BE Radio™

January/February 1995/$5.00
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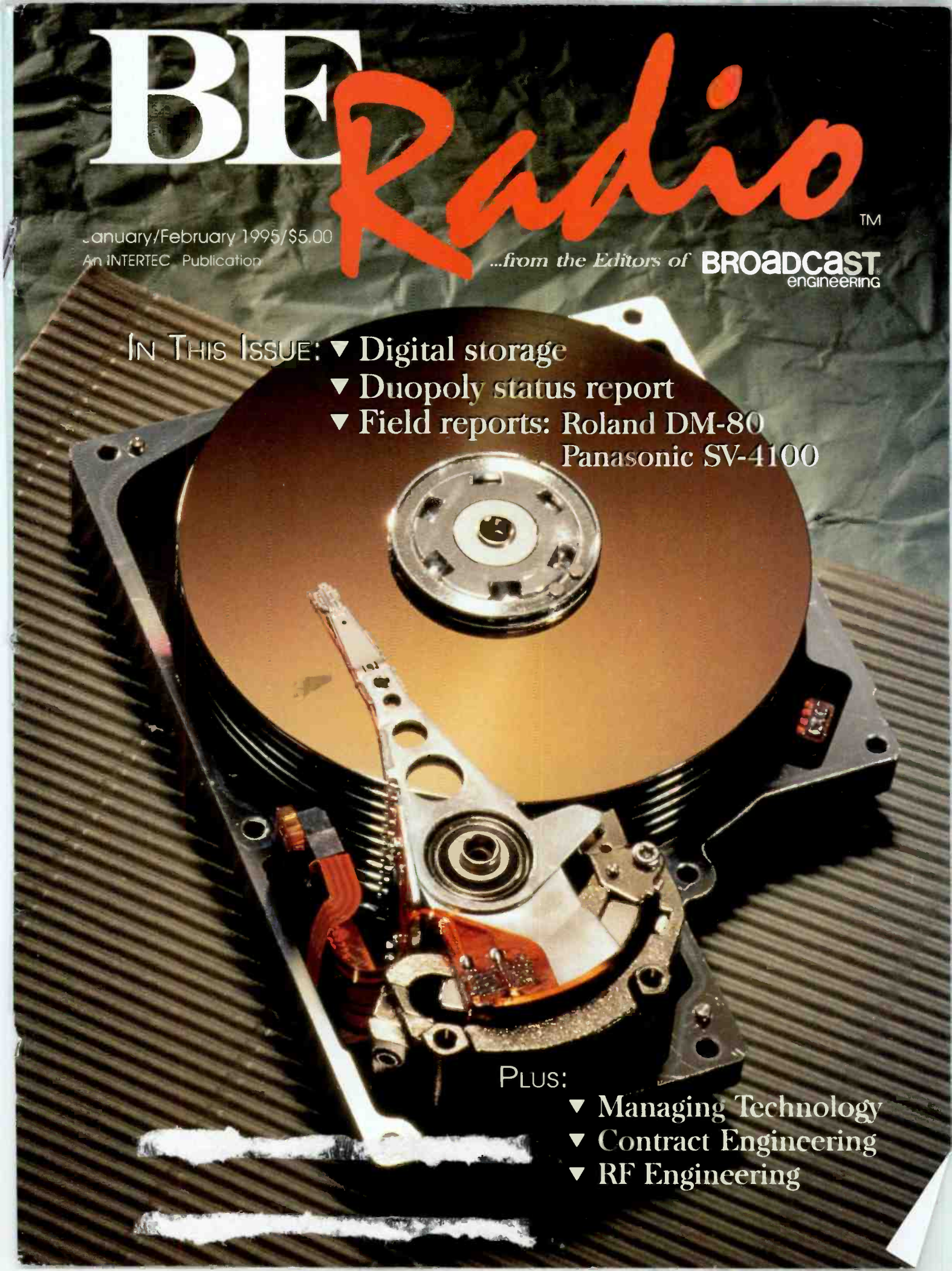
...from the Editors of BROADCAST ENGINEERING



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- Managing Technology
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Harris DX Series AM transmitters are truly a breed apart.

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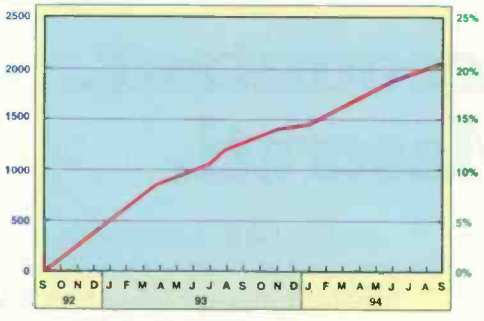
January 1995 • Volume 2 • Number 1

This month...

14 RF Engineering

20 Digital Storage

Departments...



26 Duopoly Status Report

ON THE COVER : *(Right)* The Barracuda, a high-capacity, high-speed hard disk drive from Seagate, Scotts Valley, CA.

Production Directors. Engineers. Even newsroom people swear by the DSE. Which is probably why these stations with one DSE soon wind up with two. Or even three. Learning is fast. Editing is easier. Everybody is more productive. Because not only do your station's multiple personalities get up to speed faster, they stay up there. To see it in action yourself call 1-800-622-0022 for a demo. The DSE 7000. The New Speed Of Sound.

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KSON, San Diego

"As quickly as you can conceptualize it, the DSE can do it. Or undo it."
Bill Schultz...Production Director
103.5 WYNY-FM, New York

"Radio lives by critical deadlines. With the DSE, time is on my side."
Barbara Sherry...Production Director
KQQL FM, Minneapolis

"It's the only digital system in radio that lets you edit by ear. What a concept."
Ross Wilson...Production Director
K101, San Francisco

"You install it, it runs, the production department is happy. Next problem."
Dan Metller...Chief Engineer
WNDE/WFBQ, Indianapolis

"It gives our air talent so much creative freedom, they won't use anything else."
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KKRZ, Portland

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Editorial:

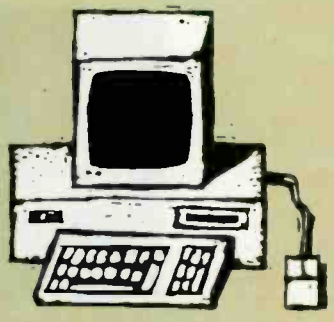
New horizons

Comedian Steven Wright claims he's a "peripheral visionary" – he can see the future, "but only waaay off to the side." In fact, that's a skill radio broadcasters could use right now, with so many changes coming from different directions at once. For instance, the dawning of this new year found the regulatory front awash with activity in the areas of EBS, unattended station operation and satellite DAB. (See "News," p. 41.)

Expect more of the same as the year goes on. By spring, the EIA and NRSC will have concluded the laboratory phase of their DAB format tests, and moved on to field trials. NAB '95 will likely include some mobile demonstrations of in-band DAB systems. New datacasting networks may also be knocking on stations' doors this year, as the FM subcarrier marketplace heats up.

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

Of course, there's plenty more: Established trends like duopolies, LMAs and automation will continue to grow in 1995. Digital audio will step up its massive onslaught into radio production facilities. The cost and availability of digital telco services will improve dramatically as ISDN deployment moves into high gear. RBDS will gradually make its way into more U.S. radio stations, cars and homes. And, 1995 may be the year of the Internet for more stations, as many come on-line with programming-related information or even audio services. (Did you know that there are already more than 100 U.S. radio stations with home pages on the World Wide Web?)



Given this fast-paced and challenging context, what better time to launch a radio-specific, technology-centered magazine? Welcome to the first stand-alone issue of *BE Radio* magazine, dedicated to help radio engineers and managers keep up with all the changes.

Many of you may have seen *BE Radio* during 1994 when it began its life as a bi-monthly supplement to *Broadcast Engineering*. Those who did will notice many changes in this issue as *BE Radio* steps out on its own. You'll find more in-depth coverage, new columns and expanded features, along with a more attractive and readable look.

Skip Pizzi,
radio editor

Many readers whom we've spoken with feel there's a pressing need for a magazine dedicated exclusively to serious radio technology. *BE Radio* is that magazine. Let us know how you like our new look and content. Also, check out the "Preview" on p. 47 for more details on upcoming issues. Note that the Internet stops at our door too! You can reach us on-line at the e-mail address below.

As radio broadcasters face their onrushing future, a clean windshield will be essential – plus side windows and mirrors, too. We'll keep the squeegees ready to sharpen your focus and widen your view.

Skip Pizzi

MAKE A CLEAN SWEEP WITH PORTABLE ONE *Plus*

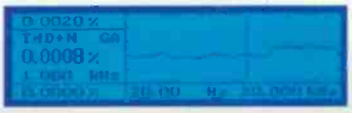
Replace the clutter on your audio test bench with the Portable One *Plus* from Audio Precision. With one instrument you can make 12 different audio measurements. All in a test set designed from the start with 2 channel level, crosstalk and phase measurement capability.

Use the unique AC Mains check function for monitoring power line problems and the built-in wow & flutter meter for measuring analog tape & disc.

The Portable One *Plus* is built to Audio Precision performance and durability standards...so you know you'll get the same superior performance in the field as on the bench.

Clean sweeps are a breeze with the graphic sweeping capabilities of the Portable One *Plus*. Plot amplitude or level (stereo), phase or distortion versus frequency.

The graph may be rescaled after a sweep, and the graphic cursor with numeric readout gives you data readings for each measured point.



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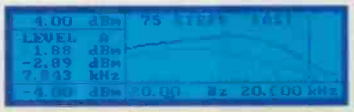

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Managing Technology:

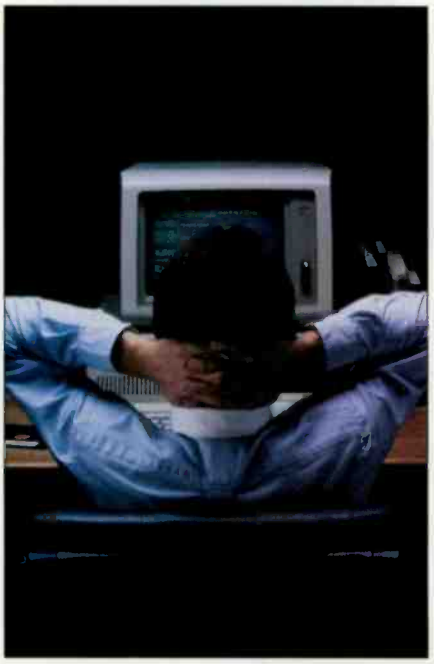
Buying new technology

By William Fawcett

As in engineering, management decisions are best made with quantitative analysis. This is especially true in purchasing, where an overwhelming array of selections can cause the administrative gridlock that some have called *paralysis by analysis*. If we remain subjective, we are often vague and uncertain, while quantitatively we can proceed with confidence.

Some preparation is mandatory: Get a good staff/management consensus on just what functions in the workplace are in need of improvement. Ask for compelling reasons why these areas are deficient. Some good examples are: Is money being wasted on low productivity? Is the station being put at a competitive disadvantage? Are there untapped sources of revenue out there? Is staff morale being sapped? Is the on-air product suffering? And so on.

The outcome of this study should provide you with a reasonable list of needs, which should be prioritized and fashioned into a reasonable master plan, perhaps extending over several years.



Next, technical solutions should be sought, in general terms, for the first problem that you will tackle. Consult subject-matter experts in that area – either on staff or outside – to determine who the key manufacturers and developers are for these technologies. Then you can get down to the real work of analyzing the details of these players' offerings.

An empirical approach

Before starting your analysis, first obtain some basic information on the equipment. A few phone calls to some friendly vendors will provide specifications (cut sheets) and pricing information. Thanks to the fax machine, what once took days or weeks can now be done in hours.

Take that information and determine which items are minimally qualified to do the work. Once you have narrowed the field, you must make a purchasing decision. This is where things often stall, especially in the realm of the subjective. To get through these doldrums, let the numbers do the talking. If you don't have a spreadsheet program, get one. It is nearly impossible to make any of these kinds of decisions without one.

An initial exercise will determine the selection criteria for your candidates. Here are some sample categories: ease of operation, audio quality, compatibility, durability, serviceability, factory support, distance to factory, use of off-the-shelf components, efficiency (transmitters) and physical size. Add your own as appropriate. Be sure to include criteria that may be unique to your specific application. Set up a spreadsheet listing the selected criteria as columns heads. The candidates are then placed in rows. Rate each candidate on a scale of one to five in each category. Then make a column that will average all scores, perhaps giving added weight to more critical criteria.

This simple process allows to you quantify what you probably already know subjectively. Just going through the exercise will help you decide which criteria are most significant. Keep in mind that the best choice may not be the product with the best score at this point.

Cost analysis

A second exercise considers the cost of the equipment. It is best to compare on a *cost-per-year* basis. Such annualizing allows direct comparison between candidates with differing life expectancies or operating costs. Once again, it's back to the spreadsheet – either a new one or an extension of the first.

On this spreadsheet, columns can include the initial cost of the unit, freight charges, estimated repairs during the life of the unit, estimated parts expense, installation cost, power consumption (transmitters) and expected length of useful life. Base the estimated parts and repairs costs on your own experience or the recommendations of other experienced users. Add up the cost columns and divide by the life and you get the annualized cost. Again, each application will have unique criteria. The life of the unit need not be exact – just make some relative comparisons. In general, you can use seven to 10 years for most professional equipment, three to five years for consumer products and 20 years for towers. Make your own guesses, but be consistent among the candidates so that the comparisons are valid.

Table 1.

	STREET PRICE	TUBE COST (10 YR.)	POWER CONSUMP. (10 YR.)	MAINT. & REPAIRS (10 YR.)	ANNUAL COST
Solid-State Name Brand	$23,000	$0	$8,760	$1,200	**$3,296**
Solid-State Off Brand	$17,000	$0	$8,760	$2,400	**$2,816**
Tube Type - Economy	$12,000	$3,350	$11,388	$3,600	**$3,033**

A sample analysis for purchase of a 1kW FM transmitter. All three units are assumed to have equal (10-year) lifespans.

William Fawcett is president of Mountain Valley Broadcast Service, Harrisonburg, VA. He is also director of engineering for the Center for Public Broadcasting at James Madison University. He holds degrees in broadcast engineering technology and business administration. Respond via the *BE Radio* FAXback line at 913-967-1905 or via e-mail to beradio@intertec.com.

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Sam Sanders, a happy Foundation 2000 user since January, estimates that he has cut his production time in half.

Our unique Edit Controller looks and feels just like the recorders you work with every day —no keyboards, front-end computers or mice to slow you down. The built-in touch screen shows you a wave form picture of your sound for instant visual reference. There's even an ASRC option so that you can convert one sample rate to another.

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Fred Venitsky (pictured) and Jimmy Regan have the distinction of owning and operating the most used Foundation 2000 on the planet.

Foundation 2000 is fast and easy to use. Audio scrubbing is so clean, you'll swear you're rocking reels. Edits are seamless. Fades are smooth and glitch-free. Plus, you can specify the "Light Pipe" for direct interface with the popular ADAT™ and RD-8™ digital recorders.

Foundation 2000LS

Designed specifically for broadcast production, this random access recorder/editor features the speed, the ease of use, and uncompromising audio quality of Foundation 2000—for less than $15,000! It's the same dedicated user interface with touch screen display, real time operation, event based editing, wave form display, and expandability to a full Foundation 2000 at any time—the only workstation of its kind to offer this important feature. Test drive the high performance Foundation 2000LS in your studio. Call 1-800-7-FOSTEX or 212-529-2069 today to schedule a demo.

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This exercise may reveal hidden costs of operation that can make a more expensive item the best buy. No attempt is made to address cash-flow games like buy-now pay-later schemes – such reasoning is shortsighted and can ultimately lead to business failure. Tables 1 and 2 present a few examples based on actual, recent purchasing decisions.

In Table 1, while the tube transmitter has the lowest entry price, it shows a higher annualized price because of its lower efficiency and need for periodic tube replacements. At one time, solid-state transmitters were seen as less reliable, but now this technology has matured and that is no longer the case.

Well-executed standard technology will always beat poorly executed new technology.

Table 2 considers the commonly asked question of whether to buy professional or consumer CD players for a manually operated on-air control room. Although the argument can be made that the expensive unit has better specifications, I can't hear the difference. Perhaps the pro unit has a jog-wheel or some other neat features, but these may not be needed in your on-air applications. If the consumer unit meets your minimum criteria (from the initial exercise above), then you should select it, based on the results of the second exercise. If you need the additional features and can afford the pro model, you should go with it. But remember, if you buy the pro model and technology advances as fast as it has in recent years, you might see future consumer units outpace the performance and features of your expensive pro model during its longer lifespan that you are locked into. (Today's consumer CD players certainly outperform the pro units of a few years ago.)

Some assembly required

This brings up a broader, related issue. In making annualized cost comparisons, be sure to factor in the price of using cutting-edge technology. Include the amount of extra time that may be required to de-bug the system. Include shipping the unit back to the manufacturer three times. Include loss of use of the equipment while you are still trying to get it to work. And don't forget that the equipment may become incompatible with the rest of your equipment if it turns out to be an intermediate step, which will effectively shorten its useful life. In considering whether to include cutting-edge technology in the candidate pool, consider the following rules.

Rule No. 1: *Stay away from the extreme cutting-edge.* Recent problems with the Pentium processor (involving high-precision math) have proven this true. Do you really want to beta-test products for the manufacturer at your expense? Cutting-edge technology may be unreliable, unproven and uneconomical. Beware of uncompetitive, "sole-source" technology.

Cutting-edge technology is always expensive: A scientific pocket calculator that cost $500 in 1975 now costs $50. New 486 computers sell for less than the IBM-XT (8088) that sits on my desk doing transmitter logging duty.

Rule No. 2: *If possible, let the technology mature.* Will today's cutting edge be tomorrow's standard, or is it an intermediate step that will rapidly become obsolete? For example: diskette-based digital cart machines. Although certainly a step up from analog tape-loops, they still require physically moving, stacking, sorting (and dropping). I suspect they will be surpassed by hard-disk-based systems, which are falling in price.

Rule No. 3: *Look for products that use consumer (mass-produced) technology.* Early CD decks cost 10 times what a decent consumer CD player now sells for. Some early versions of hard-disk audio storage devices were built on proprietary mainframes. Today, most use inexpensive PC mainframes, and take advantage of the falling prices of high-capacity drives due to consumer demand. The same is true of broadcast automation systems and many digital audio workstations. Significant economy of scale applies when development and tooling costs are spread over such a large quantity of product.

The move from proprietary components to off-the-shelf components is a sign that the technology has matured. Certain devices, such as transmitters, will never be mass-produced, but many transmitters use off-the-shelf power supplies and RF modules from third-party vendors. The use of common, non-esoteric technology ensures that the equipment, parts and knowledge will be available when repairs are needed.

Remember that well-executed standard technology will always beat poorly executed new technology. Evaluate products for forward and backward compatibility. By staying one step behind the cutting edge, you gain great cost benefit, and you also can better assess a product's likelihood of becoming the new standard.

Table 2.

	LIFE (YRS.)	STREET PRICE	IHF/PRO INTERFACE	ADD REM. START	REPAIRS (LIFETIME)	ANNUAL COST
Top-of-the-Line Pro Model	6	$1,700	$0	$0	$400	$350
Low-end Consumer Model	1	$140	$150*	$20	$0	$185

Purchasing CD players: consumer or professional? (*-IHF/PRO interface has 6-year life, so it contributes $25 to annualized cost.)

Deriving a single-figure rating

If the front runner isn't obvious by this time, a third exercise may prove helpful. Exclude candidates that don't meet the minimum score in the first exercise, and then compute the ratio of criteria score to annualized cost (i.e., score divided by cost). Higher numbers are better.

Now you can place the candidates in rank order. Select the highest-scoring unit that is within your budget constraints. This should assure you that you're getting the most for your money.

Maybe you're thinking that this system does not take into account other factors (like the salesman is my sister-in-law's cousin's ex-husband). Actually, any factor that enters into the equation can be literally entered into the equation. If you find yourself thinking, "Yeah, but...," go back and modify your selected criteria or weighting factors. This is where a spreadsheet helps – you can fiddle with the system and instantly see the results.

Not all purchases will require all three of these steps. Sometimes, after the first one or two steps, the answer will be clear. Your original gut feelings may be confirmed, but keep an open mind, and don't tweak the empirical analysis to make it turn out the way you want it to.

It is easy to become overwhelmed by a vast array of equipment choices. By quantifying the subjective, you make use of an important tool. Making decisions "by the numbers" gives credibility to your selections, and gives you confidence that you are delivering good bottom-line performance. (It also gives you something to fall back on – and rebuild from – if unforeseen problems should subsequently turn your decision into a disaster.) It's still a crapshoot, but the dice are loaded in your favor.

DM-800 Digital Audio Workstation

The Power Studio From Roland

The new DM-800 provides power, speed, portability and reliability like no other system available.

Power Eight discrete tracks with 100 layers per track. 12 channel automated mixing and EQ. Time compression and pitch correction. Nondestructive, full featured editing. Sub-frame accurate SMPTE sync. Optional ADAT, DA-88 or RS-422 interface.

Speed The DM-800 is easy, fast and quick to learn, using powerful hardware controls with tape recorder style punch in and out. No computer required.

MIDI Support The DM-800 supports MMC, MTC and dynamic functions like tempo mapping, bar and beat editing, control of external sequencers and trigger mode for instant phrase playback.

Portability All the features and functions you need are contained in a single 12 pound unit. You can literally grab it and take it with you. Uses internal and external SCSI drives. View any level of information on the built-in LCD or plug the DM-800 directly into your video monitor.

Reliability The DM-800 is a completely dedicated piece of hardware with Roland's renowned reliability.

Price Incredible Power. Incredible Price. $5995.

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Contract Engineering:

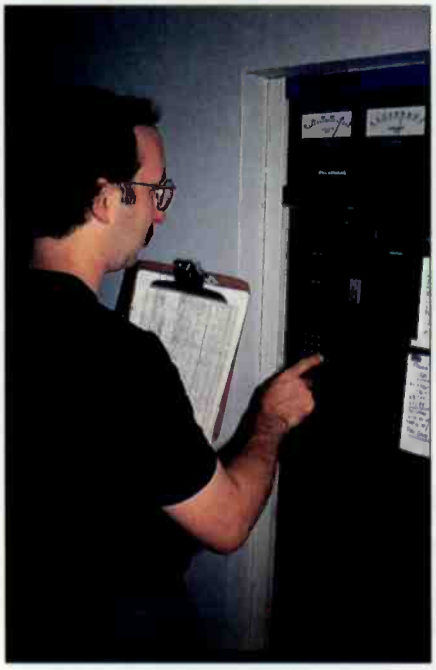
Setting up shop

By Kirk Harnack

Many broadcast engineers are considering contract engineering as a timely and appropriate career move. There are several reasons why:

- More stations are automated, combined or LMA'd.
- Modern equipment is reliable and requires less attention.
- Equipment is changing in basic design, moving increasingly toward computers and solid-state devices, with fewer moving parts.
- Better facility design at many stations is reducing the frequency of maintenance and repairs.
- Engineers and station owners are recognizing that, in many cases, a full-time staff engineer is no longer required.

If you are contemplating going into business as a full- or part-time contract engineer, bear in mind the following important concepts:



- A contract engineer will be in business for himself or herself. This is a new concept to many employed engineers and entails more varied responsibilities than being an employee.
- In addition to performing a myriad of technical engineering tasks, a contract engineer is also a business manager, bookkeeper, accountant and bill collector.
- Rather than being responsible to one or two supervisors, a contract engineer is first responsible to self and family, and then responsible for 10, 20, 30 or more clients.
- The ability to be flexible in personal scheduling, to learn new equipment and techniques quickly, and to communicate clearly with clients and vendors all become more important.

Prerequisites for operating a successful contract engineering business can be divided into three categories: technical, business and personal.

Technical prerequisites

Technical requirements are what many prospective contract engineers are most concerned about. However, it's probably the least important of the three areas.

The basic toolkit is one of the most vital and important items needed to set up shop. Invest in a good, hard case with rubber or leather tool pallets. The inexpensive toolkits from catalog liquidation outfits are usually not up to the task. Plan on purchasing the tool case and the tools separately; this will allow you to obtain only the tools you really need. Most contract engineers can get 95% of everything done with the hand tools listed in Table 1.

A dual-trace oscilloscope is also recommended. A basic DC to 20MHz model will suffice in most cases. A good contract engineer also will own or have ready access to some audio test equipment. An automated tone generator and distortion analyzer are ideal, but usually not required. The least expensive way to obtain quality test signals is by using a portable CD player and a test CD. Test CDs are available from Denon and NAB.

One of the best long-term investments is an RF spectrum analyzer. Although less-expensive satellite and cable TV analyzers are available, they are not much use for documenting and correcting real-world RF problems. Professional models, such as the Tektronix 2710 or 2712, or similar models from Hewlett-Packard and IFR give suitable performance. If you plan to do any AM transmission system work, be sure the analyzer is outfitted with a 300Hz-resolution bandwidth filter. This is an option on most spectrum analyzers. Memory, battery and printer options are also worthwhile. Be sure to charge clients for necessary use of the spectrum analyzer.

It's also important to stock and carry a good selection of parts and supplies. Keep a good quantity of the items listed in Table 2 on hand.

You will also want to carry a briefcase containing appointment/address/phone book, invoice forms, and a file containing reference information. The latter includes pages of printed material that you will need to refer to from time to time, such as certain FCC rule sections, wire and resistor color codes, common electronics formulas, IC and computer connector pinout standards and so forth. Having this information readily at hand can save lots of time and frustration.

Business prerequisites

As an employee of a radio station or station group, most business functions are performed for you by administrative staff.

Table 1.

2 Phillips screwdrivers (#1 and #2)
2 blade screwdrivers (medium and large)
Large and small diagonal cutters
Large and small needle-nose pliers
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Most of a contract engineer's work can be accomplished with these tools.

Kirk Harnack is president of Harnack Engineering, a contract engineering firm in Memphis, TN. Respond via the *BE Radio* FAXback line at 913-967-1905 or via e-mail to beradio@intertec.com.

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[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.

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The Mackie Designs 16x2 CR-1604 Mic/Line Mixer. Suggested retail price, $1095[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.

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

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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.

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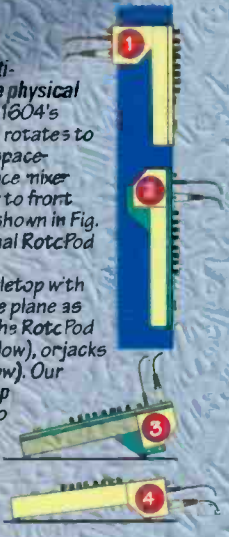
Unique, multi-way convertible physical configuration. CR-1604's input/output pod rotates to back (creating a space-saving 7-rack-space mixer shown in Fig. 1), or to front (10 rack spaces, shown in Fig. 2) with our optional RotoPod bracket. Use the CR-1604 on a tabletop with jacks on the same plane as 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.



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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When in business for yourself, those functions are performed by you (or your staff). You'll need to obtain a business license for your jurisdiction. In some locales, you may be able to apply as an architectural, consulting or engineering firm rather than a contracting firm. Those "professional" firms often pay a lower or fixed annual rate for their business licenses.

Decide whether to incorporate or operate a partnership or a sole proprietorship. Some states now offer a limited liability corporation. This relatively new type of corporation may be an ideal structure for many contract engineers.

Consult with an attorney and/or a CPA to determine what is best for you. Retain a CPA or qualified bookkeeper to assist you in setting up a bookkeeping system. This is an area you will want to set up properly from the beginning. Computer-based accounting systems like QuickBooks for Windows from Intuit can be helpful. These modern PC-based accounting programs assist the user through setting up income, expense, asset and liability accounts. Use professional help to set up your accounting system, however, because it will save a new contract engineer many hours of frustration. Once your system is up and running, be sure to keep your accounting up-to-date. Daily entry of invoices and receipts is crucial to maintaining regular cash flow in your business.

Use your CPA or bookkeeper to file the various tax and reporting forms with the IRS, state and local tax agencies, and state employment offices. As a small business, you will be required to file virtually the same number of forms to the same number of agencies as any large business in your area. Naturally, this paperwork burden occupies a much larger percentage of business and staff hours at the small business, yet it must be completed in a timely manner. Many small businesses fail due to a lack of cash flow and planning for payment of tax liabilities. Filing and paying tax liabilities late will cost you money when penalties and interest payments are assessed. Table 3 lists the forms you'll need to file and the agencies to which they must be sent.

Pick a definite location for operating your contract engineering business. It's possible to operate a thriving business from your home, but it's important to segregate the business and personal spaces. A garage or other such space can be converted into a workshop and warehouse. Having the office close to the shop yet away from personal living spaces is helpful. This will also help you keep expenses straight and take tax deductions for the costs of maintaining an office in the home. Be sure to check any local ordinances pertaining to home offices, however.

Table 2:

Shielded, twisted-pair audio cable (Belden 9451 or equivalent)
RG-58 and RG-6 coax cable
Nylon cable ties in several sizes
A selection of audio connectors, especially XLR, RCA, and $^1/_4$-inch phone plugs
Lots of spade lug and ring crimp connectors
A small selection of hardware including nuts, bolts, screws, anchors and especially 10-32 rack screws
A selection of capacitors including electrolytic caps
Common semiconductors and ICs

Contract engineers should keep a good stock of these supplies on hand.

Table 3:

Internal Revenue Service:
Annual Income Tax or Corporate Tax
Monthly or quarterly 941 (withholding) tax returns

State Tax Commission:
Income Tax
Sales Tax
Employment Security Tax

Local Tax Commission:
Property Tax
Business License Tax

Ignorance is no defense against tax liabilities. This checklist covers all the agencies and taxes that contract engineers are likely to deal with.

Setting work rates is often difficult. The most common mistake is charging too little. Before setting your rates, check with other technical service businesses, such as 2-way radio shops, copier repair firms and on-site computer repair companies. A contract engineer who knows what he or she is doing and is efficient should charge at least as much as these businesses. After being in business for a while, you will find that what you make is a lot less than what you charge. So make sure you charge enough.

Obtain proper liability and general coverage insurance. The SBE now offers its members general commercial liability insurance under a group plan for contract engineers. (Contact Peggy Hall at SBE, 319-253-1640.) Complete, individual coverage will cost from $1,500 to $3,000 per year, so be sure to budget for this necessary expense. (SBE group coverage starts around $300/year.) Your coverage should also include your business vehicle(s) and a special rider for carrying expensive equipment. This is often called an inland marine rider.

Personal prerequisites

Making the leap from staff engineer to contract engineer is not for everyone. Having an understanding and supportive spouse, family or significant other is important. When establishing a contract engineering business, it often seems there is no end to emergencies, phone calls and work at odd hours. Running a business on your own or with your family can produce a great deal of stress, anxiety and tension within yourself and those close to you. Learning to cope with or avoid such problems is important to your success and deserves a good deal of your attention.

Be prepared to make mistakes and work through them. Networking with other successful contract engineers is the best way to anticipate and avoid the inevitable pitfalls that will arise.

Summary

Contract engineering is a challenging and rewarding business. Being self-employed offers financial and personal time advantages that are difficult to find elsewhere. Such advantages and freedoms are accompanied by disadvantages and frustrations. Contract engineering is not the best choice for every engineer.

Whether you are already a contract engineer or are just opening up shop, strive for excellence at all times. Offer your clients the best possible work you can muster, while constantly seeking more and better ways to accomplish their goals.

Touchscreen Plays Music and Spots Instantly from Hard Drive

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Nothing else makes radio as fast or easy as having all your songs, spots, sounders and sweepers start with your fingertip--***always on-line and ready*** to play from hard disk. And nothing else is better for fast, exciting radio than the ***new Scott Studio System!***

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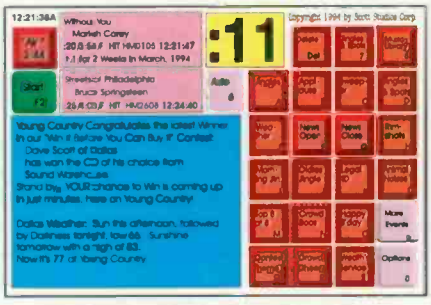
Touch the Music button at the top right of the main screen to see our "Wall of Carts" with 1,000 songs (or more) ***on-line!*** They're displayed by title, artist, year, length, category, or any way you like. Touch the song you want and Scott Studios' digital audio hard disk plays it ***instantly.***

In addition, all your comedy bits, spots, jingles, promos and PSAs have their own "Wall of Carts" so they start immediately. Or, you can pick any unscheduled song, spot, sweeper or promo and put it anywhere you want in today's log.

1, 2 or 3 Touchscreens

Teams of personalities can add touchscreens to share control. Jocks choose whether to handle sweeps themselves or let the Scott System sequence automatically.



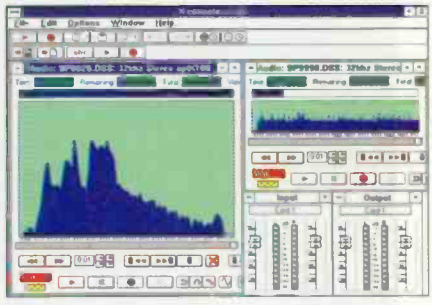
Simple and Paper-free

Weather forecasts, live tags, promo copy, contest winners' lists and programming memos automatically pop up on your Scott System's screen. As an option, we can also work with your news wire to update and display selected weather, news and sports copy.

The *Best* Digital Audio

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

Scott Studios will even pre-record your music library from CDs at no extra charge. You choose double- or triple-overlap playback (or more) while recording.



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Scott Systems pay for themselves in increased efficiency on-the-air and in production. Our graphic waveform editor quickly cleans up out-takes and works wonders with big productions.

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Compared to mere months ago, hard disk prices have dropped dramatically! Dave Scott and his team has more digital audio and automation success and experience than anyone else in the business! We also offer excellent leases. Call for details.

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RF Engineering:

Antenna tuning

By John Battison, P.E.

The last link between a radio station and its audience is the antenna system. Despite this fact, it is surprising how often this important link is ignored. Taking good physical care of an AM antenna system is considered as only a cosmetic issue by some licensees, but it is definitely much more. Anything that affects the ability of those hundreds of feet of steel to radiate your signal with great efficiency affects your station's pocketbook – and eventually, your own.

RF tuning really consists of what might be called *fine tuning*. There is no single knob labeled "RF tuning" that can be adjusted like a receiver's tuning dial for maximum signal. On the other hand, by making a number of small adjustments and corrections to an operating antenna it is often possible to get a few more watts out of it.

The *antenna-loading* control on some transmitters might be considered as a sort of tuning control. It is certainly worthwhile to verify that your antenna loading is correct, so that as much as possible of your transmitter's power is transferred into the "aether."

The height, or length, of your AM antenna is supposed to have a definite relationship with your operating frequency. Anything that changes this relationship has the ability to reduce your service area, or signal strength (although in a few cases it can have the unexpected result of improving it).

For a non-directional station, the length is usually not a critical one, within reason. In any case, its electrical characteristics are still considered when planning the operation. But for a directional station, a change of a few degrees in the effective length of a tower can have significant effect on coverage and operation.

It is not often that someone cuts off several feet from an antenna, but occasionally someone *adds* several feet to an antenna – without meaning to. Consider broken guy insulators. They may be broken through age or by lightning, or even by sabotage from hunters or vandals. Hitting a tower light or an insulator can be quite a challenge to such mischievous marksmen.

A sudden change in base operating current may indicate a shorting guy insulator, which has added new length to a tower. Increased plate current required to maintain the same base current could also be a telltale symptom. In either case, antenna tuning has changed.

A broken base insulator may not cause electrical problems for a while, but eventually an RF path will develop across the crack and tuning will change.

New towers

If you are fortunate enough to have a new tower going up, several interesting things can be done. First, make sure that nothing else is on the tower, and measure its impedance. Then connect your RF drive line. This should consist of a large, 1- or 2-turn loop of copper tubing, appropriate for the current anticipated. The more turns, the higher the reactance of the line.

Remeasure the impedance, this time from the output of the ATU through the drive line to the tower.

Install all the additional items that will be used on the tower, including lighting equipment if used. Remeasure at the same location. Now you will have your base operating impedance. You may be surprised by the difference between the bare tower and the tower that is finally loaded and connected.

If you are stuck with a short tower, you may be able to improve (raise) your base operating resistance slightly by using a larger loop, or even an extra turn or two. Ron Nott, of Nott Limited, Farmington, NM, gave an interesting paper on base-loading AM towers at the 1994 SBE Conference in Los Angeles. In essence, he contends that AM towers could be base-loaded in much the same way that amateur radio operators base-load their mobile whip antennas. It might prove helpful to stations with a radiation problem.

It goes without saying that the chief engineer should supervise closely the erection of a new tower to ensure that *all* tower joints are clean and tightly secured. If possible, all joints should have welded jumpers across them. The neutral line should be properly grounded to the tower and all possible sources of RF arcs should be eliminated.

Tower records of electrical measurements should be maintained in a secure place for later reference. When the station goes on the air with the new tower, make several spot field measurements downtown and in other areas of interest to the station. If possible, run a radial in these directions. If it is a non-directional station, the pattern should be more or less circular. For that reason it is a good idea to make radial spot measurements at the same suitable distance all around the station. Then in later years, if reception complaints come in (as they certainly will), you will have backup data on "how it used to be." Although this type of simple radiation pattern won't compare with one made using eight or more radials (such as in a real pattern proof-of-performance), it should at least confirm that the radiation is approximately circular.

> Anything that affects the ability to radiate your signal with great efficiency affects your station's pocketbook.

Of course, if your operation is directional,

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

When looking for a digital audio system for automation of satellite programing or live assist, there would appear to be many choices. But if you're looking for a system which is flexible enough to give you total control without sacrificing your sanity, there is only one choice. The Phantom by RDS.

You will see the difference as soon as you see the Phantom in action. The display provides you with all of the information you need to see in a clean, concise manner, without the crowed look that you'll find in other systems. If you are familiar with the most popular software on the PC, then you may already know how to use the Phantom. The Phantom's pull-down menus guide you through all of the steps involved in setup and daily operation, from creating and scheduling clocks to creating and editing logs.

The PHANTOM
Digital Audio Automation

The Phantom ends the confusion of automation by keeping everything organized. The Phantom simplifies your daily operations by keeping information such as input changes, voice changes, and clock changes in their own individual schedules rather than in the log. You can leave those liners and other voice drops out of the log because the Phantom will do them for you. The Phantom allows you to date new schedules to begin weeks, months, or even years in advance. When your satellite network informs you that there will be a voice substitution on Thursday, two weeks from today, you can prepare for it *today*.

The Phantom can retime spots to fit them cleanly into a satellite break without inserting silence, overlapping, or running late. The Phantom can create reports to keep you informed on a number of topics, from a list of expired spots to an analysis of potential mistakes in your log. The Phantom also maintains a history of system activity.

The Phantom has the features that others would want you to believe are theirs exclusively. The Phantom remains *completely* functional during recording, sensing relay closures and starting breaks as easily as it does when it is not recording. The Phantom can fill incomplete breaks with spots from a list you specify without ruining product separation.

While other systems tie your hands and limit your flexibility by only offering 3 or 4 inputs, the Phantom gives you 6 stereo inputs, using its AMX-84 solid state switcher, with the option of increasing the number of inputs to 14 or more. If your station is News/Talk, you know how important this can be.

The Phantom allows you to change the sampling rate, digital format, and stereo/mono settings at will to meet your needs for an individual spot. The Phantom offers a number of digital formats, including the new Dolby AC-2 format, as an option.

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you will be *required* to perform pattern measurements for the license application. In that case, future engineers will have a great deal more information available to them.

RF loading

Under the heading of tuning, you might also include methods of loading to improve radiation resistance. It is well known that it's advantageous to operate with an operating resistance around 50Ω or so. For one thing, it simplifies ATU design, but the main reason is that it provides a good *RF load* for the purpose of radiation. The greater the ratio of I^2R losses to I^2R_r the greater the efficiency of the antenna becomes. Of course, if R_r becomes too high, the problems of matching tend to reduce any special gains.

Over the years, various engineers have developed some new antenna designs to improve short tower performance and to reduce high angle radiation. The best known method of improving efficiency is *top loading*. Until recently, this was typically done by means of a *top hat* or a similar type of loading at the top of the tower.

The folded unipole

Many years ago, consulting engineer John Mullaney, P.E. developed an antenna known as the *Nord* for the US Navy. It was basically a folded dipole, although he called it the *folded unipole*. Theoretically, it is efficient when used with short towers. It also offers reasonable operating resistance with manageable reactance. In many cases, changing to a folded unipole might be likened to RF tuning because improvement is sometimes possible. But for towers more than 90°in height, there is not much advantage, except that the tower is grounded, which makes it easier to add other antennas to the tower(s).

> By making a number of small adjustments, it is often possible to get a few more watts out of an antenna.

Figure 1 shows the folded unipole concept. The actual radiator is grounded via connection to the tower, so there is no base insulator. It is important that the tower is properly connected to the ground system. Poor tower grounding can cause all kinds of problems with a folded unipole. The top of the tower holds three or six metal arms about 12 inches long, from which are hung the radiating elements. These skirt wires are brazed to the ends of the hangers and brought down to about five feet above the ground. Insulated turnbuckles (not shown in diagram) can be used to secure the bottom ends of the skirt wires, and anchor them to the ground. A loop of wire connects the three drop wires together at this same bottom point. This also serves as the feed point for the RF drive from the transmitter.

Stand-off insulators (also not shown) are required to keep the drop wire from blowing and shorting to the tower, which would cause variable mistuning.

Begin tuning such an antenna by measuring the impedance without any tuning short in place. Occasionally, the impedance may be just what you need, but generally it's necessary to move a tuning stub up and down the tower until the desired impedance is achieved. (I usually make the shorting connection on just one leg until I find the impedance I'm looking for. I then add the other two legs and remeasure, making adjustments as necessary.) It's essential to clean all paint and dirt from the tower leg before making connections.

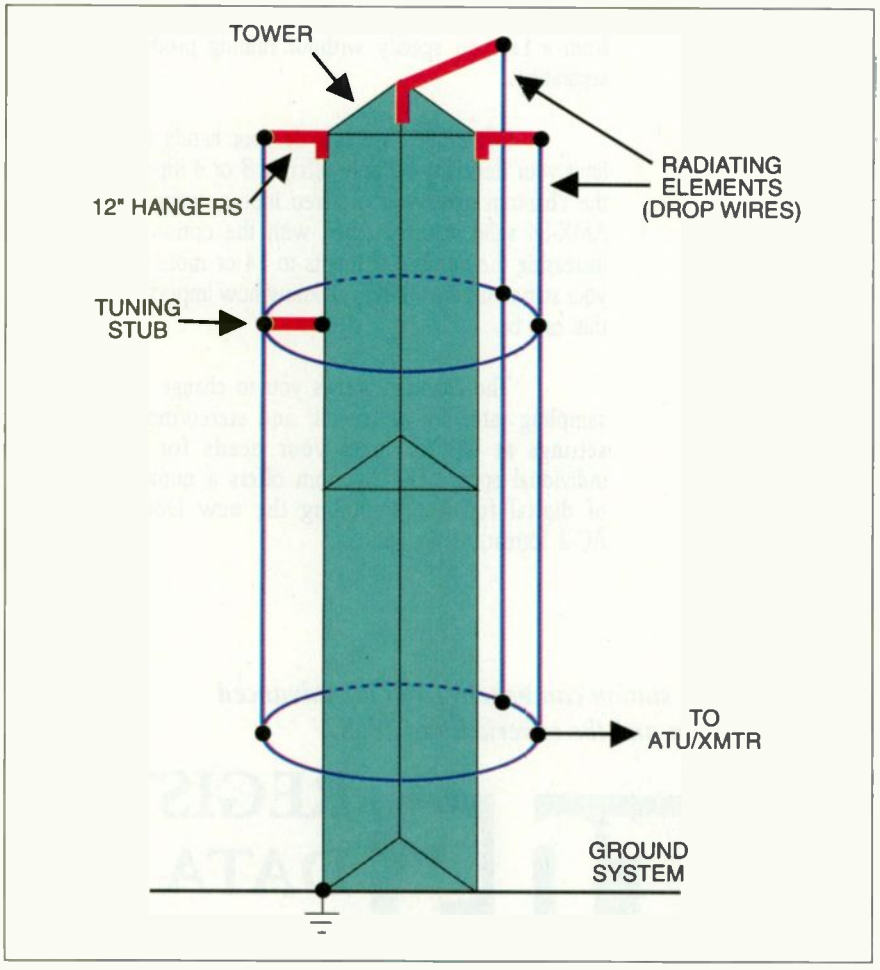

Figure 1. The folded unipole concept for AM transmission antennas.

> Tower records of electrical measurements should be maintained in a secure place for later reference.

Every engineer has a personal method of adjustment. Some like to move the tuning short about one-eighth of a wavelength down the tower before making the first reading. If converting a tall tower (over 90°) to a folded unipole, it is generally best to start the skirt somewhere below the top of the tower. But this operation is rather complex, and will have to wait until a future column.

Happy tuning!

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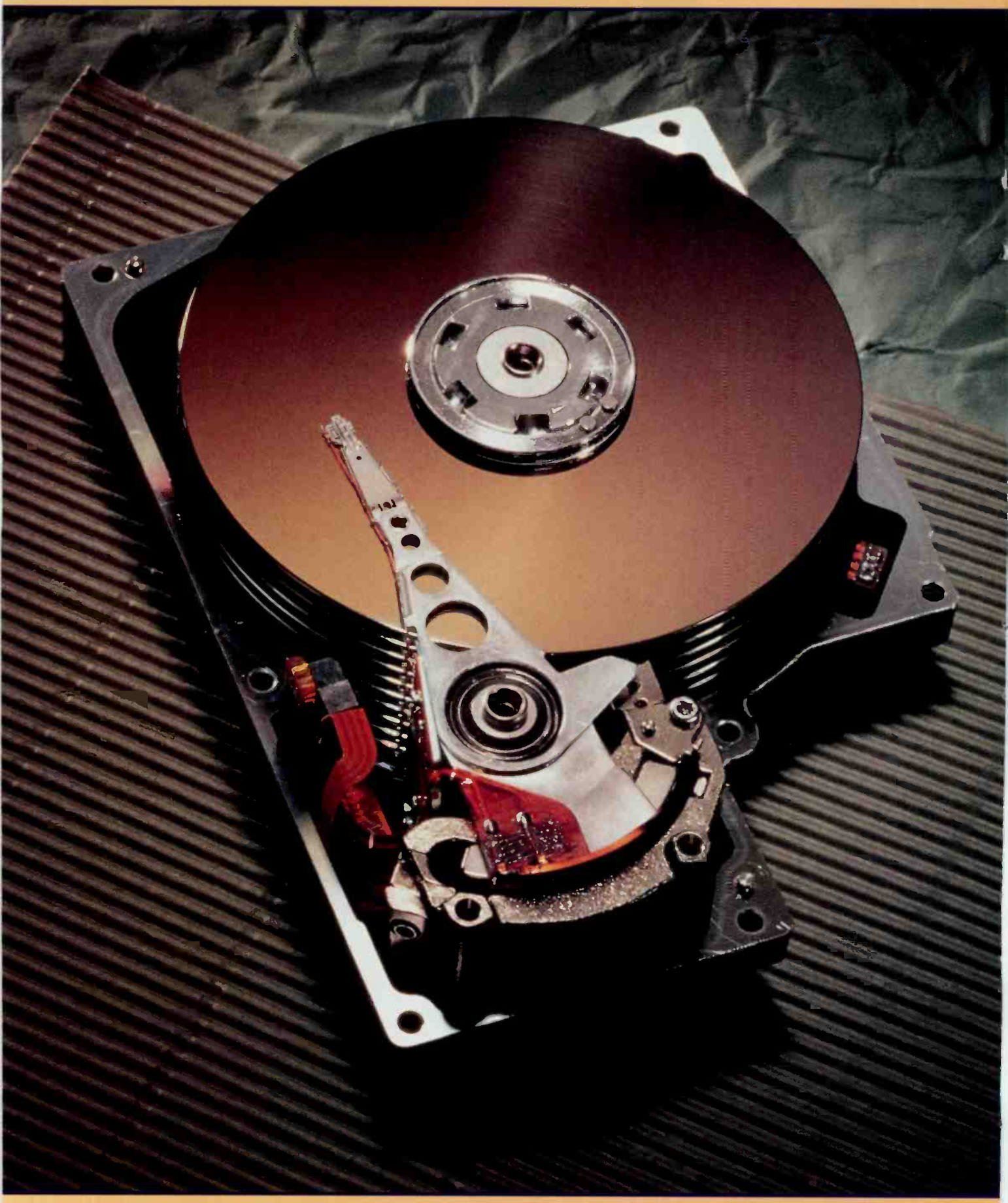


Digital storage

By Chip Morgan

Decisions, decisions...

Bottom Line: *Digital audio's high quality and low maintenance are welcome in today's radio environment, where technical support time is increasingly at a premium. The technology's high capacity for integrated control is also well-suited to consolidation and staff downsizing trends. But the choice of a digital storage format has become the most vexing issue facing radio broadcasters today.*

Digital storage – two words that can strike fear in the hearts of manager, air talent and engineer alike. Digital storage can mean machines replacing humans, or it can mean an opportunity to gradually become an expert while the technology is developing. If management, talent and engineering all embrace the new way of life in broadcasting that digital systems allow – and concurrent business trends dictate – they can use their hands and their minds to create powerful new programming elements that reach beyond their wildest dreams of even just a few years ago.

The first step requires answering some big questions. Should you buy a studio cart machine replacement, a production room digital workstation, or a fully integrated network system that provides real-time audio and data transfer between sales, production, traffic and the air studio? Can an entire radio station be run on a computer network where the main connection between workstations is a piece of coaxial cable? How will the news be produced? What about DAT, recordable CD or magneto-optical systems? Do they have a place in the radio station of tomorrow? And how will you handle remotes or field recording?

Confronting these questions is enough to send any broadcaster back to bed. Yet the entire world seems to be leaving the analog domain and moving toward digital. There's really no way to put off making these decisions anymore. To help you get more comfortable with these issues, this article will explore the various methods of using digital technology for audio storage at a radio station today. A little later, the issues involved in putting the whole puzzle together will be explored. But first, consider the options for digital storage system components separately.

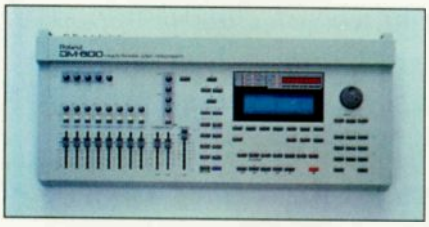
Production workstations

Digital audio workstations (DAWs) are designed entirely for quick editing (and in some cases, mixing) of complex multitrack audio. You can replace your multitrack (if you have one) with a digital workstation and do non-destructive editing down to the waveform. In many cases, the production studio mixing console and audio processing gear may also be partially or wholly replaced by a DAW. Automated mixing is often included in the latter type of system, a feature rarely found on conventional production studio mixers.

Several units have become common at recording studios and in the production rooms of major market radio stations. Because digital audio storage tends to invade the radio station's production room first, many existing systems already have their strong proponents in the radio business. As you might expect, there's a fair amount of contention among users and vendors of each system, based on everything from the platform used to the style of operation.

Platform choices include IBM PC-compatibles, Apple

Macintosh or a proprietary unit. Among the leading players, approximately 40% of DAW manufacturers use proprietary platforms, while 35% use Macintosh and 25% use PCs. This does not reflect the penetration of each platform type, however. Because of the higher popularity of some systems, the Macintosh is the most dominant DAW platform throughout the audio industry. But among radio users only, the IBM-compatible systems enjoy disproportionately higher penetration, due to that platform's long-standing predominance at stations.



The Roland DM-800 is an example of the proprietary platform DAW. It uses internal, laptop-type hard drives, or can be interfaced to external SCSI drives.

The major distinction between classes of workstations relates to what they can do. A hierarchy of three basic levels exists: 1) editing only; 2) editing and multitrack mixing; and 3) editing, multitrack mixing and audio processing. Other key considerations include the availability of dedicated hardware controllers (such as "hard" fader panels in lieu of "virtual," on-screen faders), speed of operation, the ability to network multiple workstations, and most recently, the ability to directly interface with computer-based on-air delivery systems. (More on this later.) Another recent trend is the cross-platform support that a few DAWs now offer, either by native conversion software or via the open media framework (OMF) interface.

DAWs allow much creative flexibility and corrective activity. Beyond non-destructive (i.e., "undo-able") cutting, pasting and copying, other special techniques allow blending, auto-crossfades, insertion of sound effects and looping. Time-compression and expansion are also possible, allowing you to get that 31.2 second spot to time out to exactly 30 seconds, without shifting up the pitch like a simple varispeed adjustment would. A wide range of equalization, compression/limiting and reverb/echo/flanging or other special effects are also available on some systems. These techniques are simple to perform with digital equipment, but would take impossible-to-find hours using analog equipment.

Do-it-yourself

Audio on desktop computers is actually becoming rather commonplace, with the popularity of multimedia at the consumer level, and the influx of workstations at radio stations and recording studios. Low-cost equipment is available to actually "roll your own," if you are interested in a little experimentation.

For example, up until recently, the best you could do with a low-cost PC sound card was 8-bit audio with FM synthesis technology. Now for about $500 you can get 2-channel professional-quality audio cards based on the same chips used in the high-budget units, with analog and digital I/O, and >85dB signal-to-noise ratio. You can get kits of components for approximately $5,000 that include digital signal processors and enough Mac or Windows software to configure the system as a synthesizer, sampler or hard disk recorder.

You can even get hardware and software components to set up networkable workstations, noise-reduction systems and audio-processing units. (Some of the latest desktop computers include "native" components that reduce or eliminate the need for additional, audio-specific hardware.) Add some large hard drives and interface to broadcast consoles or hardware controllers, and you've made your own digital studio. Just remember that you'll probably have to take the calls at 2 a.m. if the thing doesn't work.

On-air delivery systems

A different kind of computer-based audio system is designed to replace cart machines, reel tape machines and sometimes even CD players as the storage and playback devices for on-air programming. Some systems even replace the on-air mixing console and routing switcher.

Many of these units start by emulating cart machines, typically by using a visual representation of a cart machine on a PC screen. The manufacturers assume users want something that looks and acts like a cart machine, to minimize the intimidation factor of the new technology. IBM-PC-compatible platforms are quite dominant in this product sector – only a couple of systems use anything else.

The hierarchy of functions for these systems is as follows: 1) random access, short-form storage on hard disk (i.e., pure cart machine replacement); 2) automated playback of stored audio from hard disk; 3) automated playback from hard disk plus external machine control (for record/play interface to/from outboard DAT, CD, digital "cart" decks or other recorders); 4) all of the above plus internal audio mixing and routing features; and 5) simultaneous control of multiple program streams, each with all of the above features. As you move up this functionality ladder, more and more conventional hardware can be replaced by the digital system. (See the related article, "Peripheral Digital Storage Systems," p. 24.)

Most automated systems can be operated either manually, as *live-assist* systems, or in full *walkaway* mode. This allows different users or dayparts to be handled as necessary, employing live on-air talent, board operators only or unattended operation.

A few systems act like on-air workstations in that they replace the function of an analog 2-track tape deck in the on-air control room. These systems can integrate with your on-air phone system to automatically record phone calls, edit them, sequence them, preview them and play them back on command. The system also can be configured with an array of user-programmable buttons (real or virtual) to instantly play back numerous short audio pieces at the click of a mouse key, or the touch of a screen icon. This can be invaluable for morning shows, news or fast-paced, highly produced shows needing instant access to many cuts. The flexibility of computer operation allows a different set of cuts to be assigned to the buttons in separate memory registers for each airshift or program.

The Orban DSE 7000 is an IBM PC-based DAW with a dedicated control surface that emulates a mixer and a tape transport.

From a management standpoint, data can be extracted to supply programming and traffic with real-time information about what's happening on the air. For the first time, things like real-time song tracking, spot reconciliation and sales information are available to managers anywhere via PC access to the air system. A PD could check what was played or what is scheduled to be played without distracting air talent and possibly affecting the show. Salespeople could access the system to see when their client's spot will really play without both-

ering the air talent.

Remote broadcasts can be done easily with the air talent controlling the playback of the station audio via a PC at the remote. In fact, the screen and controls on the remote computer will look and act just the same as the screen and controls in the studio.

Fully integrated networks

An important new trend is the building of data bridges between DAWs and on-air delivery systems that connect the platforms via an Ethernet or similar local area network (LAN) interface. A number of manufacturers have cooperatively created transparent interfaces that allow a finished spot to be sent as a digital file from a DAW to the spot library of an interconnected on-air delivery system. Although a smoother process than previous methods, this LAN-based transfer often requires a file conversion process, which can take as much as the real-time length of the spot to accomplish.

The Phantom from Register Data Systems is an example of an IBM PC-based digital storage and automation system.

To get beyond these difficulties, fully integrated networks are designed to replace production and on-air recording/playback devices within a single set of fully interoperable, networked platforms that share common audio and data file formats. At their best, these systems allow nearly complete replacement of existing studio audio equipment, and they can provide a level of integration for station operations that has never before been possible.

For example, a local station salesperson can input a spot order using a modem-equipped notebook computer, calling it in from the client's location (even via cellular phone). The order is relayed to traffic and production, the spots are produced on the production workstation, then copied into the air workstation without being converted back to analog. The traffic workstation schedules the commercial, and it is integrated with the music log coming from the programming workstation. When it plays on the air, traffic and billing are updated instantly and the sales manager and general manager can get up-to-the minute reports with avails, average unit rates and other important inventory management information.

Although this may sound like science fiction, it isn't – systems are available to do this today. You can get a starter system with basic software that can work with a satellite network or local live format. A basic system could include a hard disk recorder, integrated traffic and music scheduling and a non-destructive sound editor. Well-designed systems can be upgraded so you can grow into all the other parts of a more full-blown system.

In such an expanded system, a LAN can link the various workstations to file servers using RAID arrays for storage of many hours of stereo audio, and/or to CD jukeboxes. The traffic workstation provides automatic planning and interactive generation of broadcast logs. The production workstation(s) handles direct-to-disk digital audio recording and editing with optical disk, CD-ROM or tape archiving. On-air workstations can perform live and automatic mixing and playback to air, plus recording of incoming feeds for time shifting to later playback times. News workstations add combined text and audio editing. Remote workstations can also be added that use ISDN or Switched-56 digital phone lines to broadcast from outside locations anywhere

digital telco pathways are available. Non-real-time feeds of digital audio files can come in via modem on analog or digital phone lines (or via Internet) for later playback to air.

Many integrated systems are using standard off-the-shelf LAN operating systems and hardware. Most can also support one or more types of data reduction, often assignable on a cut-for-cut basis. Some systems are providing AES/EBU inputs and outputs. Most can work either as stand-alone units or in a networked environment.

Some systems use one video monitor for audio record/playback control and display and a second monitor for visual cues, scripts, traffic, music logs and other data to be communicated to a live operator. The log that these systems follow can contain music titles, commercial breaks, external commands and text files. Many systems allow crossfading between playback sources, but this requires twice the audio-from-disk capabilities (i.e., two stereo audio playback cards). More advanced systems allow mixing of additional input/outputs for wild tracks, jingles or for simultaneous recording of one signal while playing back a different one. External controllers, such as MIDI, networks or contact closures can be linked to functions in the software. Commands to external controllers can be programmed into the log and automatically triggered during a show.

Another developing component of the fully integrated facility is the digital *store-and-forward* system. This is a PC-based device that receives and stores digital audio and data transmitted to the station from a network headquarters or other off-premises facility. Transmissions can be *direct* or *file-based* (i.e., in real time or non-real time, respectively). The store-and-forward system holds them for only a short time before they are aired. An important feature of the store-and-forward

Peripheral digital storage systems

By Skip Pizzi, *radio editor*

Although computer-based systems assume that hard disk will be the primary, if not exclusive, audio storage format, other formats may coexist in the short- or even long-term. For example, CD jukeboxes are particularly attractive to stations with large music libraries and infrequent rotations (such as classical stations). In such cases, the recordable CD (CD-R) can offer some flexibility, allowing locally produced materials to also reside in the CD jukebox rather than on hard disk. CD-R can also be used to reduce the number of CDs in the jukebox by consolidating selected cuts from original CDs that contain unwanted material. CD-Rs can also be used to circulate locally produced or selected materials among sister stations, or for archival recording. (The non-erasable, write-once nature of CD-R makes it particularly appropriate for archiving.)

Other optical disk formats use magneto-optical (MO) technology, which allows erasure and reuse of the media, along with high density and robustness on a removable carrier. In this respect, MO systems may be the most cart-like (in a positive sense) of the cart-replacement systems. Among MO systems available for broadcast use are professional versions of the consumer MiniDisc (MD) format (offering about 140MB of storage) and an audio application of the 3.5-inch MO disk used in computer data storage applications (available in 128MB and 230MB capacities). Removable magnetic disk systems can offer similar functionalities, albeit at somewhat lower storage densities in some cases. Available systems use 3.5-inch floppy diskettes (in either 1MB or 13MB varieties) and Bernoulli (65MB, 105MB or 150MB removable hard disk) formats.

The Fostex RD-8 is a modular multitrack recorder that uses S-VHS cassettes for eight digital tracks of audio storage.

Some removable disk systems offer user-selectable data reduction to extend recording times (Bernoulli and 3.5-inch MO), while others require it (3.5-inch floppy and MD). Sampling rates can also be adjusted on most units to reduce storage requirements at the cost of reduced high-frequency response. A good rule of thumb for converting data storage capacity to audio running time is as follows: uncompressed, full CD-quality stereo digital audio (44.1 or 48kHz, 16-bit linear PCM) requires about 10MB of storage per minute of audio program. (Similar-quality monaural audio requires 5MB/minute.) Typical perceptually coded data-reduction formats increase storage efficiency by a factor of about 5:1, squeezing stereo programs down to approximately 2MB/minute and mono to 1MB/minute.

Most of the removable disk systems offer external control via RS-232, -422 or -485, allowing them to be integrated into larger, computer-controlled automation systems. Some manufacturers also provide a multideck hardware controller for manual operation, and/or offer software (sometimes from a third party) for controlling their decks from a desktop computer dedicated to the task.

Two tape-based digital storage formats also play a role in the current environment. DAT is a cost-effective format for long-form time shifting, where little or no post-production is required — just simple record, rewind and playback later. It can also be a good field-acquisition format. Some editing can be performed on DAT tapes, but the required hardware is relatively expensive. Most users prefer to upload DAT recordings into a DAW when post-production is required, even if an eventual download back to DAT is required for the program's ultimate on-air playback. Using AES/EBU digital I/O for such transfers will minimize degradation, so DAT recorders that offer this capability are preferred. On a more basic level, DAT is beginning to replace the audio cassette as the preferred format for audition tapes, demo recordings and "spec" submissions, so no radio station should be without at least a basic model for these purposes of program exchange. Finally, DAT can also be used as an archival medium (in either its standard audio format, or the Data-DAT system used for computer backup), although the ultimate longevity of the format is still under some debate.

The other potentially useful digital tape application for radio stations involves the so-called modular digital multitrack systems — those using S-VHS or Hi8 videocassettes for 8-track digital recording. The modular term in the title reflects these systems' ability to be "stacked" and synchronized, so two interconnected decks can provide 16-track recordings, three can provide 24-tracks, and so on (up to 128 tracks). Here again, these systems can allow cost-effective field acquisition of multitrack recordings, for those stations that are involved with music remotes, for example. These systems have also been proposed for use in archiving or backing up multitrack DAW audio files in their unmixed form.

A final storage format that might be of use to some broadcasters is the stand-alone digital hard disk recorder, available in 2-track and multitrack types. One such multitrack unit is modular in the sense that it can be loaded for 8, 16 or 24 tracks. Unlike tape-based formats, hard disk systems can provide random-access playback, but their storage media is non-removable so recording capacity limits are absolutely fixed.

system is its alerting capacity. It can tell the station's operator or automation system that a transmission has been received, and that a data file has been updated, or a new program is ready for air. The interface between the store-and-forward system and the rest of the integrated computer system at the station is critical. Expect to see significant developments in this area soon.

At the ultimate edge of sophistication, a single platform can control multiple program streams, allowing a duopoly facility to run two or more stations from a single control room. Although most programming for the different streams will come from separate libraries, shared access to a common spot library (and other items, such as news headlines, weather and traffic reports) adds cost-effectiveness to a combined system.

Other features found on integrated systems include automatic detection of skipping CD tracks (followed by a quick crossfade to the next event), automatic reporting to traffic when a spot is ready to air, detailed copyright information on library tracks used in production, automatic timing on news scripts as they are written, and automatic currency conversion on financial reports.

The fully computerized radio station has been discussed since the first automation systems were available, and it is finally here. Turning on the coffee pot is not the highlight of this system. Rather, it is about complete communication on a real-time basis between all departments and instant documentation of what's happening on the air. This plays into the strength of radio's immediacy and makes it even stronger. Traffic, sales and bookkeeping get instant automatic updated information based on what actually played, not what was scheduled or what the air talent *said* was played. Programming can make instant music or scheduling changes. Traffic can make instant spot schedule changes. Sales can get real-time avails. Engineers can check system status from home. Owners can dial in from vacation and check profits.

No fear digital

Some new digital technologies are updates of traditional radio hardware, operating much like cart machines and consoles, in either real or virtual modes. Other systems make more radical departures, and the variety of such systems today is already astounding.

The forward-thinking designers and manufacturers of such systems are saying that it's time to ring out the old and ring in the new. Serendipitously, this trend provides an opportunity for broadcasters to rethink the way radio works. This process can uncover ways to streamline the functions of day-to-day operations. Radio performers may not have to worry about as many technical details or develop as much physical and manual dexterity as they do today. The "combo" operations that became popular in the '70s helped reduce overhead, but they increased the workload demands on the air talent. Future systems can use digital tools to reduce the busywork of air talent and let their performances shine through. These same tools can also allow the business side of the operation to maximize its productivity and profitability.

Digital storage systems can be considered as the first step toward full digital broadcasting. But regardless of DAB's arrival, in the meantime, significant benefits of digital audio technology can be enjoyed by broadcasters today.

Chip Morgan owns Chip Morgan Broadcast Engineering, a broadcast facility design, construction and maintenance firm based in Sacramento, CA. Respond via the *BE Radio* FAXback line at 913-967-1905 or via e-mail to beradio@intertec.com.

See the related article on choosing digital formats, "Tough Choices," on p. 37.

For more information on digital storage products, circle (100) on the *BE Radio* Reply Card. See also "Recording and Playback Products," p. 58 of the 1995 *BE Buyers Guide*.

Feature:

Duopoly status report

Have duopolies really made a difference?

By Neal J. Friedman

Bottom Line: *The radio industry's current consolidation trend is a powerful "payroll compression algorithm," but has it done anything else besides put a lot of former staffers on the street? A new FCC study says yes... and no. Broadcast attorney (and former broadcaster) Neal Freidman explains.*

In September 1992, the FCC took a historic step when it allowed an individual or entity to have an attributable ownership interest in more than one AM or FM radio station in a given market. Not since the earliest days of radio had this same-service/same-market multiple ownership – the so-called broadcast duopoly – been allowed. "One plus one will equal three," cheered some owners and brokers. Now, more than two years later, an analysis of the results shows that duopolies have been put into place in most radio markets, although they have not appreciably altered ownership concentrations, audiences or overall revenues. More important, however, they appear to have had some positive influence on station profits.

While broadcasters were previously allowed to own an AM-FM combination in one market, they could not have any other combination of overlapping signals in that same market. The new duopoly rules brought dramatic changes: Two years after the rule change, one in five radio stations was involved in either a duopoly or a local marketing agreement (LMA – more on these later). (See Figure 1.)

The rule change allows virtually every owner to participate, but there are some limits: In markets with fewer than 15 stations, a licensee may now own up to three stations, including as many as two in the same service, as long as the combination amounts to fewer than 50% of the total number of stations in the market. In markets with 15 or more stations, a licensee may own up to two AM stations and two FM stations, as long as the combined stations do not account for more than 25% of the market's radio audience at the time of the acquisition.

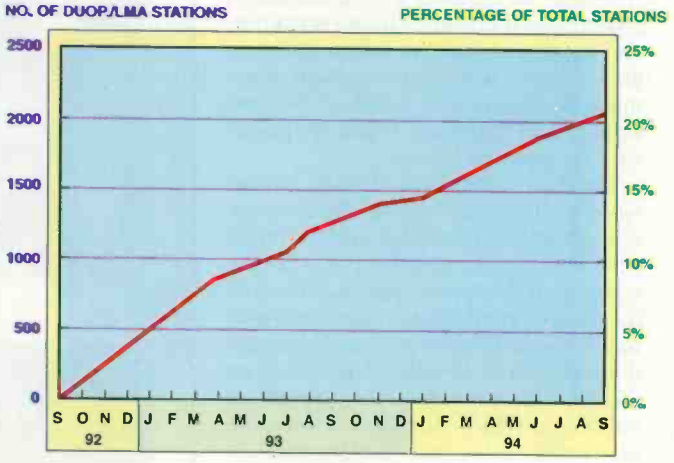


Figure 1. The number of stations involved in duopolies or local marketing agreements (LMAs, often precursors to duopolies) continues to grow. (Source: FCC.)

An FCC study conducted during the fall of 1994 found that most duopoly buyers (54.6%) picked up standalone FMs. AM-FM combinations accounted for 34% of the duopoly acquisitions, while AM stand-alones only accounted for 11.4% of the total. The FCC study also found that most of the duopoly deals were in medium markets (26-75) during the first 18 months after the rule change (September 1992 - February 1994). During the middle and latter parts of 1994, however, there was a surge of duopoly activity both in large markets and in unrated markets. (See Figure 2.) Overall, the FCC found duopolies in 127 of the 146 Arbitron markets in which there was sufficient data to analyze.

Business impacts

The most significant measure of duopolies' effect might

come from examining profitability changes at involved stations. Analysis of available revenue and audience data indicates that duopolies have not been especially successful. The FCC compared audience and revenue shares between 1992 and 1993 in 23 markets. The results, on average, were flat. (See Table 1.) Overall audience shares were down 0.3% and revenues were off by 1.1%.

Still, the FCC study found numbers in some individual markets that were impressive, although the commission warned that some caution should be exercised in evaluation of this data. In New York, the FCC reported that five stations involved in two separate duopoly deals have 15.1% of the audience and 25.6% of the revenue. In Cincinnati, where four duopoly deals combined 12 stations, those owners control 59.6% of the audience and 69.2% of the revenue in the market. In Denver, where there have been five duopoly deals involving 15 stations, the combinations now control 57.3% of the audience and 71.2% of the revenue. (See Table 2.)

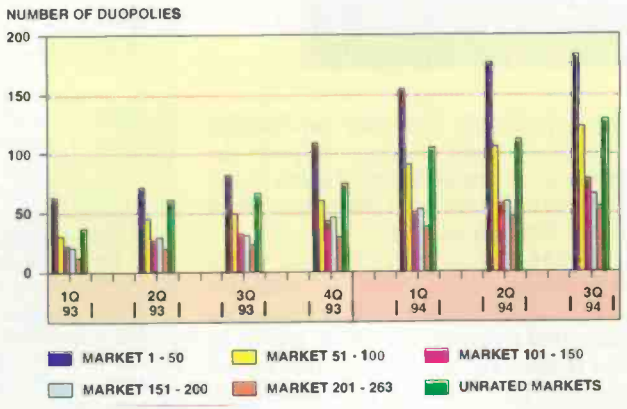


Figure 2. The popularity of duopolies has varied somewhat within different sectors of the industry. Here, the number of duopoly agreements is displayed according to market size. *(Source: FCC.)*

> Analysis of revenue and audience data indicates that duopolies have not been especially successful.

Even more dramatic numbers are found in medium markets. For example, in Buffalo, NY, four entities control 14 stations with 74.6% of the audience and 92.7% of the revenue. In Greensboro, NC, four entities control 11 of the 30 rated stations, accounting for 56.5% of the audience and an astonishing 93.8% of the revenue. In all, there are 16 markets where all duopoly combinations control more than 50% of the audience and 44 markets where duopolies control more than 50% of the revenue.

Of course, these impressive numbers may come from duopolies that were formed of already successful stations rather than any efficiencies directly attributable to the process of consolidation. But what the consolidation itself more certainly affects is the *expenditure* side of the ledger, reducing it to some extent for each of the stations teamed by a duopoly due to economies of scale. Although the FCC's recent analysis did

not empirically compare profitability yields, anecdotal evidence supports the contention that substantial gains in the bottom line have been made by at least some duopoly stations.

In San Antonio, for example, where four companies control 11 stations, one broadcaster claims that duopolies have had dramatic effects on profits in the market. Before duopoly, this source told the FCC, 40% of the market's stations were making money. Now, he claims, 80% are in the black. In Charlotte, where five owners control 90% of the revenue, one operator contends that duopolies have transformed the market from one of the country's worst into one of its best performers.

The FCC study also made no attempt to gauge the effect of duopolies on the public, or how a duopoly affected stations' abilities to meet their public interest obligations. It could be argued, however, that profitable stations are more likely to invest in news and public affairs programming, which has all but disappeared from many radio stations' programming schedules.

The FCC data does not tell the whole story and, as the commission concedes, may actually be misleading in some

Filing for duopoly

Doing a duopoly deal involves more than crunching numbers and negotiating terms. The FCC still must grant its consent and, from a legal standpoint, the duopoly deal is a bit more complicated than the ordinary transaction. The commission will require additional information on the application for assignment of the license (FCC Form 314) or transfer of control (FCC Form 315). When it adopted the new rules, the commission revised these forms to obtain information from the buyer about overlapping signals.

For processing purposes, the FCC staff considers the overlap of the principal-community contours — 5mV/m groundwave contour for AM, 3.16mV/m contour for FM. This will require the services of an engineer to prepare a study showing the number of other radio signals that overlap the principal community contours of stations involved in the duopoly. Be sure to select an engineer who has done this work before and is familiar with the showings the commission requires.

The FCC staff will return any applications with incomplete showings, resulting in delay of the required consent. A properly prepared engineering study will establish the number of stations in the market and whether the stations proposed to be co-owned fall within the limits of the rule. If the study shows fewer than 15 stations in the market, and the combined entity proposes to own not more than three stations, with only two in the same service, the purchaser has met the first requirement. In extremely small markets, the study will also demonstrate whether the acquired stations account for 50% or more of the stations in the market.

A similar study will need to be done for markets with 15 or more stations. Here the commission will allow a single entity to own as many

> An engineering study will establish whether the proposed duopoly's stations fall within the limits of the rule.

MARKET	ARB MKT. RANK	NO. OF RATED STAS.	NO. OF DUOP STAS.	1994 AUD. SHARE	1992 AUD. SHARE	DIFF. IN AUD. SHARE	1993 REV. SHARE	1992 REV. SHARE	DIFF. IN REV. SHARE
Nassau-Suffolk, NY	14	41	2	7.3	8.7	-1.4	38.0	37.6	0.4
Cleveland	23	25	6	28.4	30.0	-1.6	37.7	36.8	0.9
Portland, OR	26	27	6	20.6	20.6	0,0	29.4	28.0	1.4
Milwaukee	28	27	6	20.6	20.6	0.0	29.4	28.0	1.4
Norfolk, VA	33	28	11	36.7	40.08	-4.1	55.7	63.9	-8.2
Indianapolis	37	26	11	69.7	73.5	-3.8	88.2	91.2	-3.0
New Orleans	39	24	9	46.1	41.9	4.2	40.1	43.4	-3.3
Dayton, OH	48	27	5	27.8	21.8	6.0	42.2	38.2	4.0
Oklahoma City	51	20	6	40.4	50.2	-9.8	57.2	60.3	-3.1
Austin, TX	55	25	8	41.4	38.4	3.0	49.9	49.4	0.5
Albany-Schenectady, NY	57	27	7	24.8	25.5	-0.7	32.8	34.0	-1.2
Las Vegas	58	23	7	17.9	21.8	-3.9	29.8	29.3	0.5
Allentown-Bethlehem, PA	64	45	3	31.0	24.6	6.4	37.1	34.9	2.2
Akron, OH	68	29	3	18.8	14.5	4.3	51.5	49.6	1.9
Omaha, NE	72	18	3	19.9	15.2	4.7	17.3	16.7	0.6
El Paso, TX	77	22	3	25.1	23.8	1.3	30.1	36.5	-6.4
Salinas-Monterey, CA	79	32	2	9.3	13.4	-4.1	15.3	21.5	-6.2
Wichita, KS	88	19	10	58.5	57.3	1.2	69.8	70.0	-0.2
Columbia, SC	91	17	7	37.9	31.2	6.7	52.9	51.8	1.1
New Haven, CT	92	31	3	14.9	18.1	-3.2	45.9	51.4	-5.5
Flint, MI	110	25	3	18.0	20.6	-2.6	41.2	40.0	1.0
Erie, PA	149	12	4	25.3	33.8	-8.5	34.5	37.5	-3.0
Kalamazoo, MI	169	18	6	38.6	38.4	0.2	65.5	65.9	-0.4
AVERAGE	**(23MKTS)**	**25.6**	**5.7**	**29.6**	**29.9**	**-0.3**	**43.2**	**44.3**	**-1.1**

Table 1. The FCC identified 23 markets where ratings and revenue data were available for stations before and after duopolies were established. Note that the overall trends are flat.

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respects. The duopoly rule was changed as the radio industry was emerging from a steep decline in revenues. Thus, comparisons between 1992 and 1994 revenues could overstate trends that the observer might attribute to duopoly activities. Moreover, as noted above, revenues and ratings may not translate directly to stations' bottom lines.

Personnel impacts

One indirect measure of potential profitability can be gleaned from stations' employment figures. Although there has been a general downward trend in radio industry employment as a result of automation and reduction of local news staffs, duopolies have enabled some stations to pursue this trend even further by eliminating duplicate general managers, sales managers, program directors and technical staff. Support functions, such as traffic and accounting have been combined, as have the physical location of the formerly separate stations. All of this has resulted in significant savings. Savvy owners figured out how they could reduce fixed operating costs well before they entered into these deals. The FCC estimates that as many as 2,500 jobs may have been lost in the 500 stations involved in duopolies so far.

There is no industry consensus as to the best way to operate combined stations. For every owner or manager who believes that one sales staff can effectively sell two or more stations, there is another who will argue that the only way to keep salespeople sharp is to have them competing against each other on the street, while at the same time reminding them that they all are on the same team.

Radio managers also are divided on the question of how much to combine staffs in other areas. Clear Channel Communications, which runs duopolies in seven markets, maintains separate operations in some cases and combined facilities in others.

Overall impacts

Although the ultimate impact that duopolies will have on the industry is not yet clear, some in the industry believe it has already brought a degree of stability to ratings, revenues and cash flow, according to the FCC report. Duopolies, not unlike other group ownerships, tend to perform consistently, as the bumps

as two AMs plus two FMs in the market, but a further showing is required. The combined stations cannot account for more than 25% of the current audience share. This will require the use of ratings data. Of course, you must be a subscriber to a ratings service in order to use such data. If you are not, ratings services will perform a special duopoly study. A special study may also be required if the stations are not part of the same designated radio market. The established ratings services are, by now, familiar with the FCC's requirements in these filings.

An important thing to remember about the ratings data is that the 25% audience limit applies only *at the time of the acquisition*. If, after consummation, the combined stations become more successful and their audience share exceeds 25%, the commission will not require divestiture, and it will generally permit the stations to be sold as a group, even if their audience share has risen above 25% in the interim. But, the commission has ordered its Mass Media Bureau to prepare annual reports on station ownership, and to recommend any changes that it deems necessary to avoid any excess concentrations of audience. The commission also said it would review extreme cases, such as where the combined audience level of a single duopoly reaches 40% or more, and reserves the right to refuse to grant consent to the sale of such a property. So far, that has not happened.

MARKET	ARB MKT. RANK	NO. OF RATED STAS.	NO. OF DUOP DEALS	NO. OF DUOP STAS.	1994 AUD. SHARE	1993 REV. SHARE
New York	1	43	2	5	15.1	25.6
Los Angeles	2	46	4	9	21.2	29.9
Chicago	3	41	5	14	31.7	40.1
San Francisco	4	50	5	15	30.7	38.4
Detroit	6	32	3	8	29.1	33.5
Dallas-Ft. Worth	7	31	4	11	29.3	24.8
Washington	8	36	4	12	33.3	48.0
Boston	9	33	5	14	53.2	78.6
Houston	10	33	3	8	25.0	32.1
Miami-Ft. Lauderdale	11	37	7	19	51.2	65.7
Atlanta	12	22	2	6	30.2	31.2
Seattle	13	30	4	12	47.8	55.2
Nassau-Suffolk	14	41	1	2	7.3	38.0
San Diego	15	39	2	6	18.2	21.9
Minneapolis-St. Paul	17	21	3	7	25.5	24.6
St. Louis	18	26	5	14	46.3	46.6
Baltimore	19	36	2	6	19.4	25.4
Pittsburgh	20	30	3	7	24.8	26.0
Phoenix	21	27	2	7	20.2	22.1
Tampa-St. Petersburg	22	26	3	10	34.3	39.0
Cleveland	23	25	2	6	28.4	37.7
Denver	24	27	5	15	57.3	71.2
Cincinnati	25	31	4	12	59.6	69.2
AVERAGE		**33.2**	**3.5**	**9.8**	**32.1**	**40.2**

Table 2. Duopoly scorecard for the top 25 U.S. radio markets. (Source: FCC.)

from one station's ups and downs are smoothed by corresponding fluctuations in other stations' performances.

At least one radio chain, EZ Communications, with duopolies in six of the seven markets in which it operates, is willing to credit the new rules with an increase in profits. EZ, a publicly traded corporation, is reporting an astounding 50% increase in net income this year and a 65% increase in cash flow. EZ's founder, Arthur Kellar, told the Washington Post that duopolies have cut his stations' costs and have driven up advertising rates by forcing weaker stations out of the market.

LMAs can lead to duopolies

An LMA allows a station to "subcontract" specific business functions (such as sales, programming or spot production) to another station in its market, so long as the licensee retains ultimate control over its personnel, programming and finances. Often, such an arrangement may be the prelude to a duopoly. While the commission is processing an application for the transfer of one station's license to another station owner, operations of the two stations may be combined in much the same manner as they would be after closing of the sale. The activities now permitted under an LMA were formerly prohibited as a violation of the commission's rules against premature transfer of control.

The FCC considers the elements of control to include the aforementioned personnel, programming and finance areas. When arranging an LMA, a separate, carefully drawn agreement between buyer and seller should fully set forth the rights and obligations of each and make it clear that each licensee will retain the essential elements of control over its own station unless and until the commission grants its consent for transfer of control (i.e., outright sale of the station), and the transaction has been consummated.

LMAs often give the buyer a head start on a duopoly deal. But a word of caution – the commission and your competitors will be watching closely to ensure that the arrangement does not cross the fine line from a permissible LMA to an illegal "premature and unauthorized transfer of control." If there are changes in call signs, formats or personnel, the acquiring party should be careful to document that these changes were done after consultation with and following the approval of the selling licensee.

Radio industry analysts generally agree that it is too soon to give duopolies a final grade. Many hope that consolidation will bring investment bankers back to radio, yet it's still difficult to obtain financing for smaller deals. Soon, some of the stations involved in early duopolies will come back on the market as combinations, and that will provide a test of the cash flow multiples they will command. As one analyst, Bishop Cheen of Kagan Associates, said in comments to the commission, "God bless duopoly and double-digit revenue growth."

The dawn of a new year finds broadcasters in an upbeat mood – except for those whose positions have been recently eliminated. Although they aren't the sole cause in either case, duopolies seem to be responsible for a lot of smiles (and a few frowns) in today's broadcast industry.

Neal J. Friedman is an attorney with the communications law firm of Pepper & Corazzini, L.L.P., in Washington, DC. Respond via the *BE Radio* FAXback line at 913-967-1905 or via e-mail to beradio@intertec.com.

Field Report:

Roland DM-80

By Richard Paul

When the chief engineer announced that our station was switching to digital editing, chills went up my spine. Our radio station was moving to new facilities, and when we got there, our editing suites would be equipped not with audio boards and reel-to-reel machines, but exclusively with Roland DM-80 digital audio workstations.

This was a traumatic revelation to someone who had spent 17 years editing with tape and razor blades, but I have since become a convert – no, a proselytizer – for digital editing, thanks to a successful transition via the DM-80. The system mimics almost completely the steps you go through when editing the old-fashioned way, but it performs these tasks in greatly improved fashion.

Familiarity is the key to its user-friendliness. When it's time to find your edit point, you rock the audio back and forth over the (virtual) "playback head," mark the spot, "cut" it, and "splice" it together – all imitating the analog tape editing process.

This made the learning curve for operating the DM-80 extremely short. (I learned the system in an hour, and a few months later I taught the general manager in 20 minutes). Also, it guarantees that station staff – all of them, not just the "techies" – will use the machine.

System hardware

A complete DM-80 unit consists of a control panel, a mixing board (with faders that control eight tracks, and a simple parametric equalizer on each channel). It also features a multitrack CPU/disk recorder and one or two outboard SCSI drives (optional), each up to 4GB capacity (about 12 hours of CD-quality 4-track audio).

The DM-80 can stand alone or be used with a conventional mixing board. In the latter case, the audio goes through additional digital-to-analog and analog-to-digital conversion steps, but this typically causes no significant loss of quality.

The control panel has a small LCD screen (5" x 1.5"). Below it is a row of five function keys and a set of standard tape recorder transport buttons (play, record, stop, etc.). On the left of the panel is another row of keys for marking edit points. On the right is a jog wheel and a numeric keypad.

In understanding how to use the DM-80, it helps to think about editing with it just as you would think about editing tape. Therefore, the following descriptions will use common tape-editing terms.

Graphic display

On the screen you see not sound waves but a depiction of a piece of tape (a waveform graphic is also an option, though it is one that no one at this station has ever needed). The piece of tape sits on any one of four tracks you can work on at a given time.

Below the piece of tape are 11 functions, such as delete, copy, move, etc. that are manipulated by soft keys under the screen. There is a vertical cursor line down the middle of the screen (the *now line*) that serves as a visual equivalent of the playback head.

Loading sound

Audio can be dubbed onto the DM-80 from any source, digital or analog. You load in the material by simply hitting the play and record buttons on the DM-80.

As the audio loads into the DM-80's memory, it is depicted on the LCD screen as a strip of tape made up of a series of broken lines. The broken lines becomes solid once you have completed the upload and saved your take to the memory.

Making an edit

Once audio is loaded into the system, you can begin editing it. To make an edit, get as close as possible to the desired point by listening to the audio in play mode. When you get close, you can switch to a scrubbing mode by holding down the play and preview keys together. This creates a loop that plays over and over while you scrub with the jog wheel to find the exact edit point desired.

When you have selected your edit point, you hit the split button, which splits the "tape" in two at that spot. You can then cut to or from this edit point in a non-destructive manner.

This means that if you make a bad edit, there is no more combing through the scraps in the trash looking for an 1/8-inch piece of tape. The original take is retained on disk, and all edits are "undo-able."

> I learned the system in an hour, and a few months later I taught the general manager in 20 minutes.

Performance at a glance:

- 4- or 8-track digital audio workstation in cost-effective package
- Proprietary platform emphasizes simple, familiar operation
- Includes 8-track mixer with equalization on each track
- Automated mixing and sequencing capabilities available
- Small footprint maximizes space efficiency
- Comprehensive I/O allows flexible application and expansion
- Optional Macintosh interface adds enhanced visual display

Richard Paul is special projects producer at WAMU-FM, Washington, DC. Respond via the *BE Radio* FAXback line at 913-967-1905 or via e-mail to beradio@intertec.com.

Advantages

Although this system mimics analog tape editing in practically every respect, it offers advantages that you could never dream of in tape editing.

The random access nature of hard disk recording allows the DM-80 to easily jump from place to place in a program. For example, assume you are cutting up a talk show. Five minutes into the program the guest makes a pregnant pause that will be perfect to use as "room tone" in editing. Forty-five minutes deeper into the show you could really use that pregnant pause to help you make an edit. If you were editing with tape you would have to roll back to the pause, cut it out (or dub it onto a second source if you needed to keep the original pause in the program), roll back to the place you wanted to use it, and then cut it in.

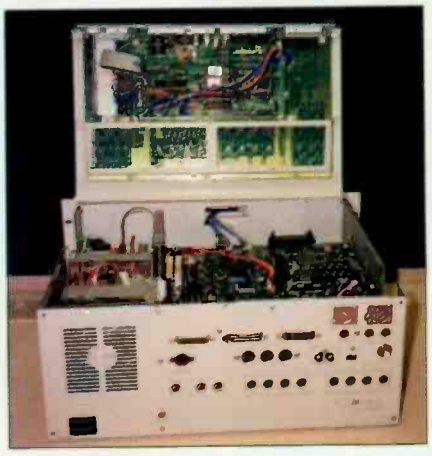
> Although this system mimics analog tape editing, it offers advantages that a tape editor could never dream of.

With the DM-80, as you are rolling past the point where you hear the pregnant pause you mark it with one of the 40 available marker buttons (e.g., Marker #1). Forty-five minutes into the show, as you hear the spot where you need some room tone, you mark it (Marker #2). To get back to the original pause, hit Marker #1. You are instantly transported back to the exact spot. Hit the "copy" button to duplicate the pause, then hit Marker #2. The pause is instantly placed in the spot where you need it and you have saved yourself 10 to15 minutes over tape editing.

Mixing and timing

Perhaps the two most valuable features of the DM-80 for a producer are the system's ability to mix and to easily "hit a post." For those unfamiliar with the term, "hitting a post" refers to the timing of a voice-over mix so that a specific event in the bed-track occurs when the voice track ends. The classic example is a DJ talking over the instrumental introduction to a song, and stopping just as the vocals of the song begin.

As anyone who does production knows, putting complex projects together



A look under the hood of the Roland DM-80's CPU (rear view). All audio, MIDI and SCSI I/O connectors for the system appear on the CPU's rear panel.

Installing and interfacing the DM-80

By Bruce Youngblood

The Roland DM-80 comes in two recording formats: 4-track and 8-track. The 8-track version can be used as a simple 8-track hard disk recorder, or with the addition of a Macintosh computer and software, an 8-track waveform editor. Without the Mac interface, it is difficult to perform 8-track operations because you can't see all eight tracks on the DM-80's LCD display — only tracks 1-4 or 5-8 are visible.

Although the DM-80 is considered a proprietary platform, it is Macintosh-friendly. The 4-track version includes one 100MB hard drive, which can record 18 track-minutes of (mono) audio at 44.1kHz sampling. The 8-track comes with two 100MB drives. We have added enough external SCSI drives (Micropolis 770MB units) to record up to 125 track minutes at 48kHz sampling.

Roland provides a list of recommended drives for such expansion purposes. Look for drives with the fastest access time and the best warranties. We had a few problems interfacing the drives to the DM-80 (which were due to the cables supplied with the SCSI drives), and through this

A complete digital production suite based on a Roland DM-80 can be set up quickly on a tabletop.

experience found out just how knowledgeable and supportive the Roland technical staff is.

Another advantage of the DM-80 is its remarkable space-efficiency. Each DM-80 installation at WAMU takes up less than half of the space that would have been required for conventional facilities of equal capability. Our typical DM-80 room adds a DAT deck, a cassette deck (for dubbing field-acquired tapes) a stereo monitor amp and a pair of small speakers to the workstation.

The DM-80 continues to develop, as well. The latest software version updated just about anything we could think of for our broadcast applications, including a built-in waveform editor (handy for music editing). Another recent upgrade allows up to four DM-80s to be ganged together through a Macintosh interface for 32-track random access recording and production.

Bruce Youngblood is operations manager at WAMU-FM, Washington, DC. Respond via the *BE Radio* FAXback line at 913-967-1905 or via e-mail to beradio@intertec.com.

with multiple 2-track tape decks requires marking in-cues, back-timing, and submixing for hours. All of that work has now been eliminated.

For example, hitting a post is remarkably simple on the DM-80. In the typical voice-over/music situation, you first dub both audio cuts onto the DM-80, placing them one after the other on the same track. Then select the spot in the music where you want the voice to end, and mark it with Marker #1. Next, move to the voice cut, and mark the end of it with Marker #2. Finally, using the move function, you move the voice down to another track of the DM-80, and by hitting Marker #1, you sync it up the two markers so that the tracks are now aligned in time exactly as you want them.

Mixing the properly placed tracks is also quite simple. As mentioned above, the unit comes with a dedicated mixing board. The DM-80 allows you to pre-program audio cuts in an automatic sequence and crossfade them as needed, but at WAMU, all mixes are done manually, using the DM-80's mixer. This hardware is another element of the DM-80's quick learning curve. Our news and production people were able to sit down and go to work almost immediately after taking the unit out of the box, because they had the option of mixing in a manner that was almost identical to what they were used to.

As many as four separate audio tracks can be lined up visually at one time, one above the other on the display screen. Levels can be adjusted manually via the mixing board as each piece of tape rolls over the *now line*. It is helpful to have this visual component added to the mixing process. You can see when the next piece of sound is coming up and move the fader exactly when you need to.

The system also has a *Compu-Mix* mode that enables you to save a mix in memory. While in this mode, you can switch the screen to show you a virtual depiction of the mixing board. As you play back a section of audio that you've already mixed, you can see the faders move up and down on the LCD screen exactly as you had moved them manually. You can now edit the mix by changing individual fader moves or update a section of the whole mix.

The resolution of *Compu-Mix* is the only aspect of the DM-80 that has caused any problem for us. It has been frustrating when, on occasion, a precise crossfade will not be saved in exactly the way it was done manually. But when balanced against the overall time saved by editing with this system, this small difficulty is certainly tolerable.

As a test, I recently went back and put together on the DM-80 a complicated, multilayered montage feature that I had originally produced on tape two years earlier. Back then the project had taken several hours. This time I was finished in about 45 minutes.

A hit among the staff

Today, WAMU has five DM-80s in operation, and they are all being used on a daily basis by engineers, production staff, news staff and a number of freelance reporters. We also plan to teach our talk show producers and executive staff how to perform basic editing and mixing functions.

Just as it's said that humans probably only use 10% of their brains, there are many other capabilities on the DM-80 (MIDI control, synchronization, etc.) that we have not yet called upon. But for the staff at WAMU, the Roland DM-80 has provided a smooth transition into the digital age.

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 Roland DM-80, circle (101) on Reply Card.

Tough choices

By Skip Pizzi, radio editor

Making the decision on a new audio recording format is one of the most challenging issues a broadcaster faces today. It's something that each station has to do on its own, based on its specific needs — everyone knows that no two radio stations do the same thing the same way. The good news is, there are so many choices: Each station should be able to create just what it needs. The bad news is, there are so many choices: the process of examining all the possibilities and making a decision can take on nightmarish proportions.

As with any large task, it's best to first split it into its separate parts. Digital audio storage is available in three major technologies (each with its own set of pros and cons): magnetic disk, optical disk and magnetic tape. There are also three major application concepts for digital systems at the radio station (each with its own requirements): production workstations, on-air delivery systems and field-acquisition equipment.

Combining these technologies and applications produces the long list of product types on the market today. Many of these systems might find a welcome place within the confines of a radio station's applications. Magnetic tape remains in two areas: DAT and the so-called modular multitrack recorders. Optical disk appears in CD and recordable CD systems, as well as in some of the removable media, digital "cart-machine" systems. Magnetic disk is perhaps the most intriguing of the lot, used in digital audio workstations and on-air delivery (or "digital automation") systems. Soon it may also appear in portable form, as well.

Each of these systems offers a variety of strengths and weaknesses when applied to the typical broadcast operations of long-form storage, short-form storage, time-shifting of programs, field recording, editing, studio production and automated playback.

Hovering over any decision process is the biggest question of all, however. How will a system fit into the fully integrated network — the "holy grail" that techno-gurus claim will run the radio station of tomorrow? Evaluating audio performance, reliability and user friendliness of these systems is relatively easy because broadcasters are quite familiar with these issues. But considering a prospective digital storage system's capacity for future integration is difficult, because it's an unfamiliar concept to today's broadcasters, and many important parameters remain unknown. What will the system be integrated into? How large and comprehensive will this "station on a screen" actually become? Will the integrated system concept really be like a holy grail, and remain largely mythical, or will it actually come to full fruition? Will the first wave of digital replacement equipment soon have to be itself replaced by a more fully integrated system?

With proper planning, and a little luck, broadcasters can choose digital storage systems that work well in relative isolation today, but that can also be fully integrated later, if necessary. "Integratability" is not something that can be easily retrofitted to a system, however, so it must be considered right along with all the other issues that you evaluate in today's new equipment purchases.

Field Report:

Panasonic SV-4100

By Flawn Williams

Anyone who has used DAT for production has soon discovered the difficulties of precise cuing and editing. To get clean-starting sound bites, for example, you often have to transfer the audio to cart or open-reel tape, or into a disk-based editor.

Some newer DAT recorders have offered marked improvements in cuing and editing, although typically with a steep price tag. But the new Panasonic SV-4100 offers fairly precise cuing and instant start, as well as a host of other features, for the lowest list price yet.

Quick start: cue and go

Manufacturers realized early on that there wasn't a practical way to get quick response and precise playback cuing from the DAT format. So they turned to a hybrid tape/RAM solution. The SV-4100, for instance, has enough RAM to hold about five seconds of stereo audio.

When you activate the machine's Quick Start mode, it loads five seconds of data from tape into RAM. Then you can search back and forth through three seconds of that sound in the RAM to select the start point you want to use. The remaining two seconds of RAM audio is needed for Quick Start playback if you happen to choose a start point that is late in the 3-second window (because the tape still has to have time to start up and be synchronized with the RAM playback).

As you use the jog/shuttle wheel to search around in RAM, the audio outputs play a discernible version of the slow-motion sound. Level meters also display and hold the amplitude of the audio as you search through it. Thus the transition point from quiet ambience to the start of a word can be found visually as well as aurally. This quickly becomes an easy cuing environment, although the sound is not as indicative as rocking the reels of an open-reel deck.

When you hit play in the Quick Start mode, playback starts instantly from RAM, with the tape taking over within two seconds when it gets up to speed.

Although the instant start and consistency of the start point are intensely gratifying to experienced DAT users (who have fought with other machines that take from 0.5 to 1.5 seconds to go into play), the cuing resolution is still not quite exact. This is because Panasonic's Quick Start system only allows editing to DAT frame accuracy, not to the individual sample.

The DAT format uses 33.3 frames per second. This means that each DAT-frame of audio lasts about 30ms. That doesn't sound like a long time, but when you're trying to trim ambient sound from the top of a sound clip, or find the exact start of a song, moving a start point even one frame can be too much.

If you've splice-edited on open reel tape, you can relate to this 30ms as roughly equivalent to a quarter-inch length of open-reel tape recorded at 7.5ips, or a half-inch on a 15ips tape. If you've learned to make your wax pencil marks with an accuracy better than a quarter-inch, you're still doing better than the SV-4100. And if you're going to the trouble to transfer your material into a disk-based editor, you can edit with a precision that is orders of magnitude greater than a DAT frame, typically $^{1}/_{48}$th of a millisecond.

For seat-of-the-pants production, however, RAM-based DAT cuing is still far cleaner than regular DAT, cassettes or carts. It's also non-destructive and repeatable. It can be easily "nudged" to try different start points – all processes that are possible but not nearly so convenient on open-reel tape. The Quick

The SV-4100 includes new capabilities that make DAT more production-friendly.

Performance at a glance:

- Instant-start DAT playback in a mid-priced deck
- RAM buffer allows editing with 30ms precision
- Flexible autolocate features
- Versatile internal or external sync referencing
- Comprehensive analog and digital I/O connections
- Wired or wireless remote-control capabilities
- Data-error display for detecting tape problems
- Numerous other features useful for radio applications

Flawn Williams is bureau engineer for National Public Radio's Chicago bureau. Respond via the *BE Radio* FAXback line at 913-967-1905, or via e-mail to beradio@intertec.com.

Start mode of the SV-4100 also includes some other new capabilities that make DAT more production-friendly.

Location, location and location

The first delight is an autolocator with five memory points, which will search and cue to the exact DAT frame you've selected. Four of these locate points can be set and remembered as long as that DAT tape remains in the machine. The fifth is a *Locate Last* feature that remembers your last selected cue point, even if you forgot to set it in one of the other locate memories.

> An autolocator with five memory points will search and cue to the exact DAT frame you've selected.

You set the current position (after trimming a cue point to frame accuracy) by holding one of the locate buttons down for at least 1.5 seconds. The locate functions only work when the machine is in Quick Start mode.

If you've got an interview recorded on a DAT tape, and you want to lift as many as five segments from it for a report, you can set locate registers for the start points of each segment. Then you can do a real-time mix, playing the interview clips back direct from DAT. As each cut ends, you simply cue to the next locate point, and the deck waits for your next play command. One caveat: beware of trying this in a combo production room with your mic open, because the high-speed tape shuttling of the DAT tape as it searches to the next location is clearly audible.

For more permanent marking of cue points you can use the DAT format's standard *Start ID* and PNO (program number) markers. RAM-based playback makes placing and searching to these markers far more dependable than on a non-RAM-equipped deck, however. Write a start ID or PNO after you've trimmed the start point in RAM, and the SV-4100 can cue back to that point later with single-frame accuracy. Just make sure that the Quick Start mode is activated – otherwise the accuracy of the SV-4100 is no better than standard DAT decks.

Another contender for cart replacement?

When placed in *single play* mode, the deck will automatically go from play to pause when a start ID or skip ID is encountered. This, in conjunction with the Quick Start features, is a practical way to use the SV-4100 as a broadcast cart-replacement system, or for theater sound effects.

But the average broadcast cart user may get befuddled by the SV-4100, because getting the deck into single play mode is not a self-evident matter. It requires simultaneously pushing three buttons on the front panel to get to system display mode, and then cycling the display past the digital input/output parameters and the error count display. None of this is marked on the machine, so you need to have the manual close at hand or become conversant with the abbreviated words on the display.

For such applications, single play mode is best used on machines that are dedicated to single play mode in on-air studios or automation systems. Once set into single play, the SV-4100 will stay in that mode (even through power interruptions) until someone wades into the system display mode and resets it.

Don't count on a single SV-4100 to cue and play a bunch of cuts in rapid succession, however. The deck does a fine job of high-speed searching, but once it gets where it's going you'll have to wait another nine or 10 seconds for it to load audio into RAM (at real time) and declare itself ready for its next Quick Start playback.

Also, the DAT format still has some trouble distinguishing start IDs or PNOs spaced less than a minute apart. Quick Start doesn't solve that quirk, so short audio cuts still need to be spaced apart on DAT tapes.

> Placing and searching ID markers is far more dependable than on a non-RAM-equipped deck.

Advanced editing and remote control

Audio insert editing can be done with a single SV-4100 (subcode data is left undisturbed). You can also "insert silence," to spot-erase right up to the desired start point of a cut. With this technique, you can prepare tapes and position PNO markers so that audio cuts have clean starts, right where you want them, for playback on any other DAT deck. (Of course, the playback startup will not be instantaneous on a non-Quick Start DAT machine. For the same reason, it's also important to put the start ID or PNO more than 1.5 seconds before audio starts when assembling such tapes.)

With two SV-4100s and an 8-pin DIN parallel cable, you can do frame-accurate assemble editing without an external edit controller. All controls necessary for RAM edit-rehearsal and edit execution are built in to the deck. But unlike fancier (and pricier) DAT editing systems, there's no user-definable crossfade – just the digital equivalent of a butt splice.

The 8-pin parallel jack doubles as a port for traditional contact-closure remote controls or external computer control. For simple hookup of start and pause remotes there's a tip-ring-sleeve jack to connect two momentary switches. The SV-4100 also comes with a wireless infrared controller, which duplicates all the on-machine controls and provides a 10-key number pad for entering PNO or absolute time numbers.

An optional parallel remote controller (Panasonic RC-410) has just become available for the SV-4100. It allows remote control of start, stop and cuing functions, including loading of the RAM buffer for instant start. It also provides a numeric keypad and 2-digit LED display for cuing to PNOs. Single-DAT-frame advance and other RAM-editing features of the SV-4100 are also possible from the remote. (The RC-410 can be used with Panasonic SV-3700 and SV-3900 DAT recorders, as well.)

Getting closer to the all-digital age

The SV-4100 has some other capabilities that mark it as a new generation of digital machine. It can synchronize its internal clock to external video or to another source of word clock. This makes it more able than Panasonic's earlier decks to handle audio-for-video work, or to be a useful building block of an all-digital studio. As supplied, this machine doesn't chase-lock to an external source, it simply synchronizes its clock to that of the external sync source.

In another welcome update, start ID and PNO subcode markers can now be transferred via either the AES/EBU or the IEC 958 (consumer) digital audio format. Older models managed this transfer in the IEC mode only.

Hardware-wise, the SV-4100's I/O is quite versatile – it can send and receive digital signals on balanced XLR, unbalanced RCA coaxial, or optical connectors.

The digital transmission format can be displayed and selected from the front panel by pushing buttons, a giant step up from the earlier Panasonic decks' rear panel DIP switch selectors. But again, the display nomenclature is so abbreviated that you'd best have a manual or a crib sheet handy before venturing in. (The manual for the 4100 does have a useful one-page primer of commands, suitable for copying and keeping with the machine.)

The RAM buffer for the Quick Start feature also offers a benefit for digital interconnection: Even after the tape "catches up" with the instant-start buffer playback in play mode, the data being read off tape continues to be buffered through the RAM. This should result in less jitter on the deck's digital output.

Staying connected with analog

The XLR analog audio output levels of the SV-4100 can be switched between +4dBm and -10dBu on the rear panel. But with some front-panel button-pushing you can lower the deck's analog output as much as 14dB, in steps of about $^1/_{60}$th of a dB. With this combination of hardware and software, a range of -24 to +4 is available, which should match the needs of almost any studio. The digital audio outputs are *not* affected by this attenuation control.

On the analog input side, the volume-and-balance-control arrangement of earlier Panasonic decks has been replaced by two separate input level controls. This may be easier for lining up the machine to a console, but stereo fadeouts are much more difficult to do at the DAT deck this way.

A window into the data

Another helpful feature that can be accessed by pushing multiple front-panel buttons is the error display. This is the same system used on Panasonic's previous studio and portable decks, and it's a great diagnostic tool. On the SV-4100, you can look at a combined error rate for the A and B heads, or look at each head separately. Mostly you'll see readings of 0 to 50 per time period, and anything below 250 or so is easily handled by the DAT format's error correction and concealment algorithms. A reading of 4992 tells you that one head is completely blocked or otherwise not responding.

> Expect to spend some time reading the manual as you get up to speed on the SV-4100...

Using this error display I could confirm the wisdom of Panasonic's recommendation not to use for audio recording the 120-meter DAT tapes being sold for the new DDS-2 computer data backup systems. A couple of years ago I'd checked the 90-meter DDS-1 computer tapes using Panasonic recorders, and the low error displays had convinced me that DDS-90's offered fewer errors than the audio DATs I'd been using. (In the DAT format, a meter of tape yields about two minutes of recording, so a 60-meter DDS tape can hold two hours of audio; a 90-meter tape holds three hours, etc.) But the DDS-2 120-meter tapes' error counts are noticeably higher than other tapes on the SV-4100. Panasonic cautions that after a lot of high-speed searching and cuing the thinner tapes' performance will degrade more than regular DAT stock.

Now what's this button do, again?

The numerous capabilities of the SV-4100 must have challenged the creativity of the designers at Panasonic. How can you do so many things with just the button space available on a 3-rack-unit faceplate? The solution was to have the machine operate in several different modes, with buttons having different functions in the different modes.

Some of this is clearly indicated on the face of the deck. But other multi-function buttons are not so clearly labeled. Not only isn't there room for more buttons, there's no room for any more labeling, either. This problem is certainly not unique to the 4100, but it affects the learning curve for users.

Expect to spend some time reading the manual as you get up to speed on the SV-4100, and be cautious about putting it into surroundings where "one button, one function" equipment is the norm.

> ...and be cautious about putting it where "one button, one function" equipment is the norm.

Speaking of the manual, it suggests using a head-cleaning cassette as part of periodic maintenance, just as previous Panasonic DAT manuals have recommended. Yet the company's service department continues to advise *against* using the head-cleaning cassettes in routine maintenance, suggesting that they be used only in emergencies. "Doing the right thing" for this and other Panasonic transports involves taking the top of the case off and cleaning the head drum and tape path by hand. Your recordings will thank you for the extra effort.

Note also that there's no need to worry with the SV-4100 (or with any of Panasonic's studio DAT decks) about leaving the tape cued and in the pause mode. These decks relax the tension on the tape just enough in pause mode so that there's a cushion of air between the tape and the rotating head drum. Unlike other DAT decks that will drop out of pause after a few minutes, the Panasonics don't "time out" of the pause mode for 12 hours.

All in all, the SV-4100 is an excellent evolutionary product. It builds on the solid base of the popular SV-3700 and offers many features of an ideal, "mature" DAT recorder. At its price point, it's bound to convince a lot of users that DAT-based production is more practical than ever.

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 and 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 Panasonic SV-4100 DAT recorder, circle (102) on Reply Card.

Movement on satellite DAB

In a Report and Order (R&O) adopted Jan. 12, 1995, the FCC officially established 2,310-2,360MHz as the U.S. satellite digital radio band. This action, anticipated for some time, follows up on the WARC-92 proceedings, in which the U.S. opted out of the "world standard" L-band (1,452-1,492MHz) allocation for Broadcast Satellite Service (Sound), choosing this S-band allocation instead. The R&O now makes the allocation official, referring to the new service as Satellite DARS (Digital Audio Radio Service).

The commission called the move "the first step toward providing the American public with new multichannel, multiformat digital radio services," citing its potential for increased choices of over-the-air programming and service to currently unserved or underserved areas and groups.

The band will be used strictly for satellite-originated broadcasts, although terrestrial repeaters (gap-fillers) within this band may be allowed in urban zones where line-of-sight to satellites is obstructed by tall buildings.

The R&O considers only the general allocation, however, and includes no rules for the service, nor any authorizations of spectrum to the service's four current proponents (American Mobile Satellite Corporation, CD Radio, Digital Satellite Broadcasting Corporation and Primosphere Limited Partnership) or any others. Further action on satellite DARS is expected soon, however, with several commissioners reportedly pushing hard to put satellite DARS on a fast track.

Included in this action is the transfer of jurisdiction over satellite DARS from the FCC's Mass Media bureau to its International bureau, where other similar satellite services are handled. This change implies that the service may not be held subject to the same regulatory standards applied to today's broadcasters under Mass Media's jurisdiction.

Satellite DARS proponents generally welcomed the news, anticipating the FCC's further action. In a representative comment, CD Radio called the action an "enormous step forward toward the inauguration of a third radio band in the U.S."

The commission also reiterated support in the proceeding for in-band terrestrial DAB, which it feels will help promote the future viability of local broadcasting. When experimental studies report that such technologies are feasible, the FCC stated that it will act "expeditiously" to implement them.

For further information, contact Lynn Remly at 202-653-8108 or Ray LaForge at 202-653-8117 at the FCC Office of Engineering and Technology.

Timex announces wristwatch receiver project using subcarriers

Timex Corporation will join Data Broadcasting Corporation (DBC) in developing a wristwatch data receiver. Like the system currently being deployed by rival watchmaker Seiko, the Timex/DBC receiver will display news, sports and financial data transmitted over FM subcarriers.

Under the terms of a joint agreement between the companies, DBC will manage the data transmission, and provide a subcarrier receiver module and antenna system of its design to Timex, who will manufacture and distribute the watch. DBC already operates a network of FM data subcarriers across the U.S. and Canada, and will likely expand the system in conjunction with this project. The service is set to begin in 1996. The companies also will explore the possibility of jointly developing other wireless consumer products.

For further information, contact Susie Watson of Timex at 203-573-5764 or Julie Craig of DBC at 415-571-1800.

ITU-R announces DAB format recommendations

As expected, the International Telecommunications Union's Radiocommunication sector (ITU-R, formerly the CCIR) has recommended the Eureka 147 system as a preferred format for terrestrial and satellite DAB. Eureka 147, which has been designed to operate on transmission frequencies ranging between 30MHz and 3GHz, has already been selected for use by many countries, and a few have begun active development of Eureka 147 DAB systems.

But the ITU-R actions stopped short of declaring Eureka 147 as a world DAB standard. It recommended that countries on less of a fast track for satellite DAB also consider a system jointly developed by the Voice of America and the Jet Propulsion Laboratory, and left the door open for other future satellite DAB systems, provided they conformed with certain minimum requirements (as listed in ITU-R Recommendation 789). For terrestrial DAB, a footnote to the recommendation added that other systems are still under development (such as in-band DAB formats), and that these might be considered for future ITU-R action, if they met some stated criteria (listed in ITU-R Recommendation 774). Whether in-band systems can meet all of these requirements remains the subject of some debate.

In an apparent attempt to limit the increasing divergence among international DAB systems, the ITU-R's recommendations also contained some general language encouraging countries to "...make efforts to bring about, as much as possible, harmonization with other system standards already developed or currently under development."

Both the Eureka 147 and VOA/JPL systems are still under examination for U.S. DAB use by the EIA and NRSC, along with several in-band DAB systems. This process is expected to lead to recommendations for a standard U.S. DAB format by late 1995 or early 1996.

The full text of these actions is provided in Recommendation ITU-R BO 1130 (satellite DAB) and Recommendation ITU-R BS 1114 (terrestrial DAB).

Aftermarket auto sound system sales soar

Consumer purchases of aftermarket car audio systems increased at record pace during 1994, growing at double digit rates during the first half of the year. According to figures from the Electronic Industries Association, overall aftermarket car audio systems' sales through June of 1994 tallied a 21% growth over the same period in 1993. A significant portion of the products sold in this category include AM/FM receivers.

Industry analysts credit the increase primarily to growing public interest in mobile electronics and high-fidelity audio reproduction in vehicles.

For further information, contact Cynthia Upson or Jonathan Thompson at 703-907-7500.

Recent FCC actions to keep broadcasters busy

The new year promises to be a hectic one on the regulatory front, thanks to a flurry of recent FCC activity. In a Report & Order (R&O) issued in December 1994, the new Emergency Alert System (EAS) was unveiled. It will begin to take effect July 1, 1995, when the current EBS alert signal will be shortened to eight seconds. This will require minor modifications to existing EBS encoders and decoders. On July 1, 1996, the new EAS service will begin, which will involve installation of new hardware and institution of new operational procedures. As broadcasters review the R&O, they are discovering its true impact upon them. (The next issue of *BE Radio* will include a full description and analysis of EAS.)

The commission also issued a Notice of Proposed Rulemaking (NPR) on MM Docket 94-130, which considers the issue of unattended operation of broadcast stations. Citing improved reliability and stability of broadcast equipment and the wide availability of automation and remote-control systems, the FCC feels that it may be appropriate to waive the requirement for a licensed, on-duty operator at broadcast stations. This action may have significant impact on radio station facilities and personnel. Final action may be taken later this year.

For further information on EAS, contact Helena Mitchell or Frank Lucia of the FCC Field Operations bureau at 202-418-1220. For further information on unattended operation, contact James McNally or Gordon Godfrey of the FCC Mass Media bureau at 202-418-2190.

BUSINESS

Telos, Cleveland, has unveiled the ZephyrNet, an ISDN-based point-to-multipoint audio distribution system. The ZephyrNet is a terrestrial method for transmitting high-quality audio to a large and readily expanded number of locations using existing ISDN PRI service.

NVision has appointed Studio Supply Company, Nashville; The Video Production Systems Company, Miami; and Washington Professional Systems, Wheaton, MD, as domestic sales representatives. Studio Supply Company will provide sales representation in Tennessee. The Video Production Company will provide sales representation in Florida, Puerto Rico, and the Caribbean. Washington Professional Systems will provide sales representation in the greater Washington DC area.

Neotek, Chicago, has sold broadcast consoles to Swedish Radio at Gavle Radio, MTV Sweden, Sormland, Uppsala, Stock, Blekinge, Gotland, Norrkopping, and Koncert Hall.

Graff Electronic Machines, England, has been commissioned by the BBC World Service to develop a system to incorporate into its "Read the News" exhibit.

Russ Berger Design Group has moved to 4006 Beltline, Suite 160, Dallas, TX 75244; phone 214-661-5222; fax 214-934-3935.

Electronic Industries Association/Consumer Electronics Group (EIA/CEG) reports that it has established the *Digital Audio Radio (DAR) Consumer Electronics Manufacturers Caucus* to represent manufacturers' views on DAB. Representatives from most major audio manufacturers interested in DAB attended a meeting and tour of the NASA Lewis Research Center on Sept. 12, 1994. EIA/CEG has developed a working charter for the caucus, including subcommittees to look at marketing and technical aspects of DAB.

The National Aeronautics and Space Administration (NASA) and CD Radio have announced a Space Act Agreement. Under the agreement, joint tests will be conducted using the Tracking and Data Relay Satellite System (TDRSS) in connection with the establishment of Direct Broadcast Satellite Radio (DBS-R). The current testing and development of DBS-R is being actively supported by NASA Headquarters' Office of Space Access and Technology and Office of Space Communications with project responsibility at NASA's Lewis Research Center in Cleveland. (See *BE Radio*, Nov. 1994).

Seiko Corporation and Seiko Epson Corporation have announced plans to deploy a high-speed global wireless network using FM radio signals to distribute information. The information will be distributed to devices such as wristwatches and car stereos.

Differential Corrections Inc. has been issued a countrywide operations license from the UK Radio Authority. The license to broadcast over the Classic FM radio network provides broadcasting capability for both differential GPS and real-time traffic services throughout most of the United Kingdom.

Worldspace Corporation, Washington, DC, held its first users' meeting for the new

Global Radio Broadcasting System. The meeting was held in Washington, DC, and nearly 100 attendees from 20 countries participated. Radio broadcasters that have signed channel reservation agreements include Voice of America, Radio Netherlands, Kenya Broadcasting Corporation, and MultiRadio of France.

Roland, Los Angeles, has reported that radio station KLOS, Los Angeles, is using the Roland SN-550 digital noise eliminator in the production of a compilation CD featuring highlights from its popular morning show.

Fostex Research and Development, Hanover, NH, and The Synclavier Company, Lebanon, NH, have announced the formation of a strategic product development alliance. The Synclavier Company will integrate its S/Link batch file of conversion software and EditView graphic user interface software with the Fostex family of Foundation 2000 digital audio workstations.

TFT, Santa Clara, CA, can supply broadcasters with the equipment needed to comply with the new Emergency Alert System (EAS). The TFT EAS 911 decoder and 912 encoder fully comply with the new emergency alerting requirements set forth by the FCC. The new EAS requirements do not support a specific system but do describe technical characteristics.

Scientific-Atlanta, Norcross, GA, has begun shipping the Encore DSR-3610 digital audio transmission system receiver. The Encore DSR-3610 uses SEDAT audio compression technology to compress digital audio signals.

The Harman Pro Group, has announced the formation of a new division, the Studer Lexicon Digital Systems Group. The new division will be responsible for developing, marketing and distributing of Studer Editech and Lexicon digital audio workstation products.

PEOPLE

Bret Brewer has joined the domestic broadcast sales team at Continental Electronics, Dallas, TX. Brewer will be based in Dallas and his territory will cover Texas, Oklahoma, Arkansas, Louisiana, New Mexico and Colorado.

Hajime Yamachuchi has been elected president of TEAC America, Montebello, CA.

Sean Bowers has joined the field sales force at 360 Systems, Westlake Village, CA. Bowers will be based in Denver and can be reached by calling 303-932-1134.

Nicholas Rose has been appointed as director of audio engineering at Eventide, Little Ferry, NJ.

James D. Godfrey and Ronnie Pohler have been named to positions with Marti Electronics, Cleburne, TX. Godfrey has been named director of sales and marketing. Pohler is sales manager.

Joe Blacker of Audio Associates has joined the sales team at Sabine, Gainesville, FL. Blacker will represent Sabine professional audio products in Virginia, Maryland and Delaware.

Ken Simons of Excellence Marketing has joined the sales team at Sabine, Gainesville, FL. Simons will represent Sabine pro audio products in North Dakota, South Dakota and Minnesota.

5V audio power amp

National Semiconductor Corporation

➤ **LM4860 and LM4861:** deliver a minimum 500mW (LM4861) or 1W (LM4860) of continuous average power into an 8W load with less than 1% total harmonic distortion plus noise (THD+N) from a 5V power supply; devices are specified for 5V operation but can operate as low as 2.7V with little degradation in performance; shutdown mode reduces supply current consumption to less than 1mA (typ.), eliminating the need for an external FET; LM4860 has headphone sensing, which provides status flag and amplifier muting when headphones are plugged into the system; in 1,000 unit quantities, the ML4861 is available in an 8-pin SOIC for $1.89 and the LM4861 in a 16-pin SOIC for $1.99.

Circle (153) on Reply Card

DAT recorder

TASCAM

➤ **DA-P1:** portable DAT offers full-featured power of studio model; features a two-head design and two direct-drive motors; maintains quality and capability from the studio using XLR-type mic/line inputs, complete with phantom power; designed to accept a broad range of signal levels from -60dBm to +4dBm; also offers unbalanced RCA connectors for S/PDF digital I/O for direct digital transfers; features A/D and D/A converters, SCMS-free recording and support for multiple sample rates - 48-, 44.1- and 32kHz.

Circle (152) on Reply Card

Time code DAT recorder

Fostex Corporation of America

➤ **D-25:** features built-in SMPTE/EBU time code generator/reader, an on-board chase/lock synchronizer with offset, an RS-422 port and interface with digital audio workstations; 16MB buffer allows for automatic storage and access to audio for instant start and insert edits; also features a 4-head/4-motor rugged transport for off-tape confidence monitoring, punch-in/out recording and variable speed operation.

Circle (154) on Reply Card

Multitrack workstation

Roland

➤ **DM-800:** performs all digital audio operations from recording to editing to track bouncing to final mix down; the 8-track recorder and 12-channel mixing system is housed in a 26x11-inch package and weighs just over 12 pounds; offers non-destructive recording/editing, optional ADAT communication bus, video display output, optional RS-422 interface, 300 virtual tracks, full dynamic automation, MIDI integration and time compression; employs a 16-bit linear recording data format with selectable sampling rates of 48-, 44.1- and 32kHz.

Circle (155) on Reply Card

Broadcast production DAW

Studer Editech

➤ **Dyaxis IIbv:** downsized model of Dyaxis II, without the synchronization and expansion capabilities; the VirtualMix feature allows a large number of tracks to be output simultaneously, eliminating the playback restrictions imposed by disk bandwidth or dense edits; features a built-in automated digital mixer, which provides level control, panning, 5-band parametric EQ and metering; functional blocks include an ADB trackball, external machine control, time code control, edit functions, fade control and transport control; precision edit wheel supplies scrub and shuttle control and can be used for precision trimming of edits and fades.

Circle (150) on Reply Card

Digital reverb and effects processor

Lexicon

➤ **PCM-80:** features digital and balanced analog interfaces, high-performance 18-bit conversion and a 24-bit internal digital bus; digital and analog inputs can be mixed together; features a new dual-DSP hardware platform, which includes the Lexichip II proprietary VLSI chip, which supports the Motorola 56002 chip; a proprietary digital audio and control bus links the two chips and is controlled by another custom Lexicon chip.

Circle (156) on Reply Card

On-air audio console

Audioarts Engineering

➤ **R-60:** features standard six-source line selector, module extenders, gold contact switches, Penny & Giles faders, Sifam meters, true modular construction, 16-bit digital audio performance and *the Simple Phone* module; open-bus architecture allows for accessory and input modules to be placed almost anywhere in the console; available in 8, 12 and 18 input module sizes with all models having two additional input and/or accessory blank positions.

Circle (151) on Reply Card

Codecs for remote broadcasts

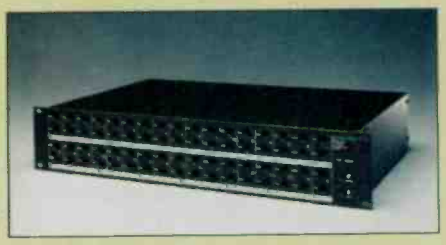
Intraplex

➤ Series 4400: switched audio codecs include simultaneously operating ISO/MPEG II encoder and decoder, G.722 encoder and decoder, ISDN terminal adapter, BONDING compatible inverse multiplexer, and a user interface that promotes call setup on a single stroke; "remote software upgrade" allows feature enhancements and changes to be sent to the codec remotely; incorporates Philips Electronics Musicore digital signal processor for ISO/MPEG Layer II encoding.

Circle (157) on Reply Card

External gain cell unit

Mackie Designs



➤ OTTO-34: designed for use with Mackie's 8-Bus series of mixers; housed in a two-rackspace chassis; incorporates 34 VCA gain cells, providing automation for up to 32 input channels and the consoles L/R master outputs; gain cells are patched into the console's channel insert points via TRS jacks on the rear panel; separate balanced send and return jacks in a normal patch-bay arrangement are provided for each channel on the front panel; all internal control functions are executed using standard MIDI command protocols.

Circle (158) on Reply Card

Digital audio workstation

Akai Digital

➤ DD1500: multitrack MO/hard-disk recorder/editor; dedicated system; comprises four main units – DD1500m (main audio processor), DD1500a (A/D and D/A converters), DD1500x (disk-drive unit capable of housing up to two MO drives or an MO drive and hard disk) and DL1500 (system controller); DD1500m offers 32 channels of audio processing; dedicated transport keys access play, stop, rewind, fast forward and record, and the jog wheel allows "reel rocking" across all tracks simultaneously; features custom video LSI for color graphics, extensive synchronization, flexible audio connections, removable recording medium and upgradeable software for future expansion.

Circle (161) on Reply Card

Digital optimizer

dB Technologies

➤ dB3000: multifunction digital audio processor; provides sample-rate down conversion from 44,100 to 22,050 samples per second, bit reduction from 17 to 24 bits to 16-bit format, optimized digital transfers, jitter removal, calibration, troubleshooting and multimedia developers tools; also features dither and noise-shaping curves designed for multimedia, real-time audition mode for immediate evaluation and dynamic QuickFit processing for increased dynamic range in 8-bit format.

Circle (162) on Reply Card

Hard disk sampler

360 Systems

➤ DR550: professional digital audio recorder that acts like a sampler, providing immediate access to 500 individual audio cuts of any length; recordings are made with Dolby AC-2 data compression and stored on a two-hour internal hard drive; cuts are mapped to 50 panel-mounted buttons (hot-keys) for ready access in 10 user-defined groups; unit is self-contained and features a bright two-line VF display, AES/EBU and S/PDIF digital I/O, analog +4dBu I/O and a printer drive; larger hard disk sizes of four and eight hours are optional.

Circle (159) on Reply Card

ISO/MPEG digital audio codec

MPR Teltech Ltd and Philips Advanced Development Centre

➤ *LIIBlue*: single-package unit includes a built-in ISDN terminal adapter(s), four-channel H.221 multiplexer, G.722, G.711, all ISO/MPEG Layer II sampling rates, remote control capability and more.

Circle (160) on Reply Card

ISO/MPEG Layer II codec system

COMREX

➤ DX230: offers full bandwidth (15kHz or more) stereo audio to be sent on a single basic rate ISDN phone line; implements G.722 algorithm for communication with other G.722 codecs; may be user configured via an easy-to-use, push-button, front-panel interface for a variety of output data rates, sampling rates and for stereo, joint stereo, dual mono or mono operation; current mode, data rate and sampling rate may be displayed on a backlit LCD, located on the front panel; features AES/EBU port for sending pre-digitized audio and offers the asynchronous transfer of ancillary data at a rate of 300- to 9600b/s, which allows for e-mail messaging or other communication to a PC over the same ISDN line.

Circle (163) on Reply Card

New Products

Internal board
Advanced Digital Systems

➤ **Radio Rock-It RDS:** allows computer to receive FM-stereo signals; displays radio text information of the PC screen, including name and artist of the music playing, traffic announcements, news and weather updates; derives its capabilities from the Radio Broadcast Data system (RBDS), a subcarrier FM frequency that transmits data; offers SRS surround sound, a five-band graphic equalizer and an onscreen digital paging system for subscribers.

Circle (164) on Reply Card

Omnidirectional microphone
Electro-Voice

➤ **RE50N/D:** features EV's patented neodymium (N/DYM) magnet structure, which results in an evenly contoured pickup pattern with extended frequency response and increased sensitivity; also features an Acoustalloy diaphragm, which permits smooth response over a large frequency band and protects the element against the abuse of high humidity, extreme temperature, corrosive effects of salt air and severe mechanical shock; DynaDamp shock mount offers greater isolation and ruggedness, and the transducer is fitted with a high-mass internal case, which is shock-mounted in the external case of the microphone.

Circle (165) on Reply Card

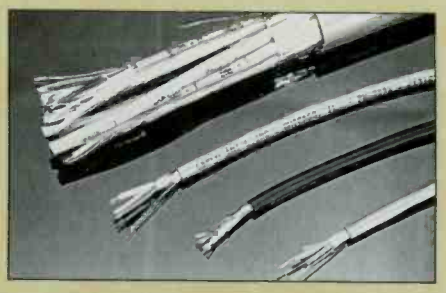
Digital audio workstations
Sonic Solutions

➤ **UltraSonic Processor:** provides up to 16 channels of digital I/O, up to 32 tracks of disk playback and 32 filter sections; solves the common problem of how to put enough I/O and audio processing power into a standard audio workstation; a full 24-channel system with eight aux sends can be configured with only two cards, leaving one slot available in the Power Macintosh for a video card or other plug-in hardware.

➤ **Sonic Power Station, Sonic Radio Station, Power Station Plus:** new entry-level systems based on the SSP-3 DSP card, previously the workhorse of the entire Sonic System line; Sonic Power provides two channels of digital I/O, playback up to eight channels from a single hard disk, and background loading to the hard disk; Sonic Radio features Time Twist and 48- to 44.1kHz sample rate conversion; Power Station Plus offers four channels of digital I/O, playback of 12 channels from a disk, background unloading and loading from the hard disk.

Circle (170) on Reply Card

Multipair digital audio cables
GEPCO International



➤ **Model 552402 and Model 552408:** designed for use in digital audio and time code applications; maintain 110W AES/EBU time code requirements, conform to NEC Article 800 and are UL Listed Type CM; cables use two solid polyethylene rods to contribute to the mechanical and electrical stability of the cable; also features 24-gauge tinned copper conductors, individually shielded and jacketed pairs and an alphanumeric surface print for easy repair identification.

Circle (167) on Reply Card

Audio processor and software
Cutting Edge Technologies

➤ **Unity AM:** complete, multiband AM processor designed to enable AM stations to tailor their broadcast sound to exacting standards not previously possible.

➤ **Unity remote software:** for Unity 2000i and Unity AM broadcast processors; allows station personnel to control their processing from their offices, homes or cars, enabling them to evaluate the sound of their station in real world listening environments and make adjustments as needed; operates on an IBM-compatible computer running DOS and supporting VGA graphics; ideal for state-run and private networks that broadcast identical programming from multiple sites.

Circle (166) on Reply Card

PCMCIA interface and translator
Audio Precision

➤ **PCM-DOS:** interface card for System One audio test, fits in standard PCMCIA card slots provided on most notebook and sub-notebook computers, eliminating the need for an ISA bus slot on the host computer or a "docking station"; available in mid-February 1995 as a stand-alone or interface upgrade when ordered with a new System One.

➤ **GAT-1:** GPIB-to-APIB translator allows users to operate their System One either via their existing interface or from and IEEE-488 GPIB controller; operates independently of the audio analyzer, thus specialized industrial systems for DC measurements or switching alone may be configured.

Circle (169) on Reply Card

Digital audio recorder
Sony Electronics

➤ **PCM-800:** uses the DTRS digital multitrack standard; designed for audio-for-video post-production applications; offers professional sound quality, excellent reliability, standard professional audio interfacing capability and full capability with other DTRS format digital multitrack recorders; features AES/EBU digital and XLR analog I/O and incorporates all basic audio functions, including precise auto punch in/out using advanced digital crossfade technology and external synchronization capability with SMPTE/EBU time code; format records eight discrete channels of 16-bit PCM audio at 48 or 44.1kHz sampling rates.

Circle (168) on Reply Card

Preview

COMING IN THE NEXT ISSUE...

Cover Story: Talk Radio

It's hot and increasingly high-tech. Learn about the latest in telephone interfacing, audio processing, facility design and computer applications for talk radio in this comprehensive feature. This is a must-read for any station doing news and talk programming.

NAB '95 Preview

Be a step ahead of the crowds in Las Vegas with *BE Radio's* exclusive pre-show coverage. You'll find everything you need to know about NAB '95's radio technology in one convenient package, covering both the conference sessions and the exhibit floor. Be sure to make it part of your convention planning.

Special Report: A First Look at EAS

Plans for the new Emergency Alerting System, successor to EBS, have recently been revealed by the FCC. This in-depth report will present an analysis of what the changes will mean for radio stations over the next few years.

Managing Technology:

Consultant Kirk Harnack tells managers everything they need to know about filing for minor changes with the FCC.

Contract Engineering:

Engineers won't want to miss this presentation of how to handle contracts and other legal matters, from fellow engineer (and lawyer) Mike Starling.

RF Engineering:

John Battison considers the engineer's rite of spring maintenance.

Plus *BE Radio's* usual slate of industry news, business and new product information — all headed your way in the March/April issue.

...And in the coming months:

Look for in-depth coverage of automation systems, radio production equipment, datacasting technology, the radio air chain, digital audio coding and an update on progress toward digital radio broadcasting. You'll also see our annual industry salary survey, numerous Field Reports reviewing hot new products, and coverage of major trade shows – including *BE Radio's* exclusive "Pick Hits of NAB," the top 10 radio products at NAB '95.

Meanwhile, our columnists will consider these topics throughout 1995:

Managing Technology: Hiring a contract engineer, EPA rules on RF radiation, owner maintenance, and computer applications for radio station management.

Contract Engineering: Billing and collection, insurance and indemnification, finding new clients, and handling multiple clients.

RF Engineering: Tower inspections, antenna and tower grounding, antenna measurements, and station proofs-of-performance.

If you have a topic you'd like to see addressed, let us know. Respond via the *BE Radio* FAXback line at 913-967-1905 or via e-mail to beradio@intertec.com.

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

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Josh Gordon
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Richard Woolley
Intertec Publishing Corp.
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Clifton Road, Deddington,
Oxford OX15 4TP England
Telephone: +44 (0) 1869 338794
FAX: +44 (0) 1869 338040
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Mashy Yoshikawa
Orient Echo, Inc.
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