rate reduction algorithm plus 5kb/s to 20kb/s of auxiliary data.

Another of AT&T's systems, this one jointly proposed with Amati Corporation, uses the *in-band on-channel* (IBOC) method, wherein a station's digital signal shares the same channel with its existing analog FM-band carrier. The digital information is placed on multiple (up to 128) narrowband QAM carriers on the two outer edges of the channel, at low enough modulation to remain under the FM mask. A "hole" of about 200kHz is left clear in the center of the channel for the analog FM signal. Hanging the two digital "sidebands" onto the channel in such a manner has given rise to the term *saddlebag IBOC* for this method. Amati/AT&T has also submitted a one-sided variant of its system for use in certain short-spaced environments. Either system could provide high-quality stereo audio using PAC with a variable amount of auxiliary data. The system includes an 8kb/s *auxiliary overhead channel* (AOC) that allows numerous modes of adaptive operation to be communicated to the receiver.

Another new wrinkle to the EIA/NRSC testing process has emerged from this system, which has spawned another acronym, IBRC, for *in-band replacement channel*. It refers to the ability of an IBOC system to eventually "fill in" the broadcast channel with additional digital data if the analog signal that shares the channel is retired from service. Field testing of this option will require shutdown of the host station's analog carrier for some short periods, probably during overnight hours.

USA Digital Radio (USADR) is the only proponent with traditional broadcast roots. It's a consortium of Gannett Broadcasting, CBS Radio and Group W, with some other technology partners developing the hardware. USA Digital has submitted two separate FM-IBOC systems, both of which are significantly different than their original system of a few years ago. While the previous system distributed data over multiple narrowband carriers spread across the entire FM channel, their new systems use wideband carriers in a saddlebag arrangement. Adaptive RF equalization is also used to help combat multipath effects. The two current versions of USADR's FM systems (called *FM-1* and *FM-2*) differ only in their hardware implementations, with the FM-1 system using a more recent, all-silicon (i.e., less-expensive receiver) design. High-quality stereo audio using the ISO/MPEG Layer 2 bit-rate reduction algorithm and up to 64kb/s of auxiliary data are provided.

USADR also has submitted an IBOC system for use on AM channels – the only proponent to do so. It places digital information across the AM channel using phase and frequency modulation so it is not detected by the analog AM receiver as anything other than a slight elevation in the noise floor. It is not

compatible with C-QUAM AM stereo, however, requiring the analog AM signal to be limited to monaural operation. The system provides substantial improvement in audio quality over analog AM (with quiet, 15kHz stereo audio, using a variation of ISO/MPEG Layer 2), and it offers a small amount (2.4kb/s) of auxiliary data.

At NAB 95, National Semiconductor showed a mock-up of a single receiver chip for USADR's AM and FM IBOC systems that could be added to a standard AM/FM receiver for small additional cost. USADR also presented mobile demonstrations of its FM-1 and AM IBOC systems at NAB 95. Observers noted that AM-IBOC signals were lost under some obstructions, and that FM signals suffered some problems from severe multipath conditions. Nevertheless, most listeners were favorably impressed, particularly by the AM-IBOC system's performance, and USADR representatives took pains to note that the systems' development is far from complete.

The most frequently noted problem with the FM-1 system during the demonstrations was a kind of digital receiver "blend" function, in which the digital audio degraded to a noticeably lower fidelity condition and then either muted completely or returned to high-fidelity. (The analog audio usually was unlistenable at these locations.) USADR explained this as an early implementation of the system's "graceful failure" function, which it claimed will be enhanced to provide a much smoother stepping-down from high-fidelity to full muting, through the addition of many more intermediate quality modes. The demonstrations also illustrated the significant amount of time-domain interleaving used by the IBOC systems. Listeners switching between the analog and digital signals noted time differentials of several seconds.

Among new-band systems, the Eureka 147 format allows up to six separate high-fidelity stereo audio signals to be multiplexed into a 1.5MHz-wide channel in the L-band, each with some auxiliary data capacity. The actual configuration of the Eureka *ensemble* of signals in the 1.5MHz channel is adjustable. Any or all of the audio services can be selectively downgraded to mono or lower audio bandwidths to allow more capacity for auxiliary data. (A fully loaded 6-channel, all-CD-quality ensemble only offers about 2kb/s of auxiliary data per audio channel.) Additionally, the error-correction capacity of each audio and data service can be independently set across a range of options.

Coded orthogonal frequency division multiplexing (COFDM) is employed in the Eureka 147 system, using hundreds of small carriers closely spaced across a wideband channel. This provides freedom from most multipath interference and allows the use of on-channel boosters and gap fillers. A variation on this theme is the *single-frequency network* (SFN), by which a group of low-power, co-channel transmitters can be used to carry the same program(s) over a large and/or irregularly shaped area.

Finally, the Voice of America (VOA) and NASA's Jet Propulsion Laboratory (JPL) have proposed a DBS-only DAB system that would use the S-band allocation (although it is of modular design and adaptable to other bands) with inexpensive receivers. The VOA's intention is to eventually replace its worldwide network of HF transmissions with this satellite-delivered, multichannel audio service. It uses the PAC algorithm for a range of possible fidelity levels in mono and stereo.

FORMAT	METHOD	MODES TESTED	AUDIO CODING
AMATI/AT&T	IBOC-FM	2	PAC
AT&T	IBAC-FM	1	PAC
EUREKA 147	NB (L-band)	2	ISO/MPEG L2
USADR AM	IBOC-AM	1	ISO/MPEG L2
USADR FM-1	IBOC-FM	1	ISO/MPEG L2
USADR FM-2	IBOC-FM	1	ISO/MPEG L2
VOA/JPL	NB (S-band)	1	PAC

Table 1. DAB formats and their modes currently under testing by EIA/NRSC for use in the United States. (IBOC=In-band, on-channel; IBAC=In-band, adjacent channel; NB=New band; PAC=Perceptual Audio Coding; L2=Layer 2.)

DBS digital radio

While the EIA/NRSC tests these systems, another proceeding is making its way through the FCC under its Docket 90-357. It involves four proponents for mobile DBS radio (DBS-R) or what the FCC calls *Satellite DARS*, which will also use the S-band allocation noted earlier. (See Table 2.) Unlike the EIA/NRSC process, which deals with technical standardization for hardware, the Docket 90-357 issue primarily concerns the licensing of DBS-R service providers. The winning proponent(s) under Docket 90-357 would become national broadcasters beaming 30 or more channels of digital audio service to a new class of fixed, portable and mobile receivers using small disc or plate antennas.

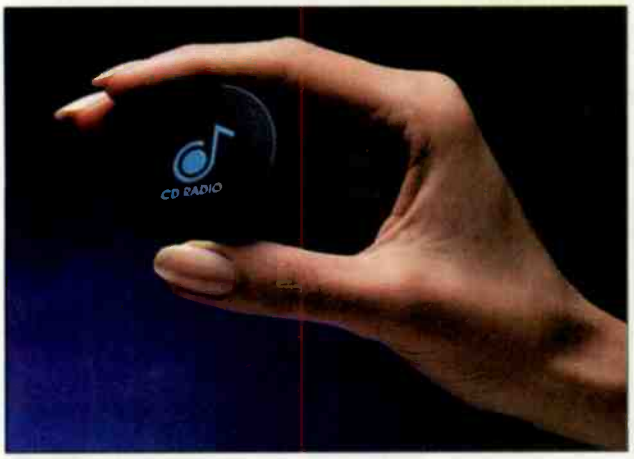
FCC rulemaking on this issue is expected soon, probably next year. Once authorized, DBS-R proponents claim it will still take three to five years before their services can begin.

More immediately, another form of

PROPONENT	AUDIO CHANNEL	SPECTRUM REQUIRED	TERRESTRIAL COMPONENT	SUPPORT SCHEME[a]	SYSTEM COST
AMERICAN MOBILE RADIO	21[b]	15MHz	NO	SUB+ADV[c]	$528M
CD RADIO	66	25MHz	YES[d]	SUB[c]	$385M
DIGITAL SATELLITE BROADCASTING	512[e]	25MHz	YES	SUB+ADV[c]	$622M
PRIMOSPHERE	30[b]	25MHz	NO	ADV	$373M

NOTES:
a) Each system's business plan describes whether revenues will come from user subscription fees (Sub) or from advertising sales (Adv).
b) Multiple audio fidelity levels offered, from speech-quality mono to CD-quality stereo.
c) Some program channels may be provided by existing broadcasters.
d) Terrestrial repeaters for satellite "gap-filling" also carry multichannel signals from local broadcasters.
e) Includes national channels plus separate regional channels on spot beams (16 channels per beam).

Table 2. Current DBS-R proponents under FCC Docket 90-357 and some parameters of their systems.



CD Radio, a Docket 90-357 applicant, has proposed this antenna for reception of DBS-R signals.

DBS radio service has already begun. Two DBS-TV services – DIRECTV and Primestar – currently offer multichannel digital audio services. This form of delivery is more specifically known as *direct-to-home* (DTH), meaning that it is not available on mobile or portable receivers. In this respect, it is similar to digital cable audio services. (In fact, DIRECTV's 30-channel audio service is provided by Music Choice, formerly Digital Cable Radio, while Jones Intercable provides the 12-channel audio service for Primestar.)

The NAB has filed objections to the FCC regarding Docket 90-357 outlining a number of items that it feels the commission should include in its rulemaking. These include the following:

- DBS-R should be subscription-based only so that it will not compete with terrestrial radio for national advertising dollars.
- DBS-R should not be given any head start in authorization over terrestrial DAB.
- There should be no terrestrial repeaters or other non-satellite components allowed.
- The application process for DBS-R service providers should be reopened so more than the current four applicants can be considered.
- DBS-R service providers should be held accountable to the same standards and public service requirements that U.S. broadcasters have traditionally been subject to. Rulemaking should encourage providers to serve niche audiences with formats that are only viable when aggregated in a nationwide DBS environment.

Other issues that have surfaced during discussions among broadcasters include the disparity between the 50MHz of spectrum allocated to DBS-R vs. the 21MHz that terrestrial radio broadcasting occupies, and the notion that DBS-R spectrum should be auctioned instead of awarded to applicants.

Significant fear and loathing of DBS-R abounds throughout the radio industry. Industry analysts have encouraged radio stations to emphasize their local services because these cannot be duplicated by DBS-R providers. Yet even this may not hold completely true. One of the current DBS-R proponents plans to deliver its signals both on national beams and market-specific *spot beams*. Furthermore, if DBS-R radios are required to be addressable (for subscription purposes),

then customized – and thereby localized – services might also be delivered by the national service providers. Even without addressable receivers, a form of *pseudo-addressability* can be offered whereby the user sets up a profile on his/her radio that filters nationally broadcast data and audio streams into a "custom-assembled" service.

On the other hand, some of the Docket 90-357 proponents have included options for incorporating local broadcasters' signals into their services. (See Table 2.) In most cases, these channels would be leased to broadcasters as either national or local/regional distribution services.

Mobile DBS-R may actually arrive first on the international scene. The U.S. firm Worldspace (formerly Afrispace) is continuing its quest to provide worldwide DBS-R service in another portion of the L-band (1,470-1,530MHz, for which it is licensed even in the United States). It has contracted with the French telecom firm Alcatel to build three high-powered satellites, expected to be launched in 1997 and 1998. Each satellite will transmit three separate beams (presumably to be aimed at different countries) with up to 96 audio channels per beam. Motorola is developing the portable *Starman* receiver for the system, using a credit-card sized antenna to receive satellite DAB and terrestrial analog (HF, AM and FM) signals, and projected to retail for less than $100.

Many questions remain

A critical unresolved issue is whether terrestrial DAB is a *replacement* or an *expansion* service for broadcasters. In the replacement case, DAB service merely provides a higher-quality delivery mode for existing radio broadcasts, similar to the current plan for advanced TV broadcasting in the United States. Under an expansion scenario, DAB could allow existing broadcasters and possibly other parties to provide new channels that would add to those available via traditional analog means. This is similar to the AM-FM expansion of the 1960s and 1970s, where initial simulcasting on the two bands was phased over to separate programming. (See "Editorial," p. 4.)

It now seems technically possible for any of the current U.S. proponents' systems to provide separate (non-simulcast) audio services via DAB. Particularly in the IBOC case, there will be no "old" (analog broadcast) spectrum to reclaim, so the indefinite maintenance of analog and digital services in the radio broadcast bands would have no significant societal downside (other than slightly increased power consumption by transmitters). But just how the FCC would manage the assignment of any new channels remains a complex issue. DAB regulations will also have to address what types of services licensees will be allowed to place on their new digital signals under both "main" and "auxiliary" rubrics.

Given the activity on the technical and regulatory fronts, it seems clear that the days leading up to the launch of digital radio in the United States will be lively and contentious. It also will be a time with great potential for either a positive or negative impact upon American radio stations.

An international discussion group (LISTSERV-type) called *RADIO-L* has been established on the Internet. To subscribe, send E-mail to LISTSERV@vm1.spcs.umn.edu and place the following text (only) as the body of your message: SUBSCRIBE RADIO-L <your name>.

Respond via the *BE Radio* FAXback line at 913-967-1905 or via E-mail to beradio@intertec.com or by CompuServe at 74672,3124.

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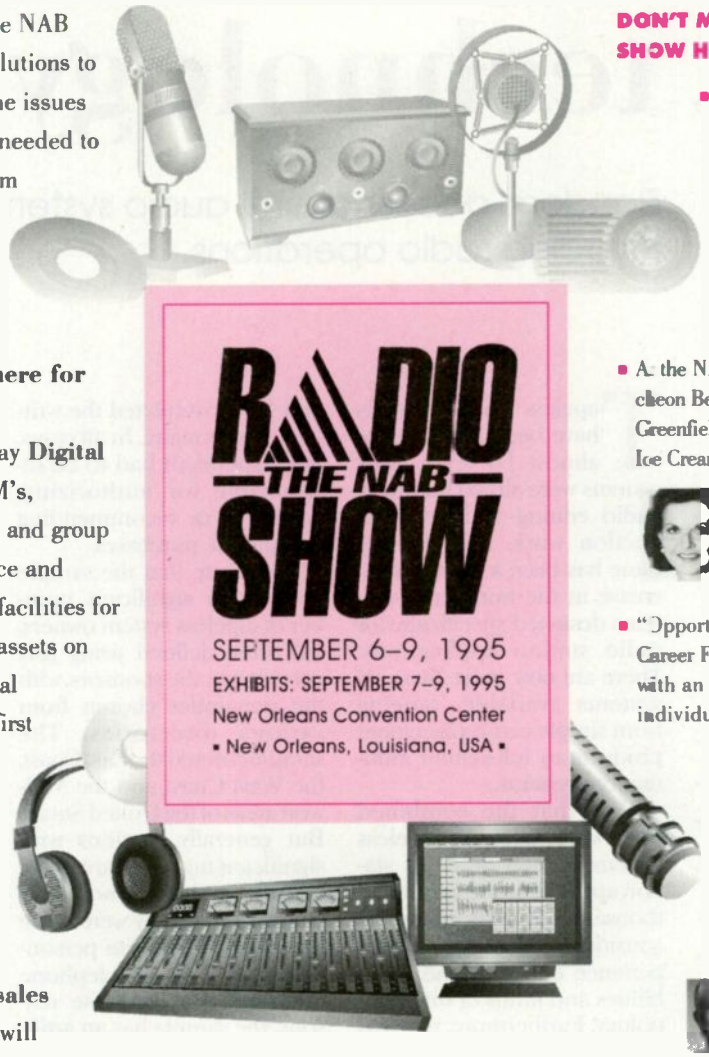

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- At the NAB Radio Luncheon Ben Cohen and Jerry Greenfield of Ben & Jerry's Ice Cream share their secrets to success and Nancy Widmann, President of CBS Radio, receives the National Radio Award.

- "Opportunity '95: The Complete Radio Career Fair" provides managers and owners with an opportunity to meet qualified individuals seeking careers in radio.
- Join FCC Chairman Reed Hundt at the Friday morning FCC Chairman's Breakfast and meet Commissioners James Quello and Susan Ness, along with other high level FCC staff, as they take part in a variety of regulatory sessions.

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Survey:

Tapeless technology

By Stella Plumbridge

Random-access digital audio systems are invading radio operations.

{A number of U.S. radio stations were recently surveyed on their thoughts and experiences with tapeless audio systems. The survey included stations that had already acquired such equipment and those that had not. Their responses provide an interesting look at an industry in transition.}

Tapeless audio systems have been available for almost 10 years. Early systems were aimed mainly at audio editing and post-production work, but recently there has been a dramatic increase in the number of systems designed specifically for radio station applications. There are now more than 50 systems available, ranging from simple cart-replacement products to full-station automation systems.

Now that the combined worldwide sales of tapeless systems aimed at radio station applications runs into the thousands of units, there is a considerable base of user experience regarding the capabilities and limits of this technology. Furthermore, tapeless technology has a high profile at trade events and in the trade press, exposing much of the industry to these systems and related information.

The survey

The aim of this survey is to provide comprehensive feedback from the user's point of view. The survey was sponsored by *BE Radio* and a number of manufacturers, including AMS Neve, Basys, Broadcast Electronics, Computer Concepts, Harris Allied, Korg, RCS, Sony and Studer Digitec. However, the method and results were managed independently by SYPHA.

The survey data was collected between the spring and fall of 1994. The format of the survey was an initial telephone interview, followed by an in-depth written questionnaire; 477 participants completed the telephone interview and 228 completed the written questionnaire. In all cases, the respondent had to be responsible for authorizing, specifying or recommending equipment purchases.

To ensure that the sample included a significant number of tapeless system owners, half were defined using lists provided by the sponsors, with the remainder chosen from various directories. The sample covered the East Coast, the West Coast and the Midwest areas of the United States. But generally, stations with significant market shares were chosen in major towns and cities because they were more likely to have on-site personnel to complete the telephone interview. For all these reasons, the sample has an artificially high proportion of owners of tapeless systems and may not be representative of smaller-station operations.

Because tapeless technology encompasses several different applications in radio broadcasting, systems were classified into three categories: simple cart replacement, cart/full automation and production-only systems.

Simple cart replacement systems

The level of awareness and knowledge of simple cart replacement systems was somewhat low, with only 44% of the sample knowing of at least one system. The majority knew of the Fidelipac *Dynamax DCR 1000*, the 360 Systems *Digicart* and the Broadcast Electronics *Disc Trak*. (Figure 1 shows the proportion who knew of at least one system for each of the three system categories.) Not surprisingly, system owners tended to be more informed than non-owners.

Ownership of simple cart-replacement systems was low – only 3% of the sample. However, this low percentage may be somewhat skewed by the methods used to define the sample. The range of simple cart-replacement systems owned also was small, generally divided between *Dynamax DCR1000* and

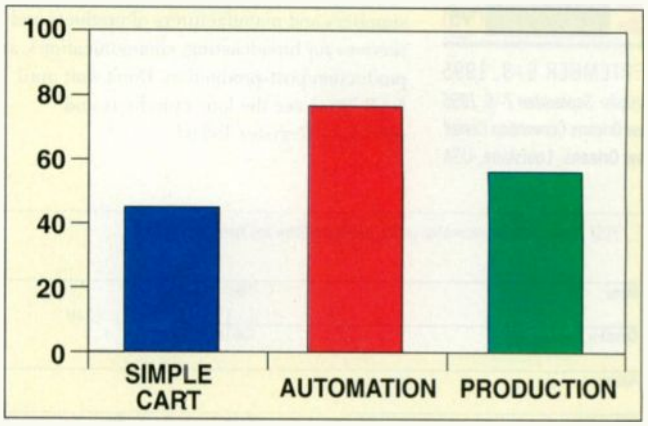

Figure 1. Awareness of tapeless systems (excluding systems owned).

Stella Plumbridge is a founding consultant of SYPHA, a consulting and research firm specializing in random-access audio and video technology, in London, England, UK. Respond via the *BE Radio* FAXback line at 913-967-1905 or via E-mail to beradio@intertec.com or by CompuServe at 74672,3124.

Digicart. All owners had purchased multiple units.

When respondents were asked which media they thought suitable for simple cart-replacement purposes, hard disk was the winning medium, with MiniDisc and floppy disk also receiving a high response.

The main reasons owners gave for having purchased a simple cart replacement system were improved quality and reliability, while the main reasons they had purchased a particular system were its ease of use and cost. It is interesting to note that most users were concerned with system features rather than the manufacturer. Of the features considered essential, reliability, ease of use and digital editing were most critical.

Approximately 53% of the owners had experienced some problems with their systems or with integrating them into existing facilities. The difficulties cited mainly involved hardware or software issues, but some problems with manufacturers and their services were also noted.

When asked to consider the range of tapeless systems now available, all except one of the owners would still purchase the same simple cart-replacement system. The one owner who would opt otherwise would prefer to invest in a hard-disk-based cart automation system.

The main advantages non-owners gave for simple cart-replacement systems were improved quality and reliability, while the main feature cited as needing improvement was the user interface. Only 25% of those asked stated that they were likely to invest in a simple cart-replacement system. Note, however, that a high proportion of those who were unlikely to invest already had cart automation or full automation systems.

Of those likely to invest, the majority planned to do so within the next three years, with budget and age of existing equipment primarily responsible for this time frame. The main reasons given for purchasing were improved quality, the need to replace existing equipment and reliability. Features cited as essential were ease of use and reliability. The main reasons given for not investing were the need for a more powerful system and cost.

Cart/full automation systems

There was a relatively high awareness in this category, with 70% knowing of at least one system (excluding systems owned by respondents). A high proportion of the U.S. sample knew of the Arrakis *Digilink*, the Computer Concepts *DCS*, the Broadcast Electronics *AudioVAULT* and the DHK *Audisk*. As with simple cart replacement, owners tended to be more informed than non-owners.

The range of automation systems owned was fairly wide. *DCS* was owned by the most respondents, with the next position approximately shared by *Digilink*, *Audisk*, Broadcast Electronics' *Sentry*, the ENCO Systems *DAD486x* and the RCS *Master Control*. More than 90% of automation systems owners had purchased multiple units or workstations, with the average being two to three units.

The main reasons owners gave for having purchased an automation system were improved quality, economics and, of course, to provide live assist or automation. The main reasons they had purchased a particular system were cost, best available and reputation of the manufacturer. Of the features given as essential, ease of use and reliability were of greatest concern. Other important issues included the desire to reduce personnel and the need for systems to accommodate satellite operations.

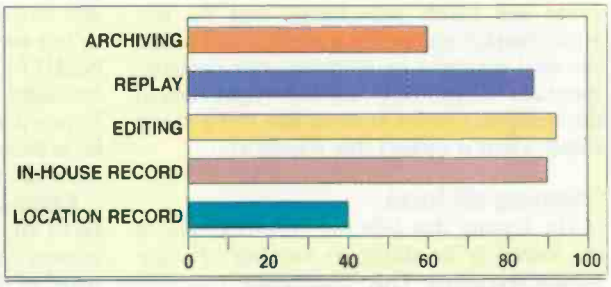

Figure 2. Percentage of respondents who felt that tapeless technology will replace conventional tape technology in various applications.

In this category, 62% of owners experienced some problems with their systems or in integrating them with existing equipment. Again, equipment and service issues were noted. Some of the problems experienced were of a serious nature, such as "instability of software forced it to be withdrawn from service," and "sales staff lied." Approximately 66% of owners thought that technical or operational assistance provided by the supplier could be improved.

When asked to consider the range of tapeless systems now available, only 77% of owners would still purchase the same automation system. Several of the owners who would not purchase the same system stated that they would analyze the market more carefully or wait for the technology to develop further.

About half of the respondents who did not already own such a system stated that they were likely to invest in one. Of those likely to invest, again the majority planned to do so within the next three years, and again, budget and age of existing equipment was primarily responsible for the timing. The main reasons given for not investing were cost and that automation was not suitable for the station format.

Production-only systems

The level of awareness of production-only systems (often called digital audio workstations or DAWs) was moderate with 55% knowing of at least one system (other than those already owned). A high proportion of the respondents knew of the Orban *DSE 7000* and the Roland *DM-80*.

Ownership of production-only systems was fairly low, at 25% of the sample. Among non-owners, 47% said that they were likely to invest in DAW systems.

Digital audio transfer

Overall, there was a clear preference for digital tapeless methods of transferring audio material around the station. Response was fairly evenly split between using data-compressed or uncompressed audio for networking with concerns expressed about the effects of lossy compression particularly with multiple coding and decoding generations.

Among those using digital lines, the majority employed Switched-56, although ISDN and T-1 were also being used. Coding schemes used included ISO/MPEG Layer 2, AC-2 and G.722.

The future

On the whole, radio has been one of the slower areas of the audio industry to take up tapeless technology. However, with the introduction of systems aimed at every type and size of station, this is changing, and radio now represents a major growth area for the technology.

Figure 2 shows how this survey's respondents felt about tapeless technology replacing conventional technology in various applications. Overall, it indicates a rosy future for tapeless system manufacturers.

Editor's note: Copies of the full report "Tapeless Technology in Radio Applications: the User's Point of View" are available for $380 from SYPHA, 216A Gipsy Road, London SE27 9RB, UK. Tel: +44 181 761 1042, fax: +44 181 244 8758.

Field Report:

HHB PortaDAT PDR1000

By Flawn Williams

Performance at a glance:

- Mid-price portable DAT recorder with many unique features
- Fully professional design, not an upgraded consumer deck
- Rugged construction based around computer data transport
- Confidence heads allow off-tape monitoring
- Long-play mode allows double-length recording and dubbing
- Flexible microphone inputs with phantom power
- Versatile ID marker system.

The market for portable DAT recorders has gradually polarized into two camps. On one end are a few high-quality audio machines aimed at film and video production, sporting SMPTE time code, off-tape monitoring and many helpful features to make them worthy successors to the venerated Nagra analog recorders. The price for these features can run well up into five figures.

At the other end of the spectrum are a dozen or so inexpensive models, some aimed directly at the personal stereo consumer market, while others are pitched to the radio and pro-audio market but still showing their consumer roots.

The gulf between these two groups, in terms of price and features, has been huge. But one new entry into the field, HHB's PortaDAT PDR1000, has landed squarely in the middle ground, offering a professional field recorder that's within range of mortal audio budgets.

The PDR1000 is built around a DDS computer-data transport, with separate direct-drive motors for each function. With DAT's original market in the consumer audio world still barely percolating, and the pro audio market remaining a pretty small niche, the real progress in research and development of DAT products has been happening in the computer world. It looks like HHB chose wisely when it picked this transport.

Listening off tape

The feature that lifts the PortaDAT above the crowd is its ability to monitor off tape during recording. This *confidence monitoring* is made possible by having four heads on the 30mm head drum and separate record and replay circuitry.

Confidence is almost too mild a term. Not only can you be confident that data is making it properly onto and off the DAT tape while recording, but you also can hear the sound after it has travelled through the whole A/D and D/A cycle, instead of just listening to the input signal.

The time delay between record and replay is about an eighth of a second, which is longer than you might expect. It's about the same as a reel-to-reel recorder running at 15ips. This makes it easy to distinguish in the headphones, but it's also long enough to cause echoes if loud headphones leak into sensitive nearby microphones. (Yes, there's plenty of gain on the headphone output.)

Ins and outs

The PortaDAT's designers have packed an impressive array of controls and connections onto the small chassis in a sensible layout. This is currently the only portable DAT recorder available for under five figures that can handle most radio recording assignments without external accessory boxes – and HHB has priced it at less than half that amount.

On the right side panel are XLRs for analog inputs and AES/EBU digital I/O. RCA jacks are used for the analog outputs and the S/PDIF digital connections. (Not a stereo mini-jack in sight here, happily.)

Mic/line switching, 30dB attenuation and high-pass filtering are each independently selectable on left and right analog input channels. This makes the machine a good choice for doing "split track" recordings, where two separate mono sources (often of differing level and/or tonal quality) can be recorded on a single tape for later mixdown.

The input amplifiers are not the quietest in the industry, however. If you're looking for a deck to record quiet nature sounds with dynamic mics, then look elsewhere. But the PortaDAT sounds great when used with modern condenser mics, exhibiting less grittiness or harshness than some other portable DATs. To get comparable quality from cheaper DAT decks, you'd need to use a high-quality outboard mic pre-amp.

Phantom power of the 48V-balanced variety is available at the flick of a switch. For 12V T-powered mics, you'll have to provide an outboard supply.

Power consumption

Portable DATs are notoriously power hungry, but the PortaDAT performs quite respectably in this regard. The deck is rated by HHB to run two hours on an internal rechargeable NiMH battery if the phantom power and the backlight for the LCD display are turned off. In practice, this kind of record time seems to be achievable even with phantom power and backlighting on.

External power can be drawn from the HHB AC supply or from any stable +12V source, via a 4-pin XLR socket on the left side panel of the deck. The deck's AC supply can provide 12VDC to run the recorder or to charge a battery, but the user must switch it between these two functions. If you're not careful, you could start using the deck on the AC supply without realizing that it's set to the charger mode. In such a case, you're still running the deck off the battery even though the AC supply is plugged in. Luckily, a beeper alerts you to a low battery condition.

The AC supply/charger holds two batteries, which it charges sequentially. One of the two battery bays can also recondition batteries to reduce memory effect. Charging a single battery takes 1.5 to 2 hours, with full reconditioning that requires six hours.

Talking digitally

The deck supports 48, 44.1 or 32kHz sampling rates at 16-bit resolution via either AES/EBU or S/PDIF formats. Using the analog inputs you can also select the *long play* (LP) mode double the record time of any DAT cassette with a sampling rate of 32kHz and 12-bit non-linear resolution.

The deck also can accept a 32kHz 12-bit digital signal from another LP DAT deck via its digital input and record it properly at half speed. This unique feature allows more productive use of the LP mode for "FM-quality" voice recordings.

The wide array of digital and analog inputs and outputs, as well as the off-tape confidence monitoring, makes the PortaDAT as useful in the studio as it is in the field. HHB has even provided a remote-control jack on the left

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panel of the PDR1000 for eager interfacers who'd like to interface the machine into their studio control systems. (HHB does not market a remote controller for the unit.)

Transport functions

The transport controls are well placed on the top and front panels of the PortaDAT. There's enough variety of shape and texture in the controls to make it possible, with practice, to operate the deck without looking at it.

But there are a few quirks in the transport. First, the deck cannot store commands: one command must finish executing before the next can be entered. Also, the fast forward function will not permit fast-wind over unrecorded tape. When the deck senses unrecorded tape, it stops and cues back to the last recorded data. This prohibits the user from "exercising" a new DAT cassette, as some tape manufacturers recommend.

So if fast forward behaves that way, what's the difference between it and the *end search* function, which is provided on a separate button? On the PortaDAT, end search winds back all the way to the top of the tape, then searches forward for blank tape or an end mark. (On many other decks, the end search command winds back only far enough to find the most recent PNO number, so that it can continue assigning PNO numbers in sequence.)

Subcode data

The PortaDAT shows its professional intentions in the way it handles subcode markers. Older machines have just included some variant of the original consumer features, but HHB has taken a fresh approach.

First, the *start ID/program number* (PNO) system is well thought out. There are two modes for writing these markers: automatic and manual. The automatic function writes a marker whenever recording is started. It also places a marker every time the audio level falls below a threshold for a few seconds and then gets loud again.

In the manual mode, the recorder will write a marker only when the front-panel button labeled *ID write* is pushed. No marker is created when the machine starts recording or leaves the record/pause mode. This allows the user to place IDs only where desired, without having to wade through extra markers from later.

Buttons are provided for *ID erase* and *PNO renumber* functions. There's also an end mark subcode marker to speed the process of finding the end of recorded information on the DAT.

Timing information is also written in the subcode. The basic PDR1000 deck writes *absolute time* (A-Time), plus date-and-time stamp information. A SMPTE time-code-capable (R-time) version of the deck is also available (PDR1000-TC). The LCD display can also show *margin*, which stores and displays on two digits the level of loudest audio peak in a recording.

Built for the field

The PortaDAT has been designed for ruggedness and survivability. The DAT transport is nested beneath a double hatch door to keep out dirt and moisture, and an excellent fabric carrying case is included with the machine. The headphone control knob pops up with a light push for adjustment, and then slips back into the machine with another light push.

There's a small speaker on the top panel, far from hi-fi, but adequate for some cuing purposes. It's muted when headphones are plugged in, and also is inactive during recording from analog inputs. But when a digital input is selected, the speaker can remain on during recording -- a handy feature, but a potential feedback trap if you're recording in the field with a digital mixer.

Protecting the investment

While HHB has a strong reputation in England, the deck is being imported and represented here in the United States by the relatively small Independent Audio. An impressive list of regional dealers has been assembled to sell the PortaDATs, however. As with any major purchase, find out from your dealer what the service turnaround time, parts inventory and loaner policy are.

HHB recommends the use of a head-cleaning tape when the heads or tape path need cleaning. But if you're not keen on using abrasive tape to remove the debris, removing four screws will get you adequate access for manual cleaning. And simply removing another three screws lets you remove the entire transport.

Overall, HHB has brought a useful machine to the marketplace. The PDR1000 doesn't match all of the capabilities of today's top-flight (and far more expensive) portable DAT recorders, but it offers a strong combination of truly professional features and quality at a price not far above the modified consumer machines.

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

For more information on the HHB PortaDAT PDR1000, circle (106) on Reply Card.

FCC proposes rules for DAR satellite service

A Notice of Proposed Rulemaking (NPRM) has been issued by the FCC regarding a new satellite digital audio radio service (DARS). This service will provide 30 or more channels of national digital audio programming tofixed and mobile receivers, with the potential for each licensee to offer CD-quality audio channels. (See "DAB Update" p. 30.)

The FCC has requested comments on the following issues: how many nationwide licenses should be awarded; how much spectrum each licensee should be assigned; how licensees should be selected if mutually exclusive applications are filed; how the service should be regulated; and whether licensees should be permitted to use some of their spectrum for non-DARS services.

Licensing options include assigning all of the available spectrum (2,310-2,360MHz) to only the four current DARS applicants, licensing some of the spectrum now and holding some in reserve for future applicants or opening up the spectrum to all interested parties. If the FCC decides not to allocate the entire spectrum to the four current applicants, it has tentatively concluded that licenses should be awarded through the auction process.

The FCC has proposed that licensees begin construction of their first satellite within one year of grant of their applications. The proposal also requires the launch and operation of the first satellite within four years of a license grant, and full operation of a satellite system comprised of more than one satellite within six years of grant.

The deadline for filing comments is Sept. 15.

DAR testing nears completion

After a year of laboratory testing and evaluations, seven digital audio radio (DAR) systems are about to leave the National Aeronautics and Space Administration's (NASA) Lewis Research Center in Cleveland and move to the field-testing stage in San Francisco.

The testing is being conducted at the Lewis Research Center under the aegis of the Electronic Industries Association's (EIA) DAR Subcommittee and the National Radio Systems Committee's (NRSC) Digital Audio Broadcast (DAB) Subcommittee. The NRSC is a joint EIA- and NAB-sponsored committee. The NRSC DAB Subcommittee oversees the testing of in-band/on-channel (IBOC) systems; the EIA DAR Subcommittee manages the testing of all other systems. (See "DAB Update" p. 30.)

The subcommittees collect information from DAR system proponents, formulate test methods to evaluate potential systems, oversee proponent testing, establish system selection criteria and develop a voting procedure through which a final DAR system or set of criteria will be recommended to the FCC.

The subcommittee recognizes that the testing process cannot produce a numerical result that indicates the best system for use. But it will provide quantitative answers to the degree and practical significance of technical design compromises each system has made to meet service objectives.

The overall objective has been to help ensure that the United States adopts a radio service that will meet the needs of the public to the greatest extent technically possible and that this service will be available in the near term. Measuring how well a system meets the public's needs requires that the subcommittee evaluate quality of service, range of services, cost of providing/receiving the services and the time required to make all required infrastructure available. The service objectives adopted by the subcommittee are: CD-quality sound; immunity to multipath and other interference; no objectionable interference to other services; minimization of transmission costs and reception complexity and costs; additional data capacity; and deregulation at the reception area threshold with a minimum of objectionable artifacts.

Quality assessments and digital impairment testing have been completed. Analog compatibility testing will conclude shortly and laboratory test results will be released by the end of this summer. Field testing will begin in August in San Francisco. The subcommittee plans to present its findings to the FCC by the end of the year.

EIA RDS program update

The Electronic Industries Association (EIA) met with FM radio broadcasters in the Los Angeles market in July regarding its nationwide campaign to provide them with Radio Data System (RDS) capability almost cost-free.

The Los Angeles meetings were followed by similar sessions with FM broadcasters in the New York market at the end of July. This visit completed the EIA's introduction of the top-5 market broadcasters to the new listener and revenue-producing features that RDS technology offers.

In exchange for providing stations with RDS encoders, radios, software and technical support, the EIA seeks advertising or underwriting credits to be used in consumer awareness promotions.

The EIA nationwide program is planned and funded to add RDS to the nation's FM broadcast system and boost awareness of this new radio technology.

NAB supports Senate version of Telecommunications bill

The NAB has responded favorably to the Senate for passage of the telecommunications bill. According to NAB, the radio ownership deregulation that was included in the bill will be instrumental in helping the radio industry remain an important and competitive player in tomorrow's communications marketplace. The legislation also included other broadcast reforms, including 10-year license terms for radio and television and license renewal reform.

NAB's Jobline operates 24 hours and checklist booklet available

The NAB's Employment Clearinghouse Jobline is available 24 hours a day. The clearinghouse collects résumés for referral to broadcast stations for jobs ranging from entry-level to managerial positions. To assist employment seekers, the Jobline runs recordings of jobs. On a daily basis the categories change: Monday – on-air talent; Tuesday – sales; Wednesday – production; Thursday – engineering; and Friday and weekends – news.

The Jobline phone number is 202-429-5359. For more information about the NAB Employment Clearinghouse or the Jobline, contact Mike McKinley at 202-429-5497 or E-mail at mmckinley@nab.org.

In other NAB news, the organization's legal department has produced a booklet entitled *Checklist for On-Air Radio Personnel* that has been mailed to all radio members. The booklet provides information for on-air radio personnel about specific FCC rules and policies, plus other laws that affect radio broadcasting. The checklist is designed to help stations avoid FCC fines.

The booklet describes each issue, citing the FCC rules and/or other applicable federal law, plus references to

Correction

Due to a reporting error, two new products noted in *BE Radio's* NAB coverage (May/June 1995, p. 34) were associated with an incorrect manufacturer. The STL-1 and STL-2 frequency-agile composite studio-to-transmitter links are manufactured by Energy-Onix.

BUSINESS

Harris Corporation's broadcast division has received a contract to provide seven 600kW solid-state medium-wave transmitters for the People's Republic of China (PRC). The contract was awarded by the PRC's Ministry of Radio, Film and Television and includes on-site commissioning and final acceptance for the first two transmitters, as well as factory training at Harris Broadcast Division headquarters in Quincy, IL.

Slated for delivery later this year, the Harris 600kW transmitters will replace old tube-type transmitters at some sites in China.

Beta testing has begun on interconnect software for **Orban**'s DSE 7000 digital audio workstation and **Broadcast Electronic**'s AudioVAULT digital audio delivery system.

In operation, a network adapter is added to the DSE 7000. The BE system recognizes spots sent from the DSE as if they came from another AudioVAULT workstation. Mono or stereo productions originated on the DSE 7000 may be sent directly into the AudioVAULT's database, where they are immediately scheduled for on-air playback via any AudioVAULT workstation in the system.

Harris Allied and **Sage Alerting Systems Inc.** have signed a letter of intent for Harris Allied to market and distribute Sage emergency alerting equipment. The Sage equipment has been designed for broadcasters in response to the Emergency Alert System (EAS) recently mandated by the Federal Communications Commission.

Industrial Computer Source has released its new *1995 Computer Systems Edition 3* Source-Book for data acquisition and control. The 128-page catalog features approximately 25% new products, including up to 100MHz single-board Pentium CPUs, SB585TCP series; full-featured ISA bus CPU boards with PCI video and IDE, SB486PV series; embedded system CPUs with PC/104 bus, 386SX/486SLC models; Alpha AXP RISC systems with 166MHz CPUs, 11500 series; and self-contained, full-height RAID 3 or 5 systems, Micro Array 2000.

Product sections include: CPUs; rackmount, benchtop and floor-mount chassis; chassis with monitor; embedded controllers; disk drives and memory backup systems; networking; video, graphics and communications cards; digital and analog I/O; and PC instrumentation.

Each product description contains specs, ordering and price information. A reference section at the front provides easy-to-use directions for configuring and ordering various combinations of system chassis, CPUs, backplanes, memory, peripherals and accessories.

Communications Data Services Inc. has added new remote-access program elements as part of its Online Engineering Services database.

Also available are an AM Groundwave contour calculation program and offsite user access to a Soil Conductivity Retrieval program, with a choice of either the M3 or R2 database.

The ability to conduct RF Propagation Analysis studies from an engineer or technician's own PC has also been made available. The output of the study is a pictorial map showing the location of selectable signal levels within the area of the study.

ComStream has announced the installation of a digital audio satellite network for Radio Vatican, allowing the station to broadcast Catholic news and events to church centers all over the world, rather than just within the broadcast range of The Vatican.

DG Systems announced the electronic link of its 2,000th U.S. radio station on its DG Systems Network. With the installation of a DG Systems terminal at WMEE, Fort Wayne, IN, advertisers can now deliver CD-quality audio spots reliably and quickly to a critical mass of radio stations using DG Systems' services.

The company also announced the transmission of its 250,000th radio spot delivery.

SADiE has announced the installation of a digital audio editor for the International Broadcasting Corporation (IBC) in its facility in Bangkok, Thailand.

Audio Processing Technology, Belfast, Northern Ireland, has now supplied more than 100 digital audio codecs employing proprietary apt-X compression to radio broadcasters in Japan. The systems are widely used for ISDN (Integrated Services Digital Network) audio transmissions between studios and for studio transmitter links.

AKG Acoustics has supplied two AKG K240M monitor headphones, two C647 condenser microphones, two D3800 hand-held dynamic microphones and four KC270HC headsets with a miniature hypercardioid condenser microphone on an adjustable boom to Universal Studios Florida. The equipment is being used in the company's Landshark, a roving promotional vehicle for the theme park.

PEOPLE

Daimon Hall has been appointed as manager of worldwide system sales for Circuit Research Labs Inc., Tempe, AZ.

Gale Gilbreath has joined Continental Electronics Corporation's domestic broadcast sales team in Dallas.

Bruce Peterson has been named director of marketing for Crown International's audio division, Elkhart, IN.

Also, **Clay Barclay** has been named science and innovation advisor for the audio division of the company.

COMING IN THE NEXT ISSUE...

Cover Story: Radio Production
An in-depth look at what's required for putting together a production studio for today's radio facility, plus some tips on getting new studios up and running quickly. A related story examines the special production techniques required for online audio services.

Audio Codecs and ISDN
These two exciting new technologies are bringing down the costs and bringing up the quality of radio remotes.

Managing Technology: New RFR Regulations
Top-flight broadcast consultants look at the new regulations on Radio Frequency Radiation.

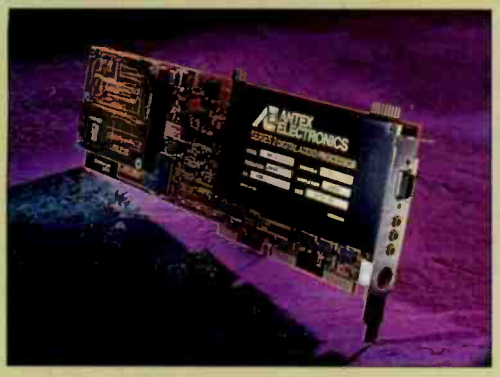
Contract Engineering: Finding New Clients
Developing a good client base is an essential part of the contract engineer's business.

RF Engineering: Folded Unipoles, Part 2
This installment considers the installation of folded unipole antennas.

New Products

Digital audio adapter
Antex Electronics Corporation

▼ **Series 2/model SX-26:** a digital audio adapter featuring the apt-X algorithm, a real-time encoding scheme using a split-band adaptive differential pulse code (ADPCM) technique that compresses 16-bit PCM digital audio to 4 bits with no subjective loss of sound quality; the SX-26 also has the ability to record or play two independent stereo digital audio files simultaneously, providing the versatility of two boards; other features include balanced and unbalanced analog and AES/EBU or S/PDIF digital input and output for maintaining the integrity of the original analog or digital signal.



Circle (150) on Reply Card

CD interface
Electric Works Corporation

▼ **CDI-16/32 CD interface:** a serial microprocessor-based control unit for up to 32 consumer CD players, video disc players or audio devices; the CDI controller connects to a standard RS-232 serial port on the PC, providing direct access to as many as 32 of these compatible devices and allowing massive storage of audio or video tracks or direct control of other devices; in most cases, machines from the same manufacturer can be mixed; the CDI controller also has optional inputs for up to eight incoming logic closures and can generate up to eight outgoing logic closures under microprocessor control.

Circle (151) on Reply Card

Power tube
Svetlana

▶ **YC130:** a new exact replacement power tetrode for the YC130/9019 used in 35kW FM transmitters; the tube is designed with a no-compromise full-power filament that assures long-life performance; tube is manufactured with high-alumina ceramic doped with chromium and molybdenum resulting in a stronger metal/ceramic bond; the stronger bond allows higher processing temperature.

Circle (152) on Reply Card

Digital audio workstation
Pacific Recorders & Engineering Corporation

▼ **ADX Ensemble:** an 8-channel multitrack digital audio recorder/editor with the same flexible software as all members of the ADX family; a moving-fader automated control surface is built into the front of the workstation; this rack-mounted digital signal processing unit allows simultaneous playback of eight tracks from the standard 2.4Gbyte (expandable) hard drive, providing six track hours of linear (uncompressed) PCM audio; the onboard 66MHz DSP chip provides full 20-bit digital mixing, panning, 3-band parametric equalization with high and low shelves and variable mid "Q" and two stereo sends and returns; the system will accommodate digital-to-digital transfers to and from AES/EBU-equipped devices.

Circle (153) on Reply Card

Audio interface
Radio Design Labs

▼ **RU-LA2D IHF-PRO:** an audio interface that is a new addition to the RACK-UP product line; interface is designed for applications where bidirectional, connectorized conversion is required between balanced and unbalanced audio equipment; unbalanced-to-balanced conversion is based on -10dBv to +4dBv levels with multiturn trimpots providing front-panel gain adjustment from 6dB to 18dB; balanced-to-unbalanced conversion is based on +4dBv to -10dBv levels with multiturn trimpots providing front-panel gain adjustment from -3dB to -20dB.

Circle (154) on Reply Card

Distribution amplifier

Audioarts Engineering

• **Model 8400:** a distribution amplifier that functions as an 8-output stereo DA or four 1x4 DAs; each input and output has its own dedicated 3-conductor connector (mating plugs supplied) allowing easy wiring in the field, rapid troubleshooting, and further avoids the conductor pinching that is associated with screw terminals.

Circle (155) on Reply Card

Graphic interface

Computer Concepts Corporation

• **Maestro:** a Windows-based graphic interface for Computer Concepts' DCS audio hard disk system; designed to integrate music, news, text and other information seamlessly into station operation; provides capability to execute crossfades and talk music intros and outros; Maestro interfaces directly with the music scheduling database and is user-friendly.

Circle (156) on Reply Card

Format conversion box

Spectral

▶ **Translator:** a rackmount format conversion box that provides direct digital translation and communication of eight channels of audio among the following formats: ODI (Alesis, ADAT, Fostex RD-8), TDIF-1 (Tascam DA-88), Y2 (Yamaha, DMR8 and DRU8), and SMDAI (Spectral AudioEngine and Prisma products); Spectral digital audio workstations can lock Spectral to in-house or client digital tape machine formats for track expansion or editing, and to off-load hard disk material across multiple tracks eight times faster than monophonic real time.

Circle (159) on Reply Card

CD players

Marantz Professional Products

▼ **PMD320** (shown) **& PMD321:** the PMD320 is a high-grade compact disc player featuring fader start and pitch control; the unit mounts into two 19-inch rack spaces without modification or additional hardware; an RC-5 control bus on the rear panel makes the unit compatible with major remote-control systems including AMX and Crestron; the addition of an RC-5 accessory will allow direct IR control; the PMD321 has the same features as the PMD320 and also includes +4dBu balanced XLR outputs and a cue-to-audio feature.

Circle (160) on Reply Card

Double cassette deck

Denon Electronics

▶ **DN740R:** a rackmount 2-well cassette deck that includes Denon's exclusive RC-41 wrist commander remote control; with two C100 cassettes, the DN740R offers relay playback exceeding three hours, and the relay play mode will repeat the A-B cycle for up to five cycles (almost 17 hours); optical sensors sense tapes' blank leaders, allowing it to automatically cue to a starting position just past the leader and auto-reverse nearly instantaneously; features include auto-reverse, speed controls for each deck and an advanced music search system.

Circle (158) on Reply Card

Sample rate converters

Z-Systems Audio Engineering

• **z-link:** sample rate converter that features the same audio path as the Z-Systems z-1src sample rate converter but in a hand-held package; based on the Analog Devices AD1890 asynchronous sample rate converter chip, the z-link has 75Ω transformer-isolated coaxial inputs and outputs on either RCA or BNC connectors; the unit accepts digital audio inputs at any sample rate between 25kHz and 55kHz and can output digital audio at either 44.1kHz or 48kHz in either AES/EBU or S/PDIF mode.

◀ **z-link+:** offers the same features as the z-link but can be synchronized to an external AES/EBU or S/PDIF reference signal; the z-link+ has a 75Ω transformer isolated sync input as well as a sync output so that the sync signal can be looped through the device.

Circle (161) on Reply Card

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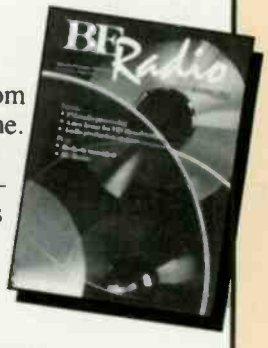

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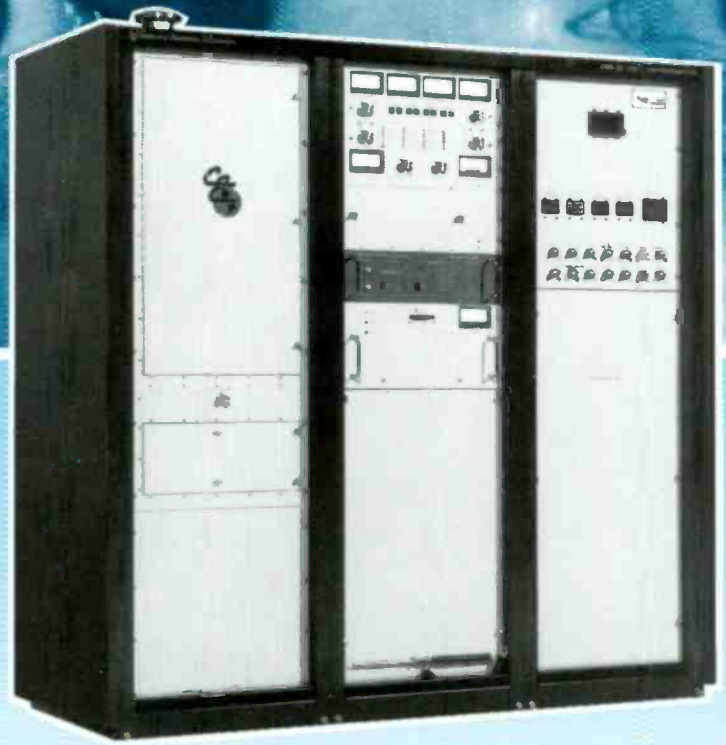
Turning 30 Is Not As Difficult As You Think



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