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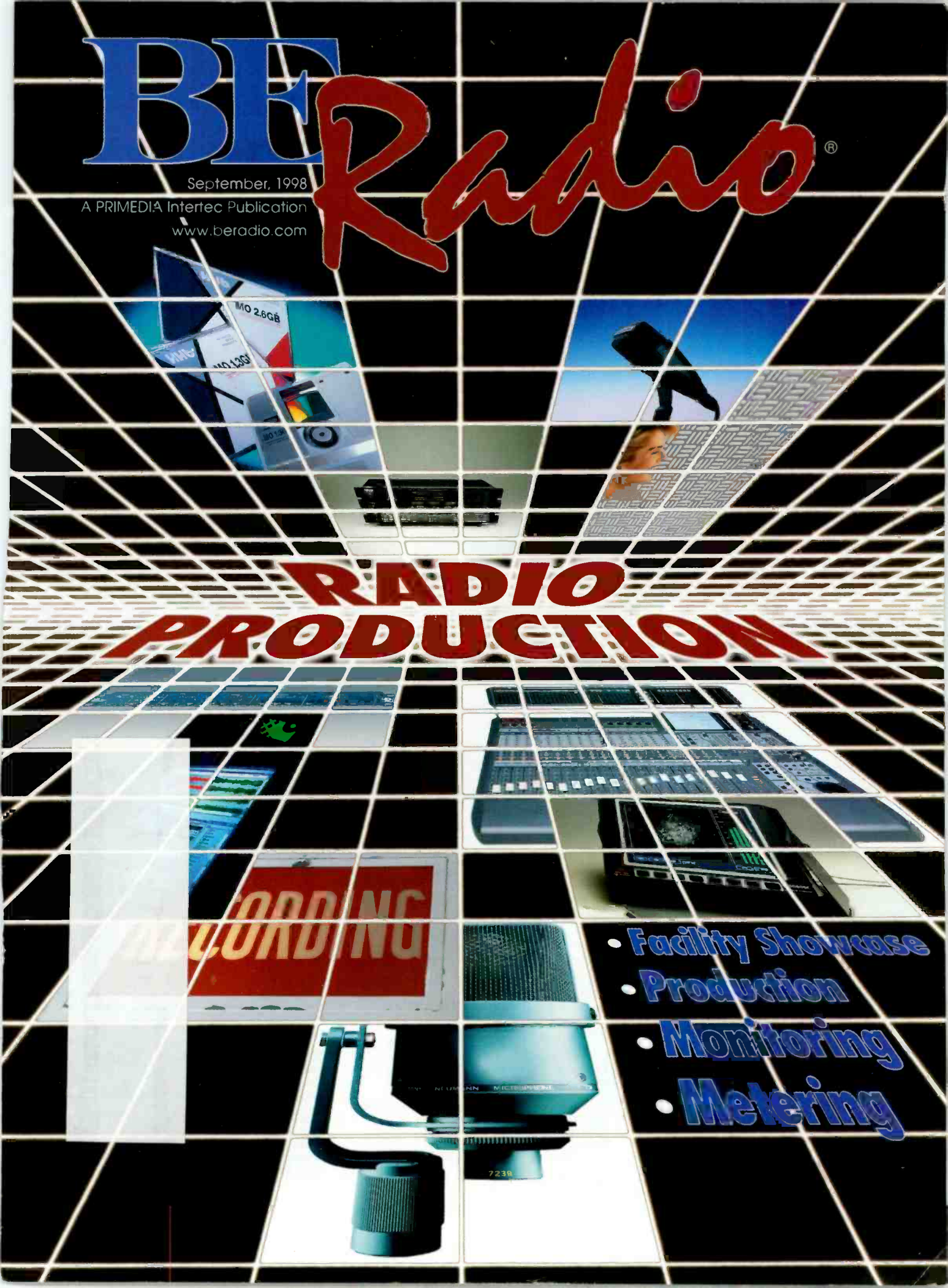

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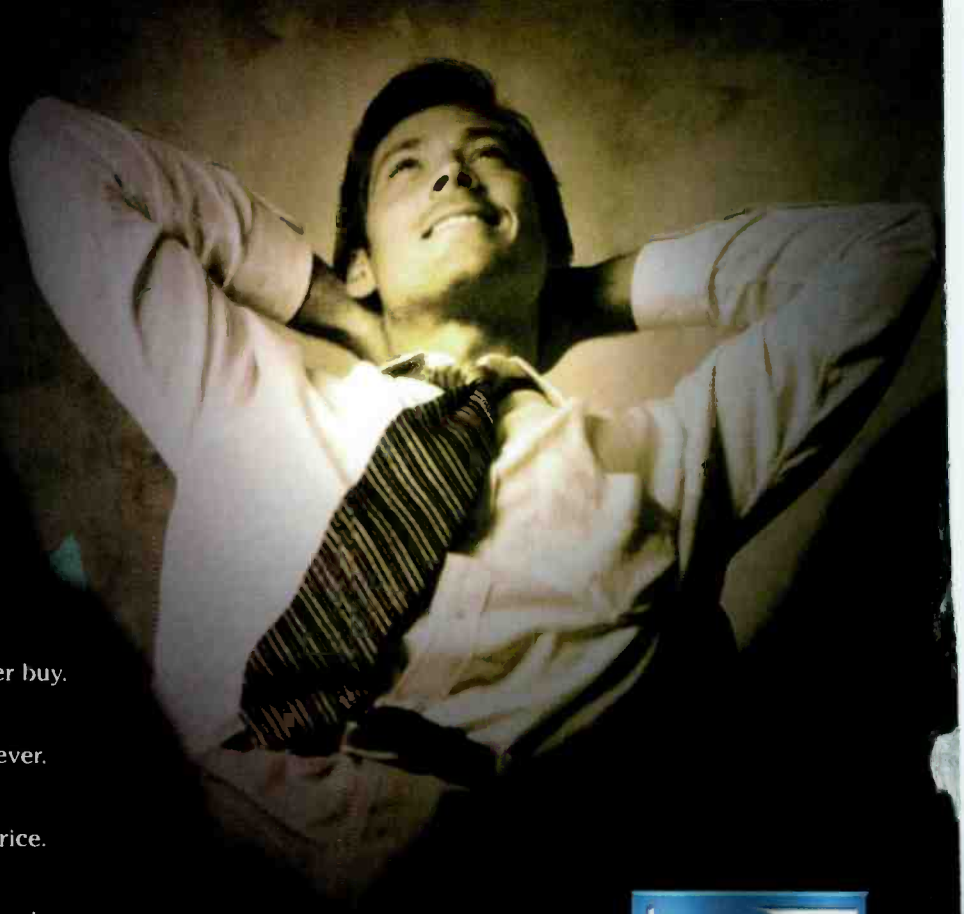

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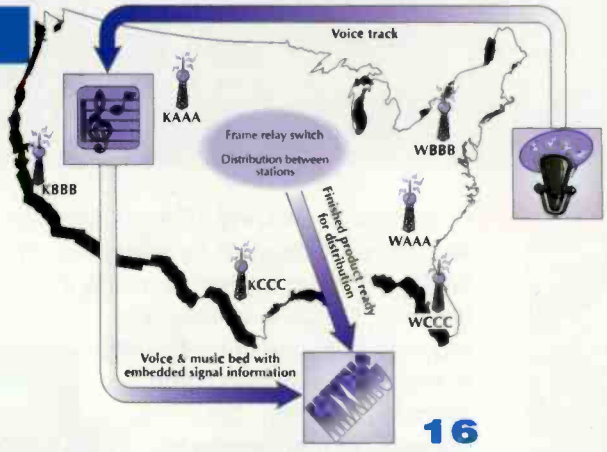

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ON THE COVER: The force behind radio is good audio. Production tools and a first-class facility are a major part of that force. Cover design by Michael J. Knust.

If you don't have the all-digital Omnia.fm processor from Cutting Edge, you're missing out on a major sound explosion. Clean, clear highs. Tight, thundering bass that shakes the walls. Digital precision that's as smooth and fluid as analog, with amazing loudness. Warmth that gets vocals and other musical elements "up front," with a richer, more natural timbre.

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Editorial

Foothold on the future?

Broadcasters are slowly realizing that their value in the digital age may be a bit different that what they originally thought. It's not just about better signal quality, but about multiple services, including those that broadcasters deliver from outside content providers. It's also about agility in migration to a different future receiver philosophy and user behavior.

Digital television and even some Eureka 147 DAB services are already hedging their bets and using digital broadcasting as leverage into both the *appliance* (dedicated receiver) and *platform* (PC-based) worlds. A similar movement occurred in the packaged media market, where the interactivity and data-storage of the CD-ROM eventually joined the original audio CD. Today, DVD is being deployed in both linear A/V and interactive/data forms from the start.

Interestingly, this reduces the value of CD or DVD players (appliances), since they can only play the linear audio or video titles, while PCs (platforms) can play these as well as interactive/data discs. The downward compatibility of DVD to CD thus makes the DVD-equipped PC a "universal optical player" today. In similar fashion, as TV broadcasters (terrestrial, cable and DBS) begin to deliver both linear and interactive/data content, the platform-based DTV receiver (i.e., computer with DTV card) will outperform the standard TV appliance as a "universal receiver." (The current form-factor and reliability of PCs may make them less desirable than the appliance players for many applications, but this is still subject to improvement.)

Yet where is US *radio* in this movement? Radio's mobility could remain an advantage over US DTV for data delivery because the latter's 8-VSB modulation system has problems with mobile/portable reception. FM (with subcarriers) or COFDM-based terrestrial DAB (with auxiliary data) is a universal delivery method of both linear audio and data, to both fixed and portable PCs. This may seem bleeding-edge today, but it could well be radio's entrance ramp to the future. TV will probably be there to serve the converged home media platform. Will radio be able to say the same for the converged *mobile* or *portable* media platform?

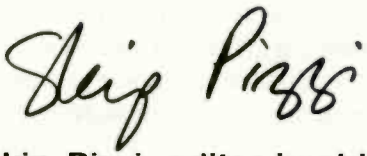
All of the above exploits radio's ability as a *service* provider, similar to a telco, where a customer pays for connectivity. Instead of the point-to-point/two-way connection that telco provides, radio offers a one-way/point-to-multipoint architecture, which could be more useful to someclients.

What about radio's other role as a *content* provider in this future environment? The consumer with access to on-air and on-line media will live in a bifurcated world. Radio operators will need to exploit their basic production expertise and infrastructure to provide multiple flavors of service, much like major retailers have added lines of small, narrowly targeted shops to complement their full-service department stores. (This co-branding can be stressed or suppressed, whichever seems wiser.)

"We should all be concerned about the future because we will have to spend the rest of our lives there."
— *C.F. Kettering*

The downside to all the choices available on-line is the consumer's inability to know about them all. Here's where the synergy between on-air and on-line services adds more strength to the broadcaster's uniquely bipolar position. On-air mentions can guide listeners to the broadcaster's (or others') on-line services. Helpful search and filtering features also increase an on-line service's value. As the saying goes, "I'd be willing to pay more money for less data, if it was only the data I really wanted."

Successfully adapting both sides of the radio industry — content and service — to this new environment will virtually guarantee the industry's continued strength. Conversely, any imbalance in this diet could threaten radio's future health.



Skip Pizzi, editor-in-chief

See Skip at:

- **AES 105th Convention, September 26-29**
  Skip will chair a workshop on "Audio on DVD," September 27, 2 - 5pm.
- **NAB Radio Show, October 14-17**
  Skip will chair and present in the "Digital Facilities Workshop" (October 15, 8am - 5pm), and will also chair the "Future Trends — 21st Century Radio" session (October 17, 10:30-11:45 am).

Hit the Road

Courtesy of WEKS The Bear

Remote broadcasts have never been easier!

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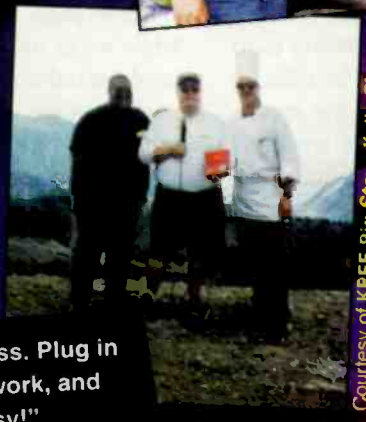
"People thought the interview was being done in the studio!"

Courtesy of KTWN

Courtesy of Middleburg Broadcasting Network

"I didn't have to do my usual routine of pulling a muscle contorting my radio antenna to avoid (RPU) interference."



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Viewpoint

A ticket to ride

The summer is almost over. The plethora of remotes will finally be coming to an end, and now you can focus on some of the studio and transmitter projects that have been on season-long hold.

I have had several conversations recently dealing with digital transition and integration. You have been reading about digital technology for quite some time here in the pages of *BE Radio*. We have also looked at ways of making the transition as smooth as possible. For every facility, there is going to be a unique approach to keeping up in the technology race and ensuring that your station is the best that it can be.

Planning the transition can be like aiming at a moving target. Once you have a plan, some new bit of news comes down that makes one element or another archaic or obsolete. Diving in to make the change can be difficult and will certainly be the source of no small amount of anxiety.

We bring information and news of technology and applications every month. However, for each idea we present, there are many more that are still out there. Every facility is unique in how it will implement new technology. What works well for one may not work at all for another. The spring NAB show is full of content covering the huge spectrum of technology, but unfortunately, radio is only concerned with a small portion of it for day-to-day operations. The fall NAB Radio show offers the advantage of being for only the immediate (radio) family. No TV or video to cloud the issue (they're busy enough, working on DTV).

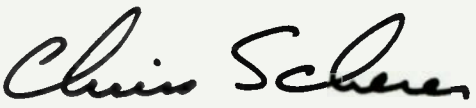
While this year's NAB Radio Show may not be convenient for you to attend — especially if you're in Florida or Maine, there are plenty of other opportunities for you to get out and rub elbows with your peers and investigate options with manufacturers. It can be as small as attending local SBE meetings. Many state broadcaster's associations hold conferences and conventions. The recent ARMA show in New Jersey and distributor shows like those upcoming for Harris and Audio Broadcast Group are excellent opportunities to get out of the station and get a fresh perspective on the industry.

I also have a few notes with some general business. I'm sure you have already visited the *BE Radio* website at *www.beradio.com* and made use of the features and information it offers. Take another look. We've added a few things to help you even more.

We've always provided you with manufacturer's web addresses whenever possible. Now we have made it easier for you to find and remember them. The Industry Links page has links to many manufacturers and dealers to make it easy for you to find information online. Now at the bottom of that page is a list of the links that appear in every issue. If you want more information on a device listed in the New Products section, there's no need to try and remember or write down the URL only to forget it later. Just remember *beradio.com*. All the links will be there.

We have also added a section for our classified ads. Now you can browse them online as well. Look for the link on the home page.

While we're on the subject, I would also like to remind you of our online feature called the Studio Spotlight. Take a look at what other stations and facilities are doing around the world in this photo layout. I welcome input on facilities we can spotlight here.



Chriss Scherer, editor

See Chriss at:

- **Harris Broadcast Expo, September 15**
  Chriss will be one of the Luncheon speakers with the topic *The Future for Radio.*
- **AES 105th Convention, September 26-29**
  Chriss will chair a workshop on "Internet Audio Systems" and the reality of Internet Radio, September 27, 9am - noon.
- **NAB Radio Show, October 14-17**
  Chriss will participate in the "Digital Facilities Workshop" (October 15, 8am - 5pm) with a presentation on *Computer-based Audio Operations - Production & Delivery*, 9am.

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Audio levels and metering

By Michael Robin

Audio signal amplitudes are continuously variable. Given the extremely wide range of audio voltages, it is customary to express audio signal levels in decibels with reference to a specific power or voltage level. Currently, there are three commonly used units for the measurement of audio levels: dBm, dBu and dBV.

The dBm

The dBm abbreviation is used to express the root-mean-square (RMS) power of a sine-wave signal with respect to a one milliwatt (mW) reference. A power of 1mW dissipated into a 600Ω load results in a 0.77459V RMS voltage (rounded up to 0.775V RMS). When dissipated into other load values, other voltages result. The power of 1mW is defined as 0dBm. Other audio power levels are expressed in dBm with respect to the reference 0dBm power level according to the formula:

$$N(dB) = 10 \log10 (P/P_{ref})$$

(where N(dB) = The number of decibels,
P = The measured power level, and
P_{ref} = The reference level of 1mW)

The formula can be extended to the measurement of voltages or currents as follows:

$$N(dB) = 20 \log10 (V/V_{ref})$$
$$N(dB) = 20 \log10 (I/I_{ref})$$

The above formulas assume identical impedances (e.g., 600Ω).

The dBu

An alternate method of expressing audio signal levels is the dBu, which assumes a near-zero source impedance and a near-infinite load impedance. Under these idealized open-load conditions, the source does not dissipate any measurable power into the load, and the open-load source voltage is unaffected by the load. The reference signal is 0.775V RMS. For practical purposes, the dBu concept requires source impedances of 50Ω or less and load impedances of 10kΩ or more.

The dBV

An alternate method of expressing audio signal levels is the dBV. This is an open-load voltage concept, and the reference voltage is 1V. The dBV is used by microphone manufacturers.

Signal-level monitoring

Audio-signal levels are closely monitored in a studio environment to ensure that sudden or sustained peaks do not cause overloading and distortion in various elements of a system. There are two generic types of audio monitoring meters found in applications for studio environments. These are the volume unit (VU) meter and the peak program meter (PPM).

The VU meter was developed in North America primarily for the control and monitoring of audio program. The specifications of the VU meter reflect the philosophy of the 1930s. Essentially, the VU meter is a moving-coil RMS-type audio-signal level measuring instrument. It is fitted with a VU scale measuring from -20 to +3, and a percentage scale with 100% corresponding to 0 VU.

The VU meter has an input impedance of 7.5kΩ and as such has a minimal loading effect on the 600Ω source impedance. Its sensitivity is adjustable so that the VU reference level (0VU) can be made to correspond to the *standard operating level* (SOL) (typically +4 or +8dBm) under steady-state sinusoidal voltage conditions. Its dynamic characteristics are such that if a sinusoidal voltage of a frequency between 35Hz and 10kHz, and of such amplitude as to give reference pointer deflection (0 VU) under steady-state conditions, is suddenly applied, the pointer will take 0.3 seconds to reach reference deflection. This characteristic was chosen to approximate the assumed response of the human ear. The 0.3-second rise-time characteristic of the VU meter introduces a masking effect. Essentially, the instrument is unable to give accurate audio signal level indications under complex-wave, fast-rise time, input signal conditions. The instantaneous speech or music signal level may, in reality, be

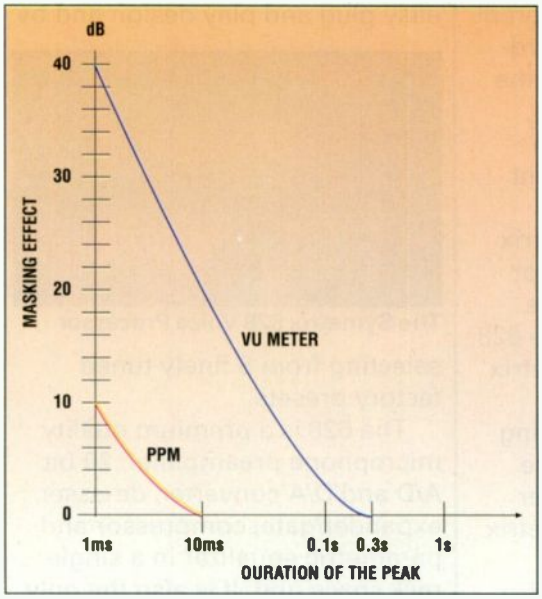
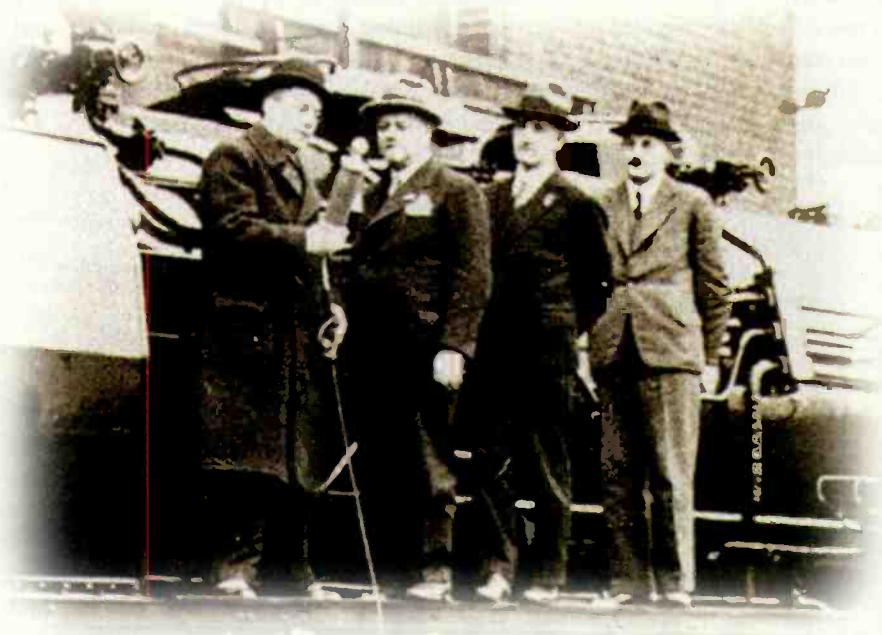


Figure 1. The masking effect of VU and PPM meters.



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10VU or more above the readings of the VU meter. The timing of the masking effect is shown in Figure 1.

The use of the VU meter has resulted in the need for a relatively large headroom in recording and distribution system elements to avoid the clipping of sudden bursts in audio signal levels. Typically, audio equipment designed to handle an SOL of +8dBm is capable of handling output signal levels in excess of +18dBm at a total harmonic distortion (THD) not exceeding 1%. Such undistorted audio peaks, unnoticed by the operator, are likely to reach the next audio stage and overload it.

The PPM is a peak-reading instrument of European origin capable of adequately displaying audio signal transients. Some current designs feature a 10ms attack time (risetime) and a 2.85-second fallback time. This characteristic amounts to a "sample-and-hold" approach to audio-signal-level monitoring. It allows the user to accurately monitor audio signal levels under steady-state and program conditions, reducing the need for large amounts of headroom in studio equipment. Neither the scale nor the display is universally standardized. Its input impedance is usually in excess of 10kΩ. The use of the PPM is gradually gaining favor in North America and is in common usage in most European countries. When properly used, it reduces the need for signal compression as overload of the next audio stage is less likely to occur.

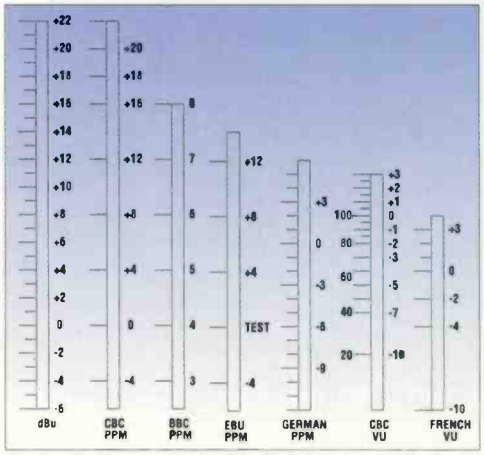

Figure 2. Upper-scale details of some audio level meters used throughout the world and the corresponding steady-state signal level in dBu.

Dynamic range

In audio environments, the overload level, also called *maximum operating level* or *maximum output level* (MOL), is usually defined in terms of acceptable *total harmonic distortion* (THD). Although there is no universal agreement on the maximum accepted value for THD, 1% is generally quoted for audio consoles and distribution amplifiers. Analog audio equipment is adjusted such that the MOL is higher than the SOL. The difference between MOL and SOL, expressed in dB, is called headroom and is usually 10dB or more.

The maximum audio signal level accepted by digital audio tape recorders before clipping is the largest digital code the A/D converter can offer. This level is called 0dBFS (decibels full scale), and all digital levels are referenced to it and assume negative values. The noise floor, a consequence

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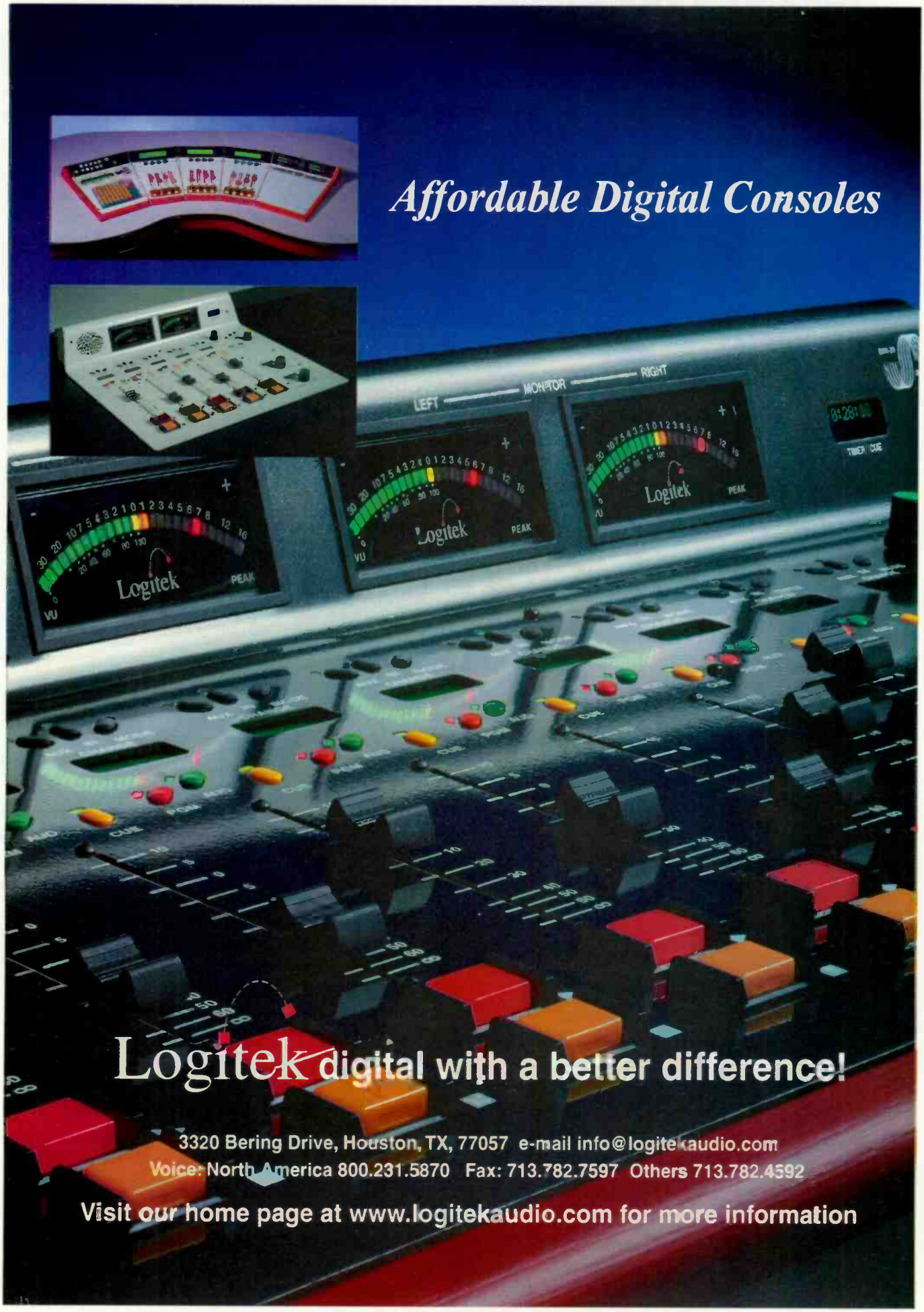

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of quantizing errors, is the quantizing noise that is on the order of -120dBFS for a 20-bit A/D converter. The resulting signal-to-quantizing-noise ratio is 120dB. Quantizing noise occurs only in the presence of an analog audio signal and can best be described as "noise behind the signal." At low analog input signal levels, the quantizing errors result in signal distortions. In the absence of an analog audio signal at the input of the A/D converter, no audible noise exists.

The *maximum signal level* (MSL) is the analog RMS voltage corresponding to 0dBFS for a particular system or device. Manufacturers have chosen -20dBFS as the SOL (equal to +8dBu or 0VU), which results in 20dB of headroom. This ensures that digital audio tape recorders will accommodate peaks extending 20dB above the average. The resulting dynamic range, assuming a low-level SNR of 40dB, is on the order of 80dB.

In analog audio environments that use VU meters for audio signal level monitoring, digital audio tape recorders may be fed with occasional peaks exceeding +10VU. The 20dB headroom of the digital audio tape recorder ensures that under practical circumstances there will be no signal clipping. The overall dynamic range is then determined by the audio console.

In analog audio environments that use a PPM for audio signal level monitoring, audio signal level peaks will normally not exceed 3dB above SOL. Some organizations using PPMs tend to restrict the digital audio tape recorder headroom to less than the 20dB reserved by the manufacturer in an effort to further increase the SNR. Encountered headroom values may vary between 12dB and 18dB. Under these circumstances, there is a high probability that occasional audio peaks will reach 0dBFS. With reduced dynamic range audio signals, the average audio signal energy will hover around 0dBFS. This could create some problems when digital audio tape recorders are used to feed analog audio equipment. The 0dBFS peaks result in +28dBu analog signal audio peaks that will overload conventional analog audio equipment.

A few ground rules will ensure smooth work in a hybrid analog/digital environment:

- The 120dB SNR typical of 20-bit digital audio equipment results in considerable dynamic range. However, reducing the 20dB overhead results in only a marginal benefit and should be avoided.
- Changing from VU meters to PPMs is recommended.
- If the superior dynamic range of the digital audio recorder exceeds the capabilities of the analog signal distribution medium, soft compressors may be used.

Michael Robin, former engineer with the CBC engineering headquarters, is an independent broadcast consultant in Montreal, Canada. He is a co-author of "Digital Television Fundamentals," published by McGraw-Hill.

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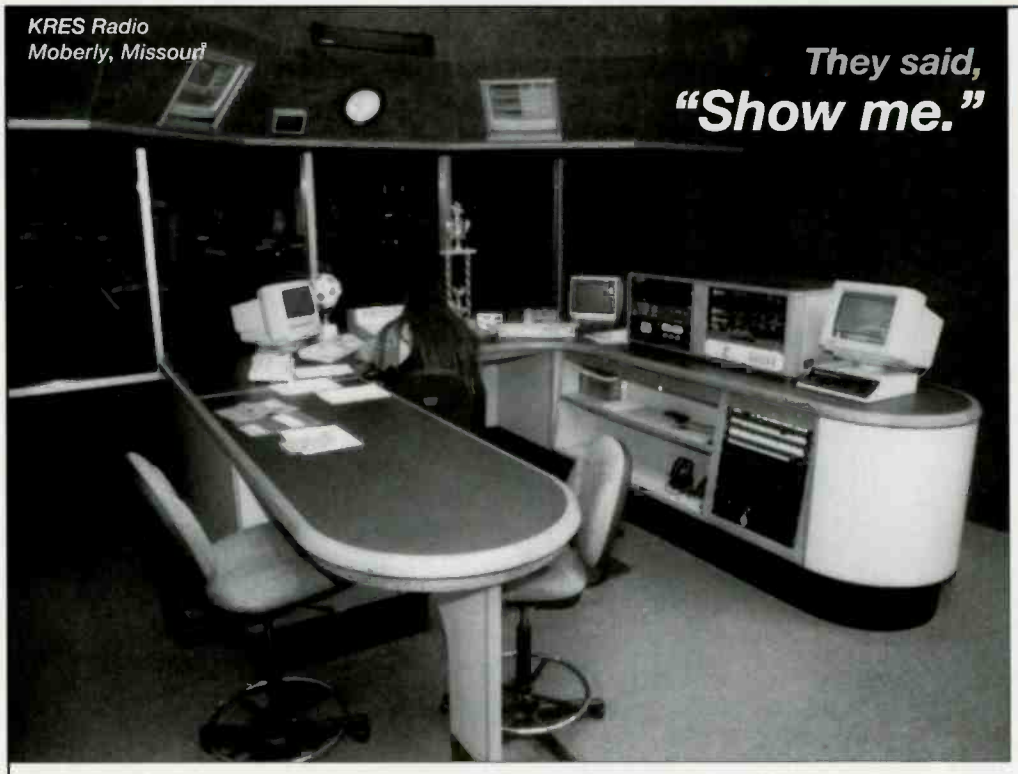

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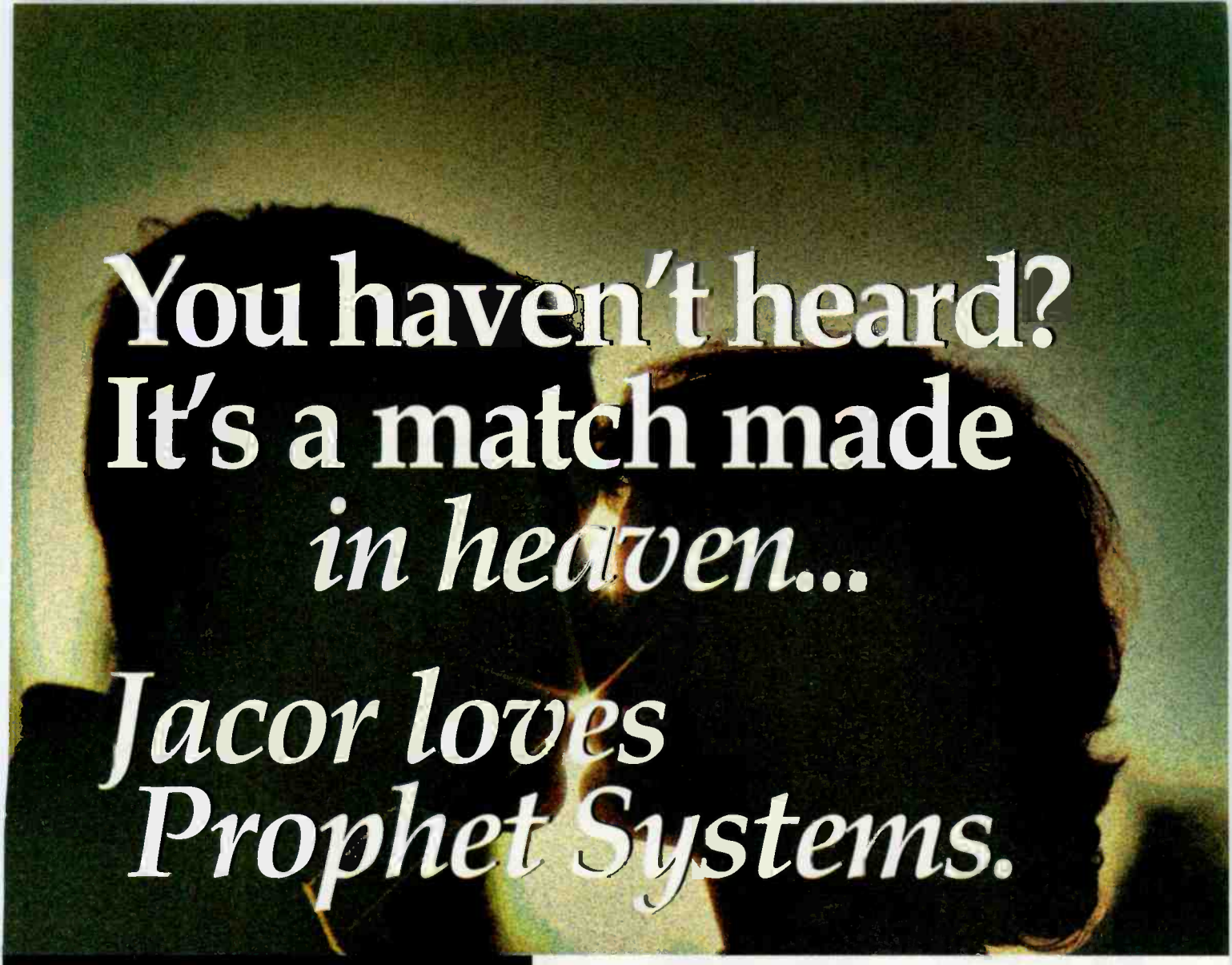

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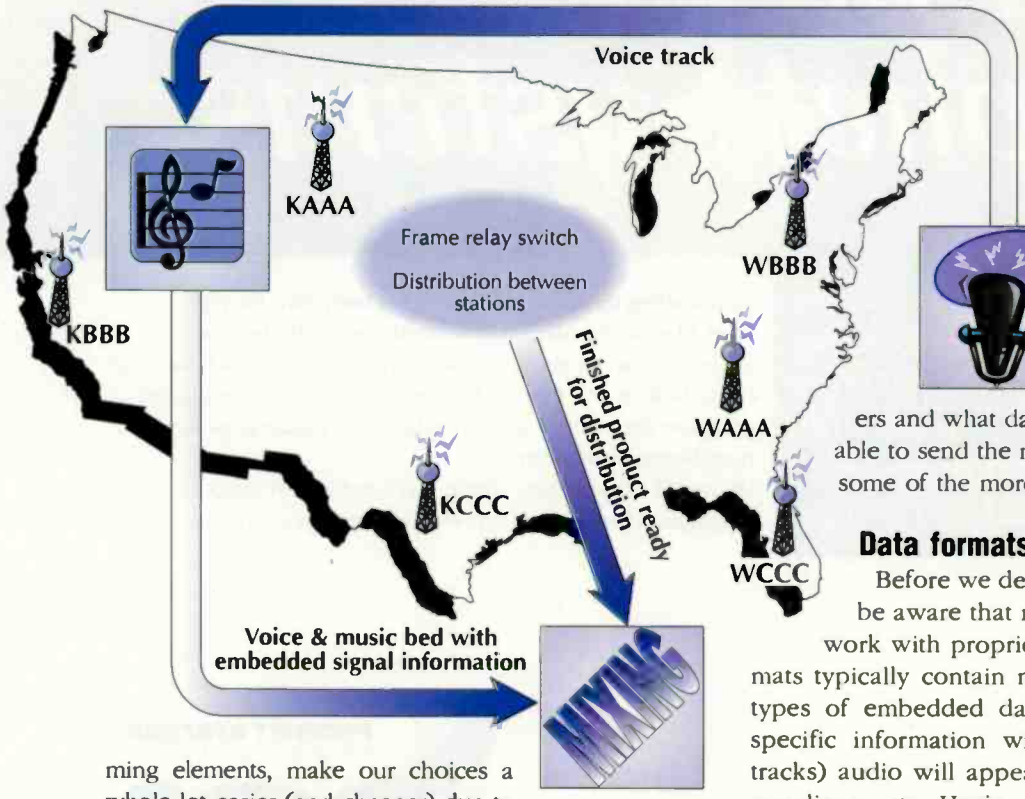
Consolidation of production

By Kevin McNamara, CNE

With the dust finally settling on the consolidation landscape, owners are looking for methods to leverage their resources in order to realize the true economies of scale. At least one group has already made a substantial commitment to link on-air programming material from their various facilities via PC-based servers connected to a Wide Area Network (WAN), and I suspect several more groups will use this approach as they go forward. Implementing such a network to carry real-time programming is still expensive, due to the nature of the leased, dedicated, high-speed data circuits required to reliably deliver the programming to its destination, with the key word being *reliably*. Sharing tasks that are not real time in nature, such as custom production or certain programming elements, make our choices a whole lot easier (and cheaper) due to the availability of several less-reliable, and bandwidth-intensive, delivery methods. For this reason, consolidating production tasks among various stations within a group is a practical solution.



Two roads

Production facility consolidation can take one of two possible forms:

1. Using fewer production resources (people) and concentrating capital spending on the minimum number of production studios necessary to create and distribute materials to the other facilities.

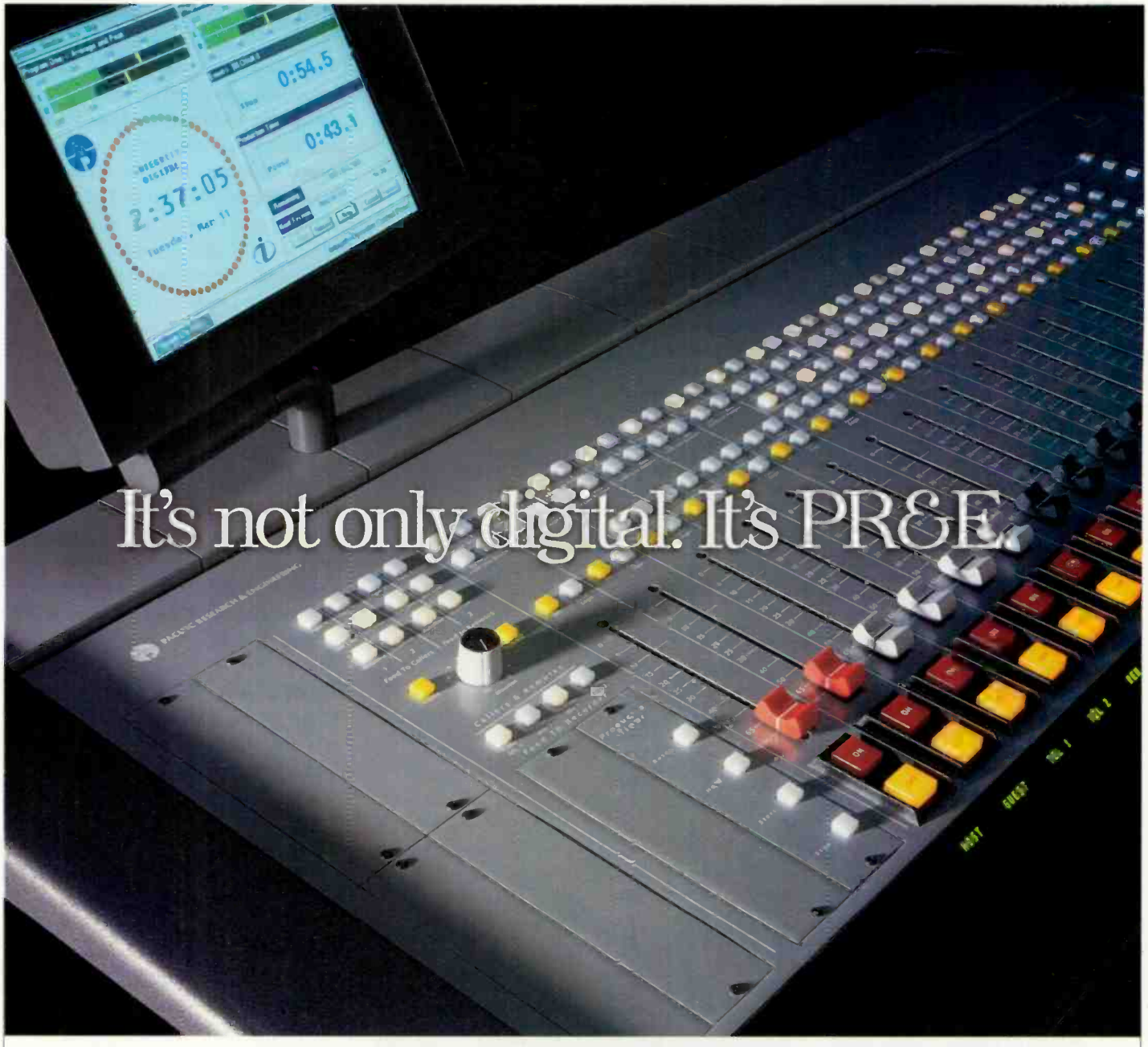
2. Creating a collaborative workgroup environment by using two or more resources, presumably with specialized skills, but located in different facilities, or even states. An example of this would be a production talent with a unique voice who is located in one city, and who shares a voice track with another production person (located in another city) who then, in turn, creates custom music beds. Then perhaps the resultant tracks are sent to yet a third person who can mix and create the final product.

The first model is the obvious choice for most owners; however, the second model allows a company to leverage its talent pool in a unique way in order to create a very different sound for each of its stations.

You need to be aware of certain limitations with respect to the specific file formats used by various manufacturers and what data transport methods are available to send the material around. So let's review some of the more universal technical issues.

Data formats

Before we delve into this area, you need to be aware that most, if not all, manufacturers work with proprietary data formats. These formats typically contain not only the audio, but other types of embedded data that are used to provide specific information with regard to where (which tracks) audio will appear, or even to control faders, equalizers, etc. Having this said, unless all of your digital audio workstations are from a common manufacturer, it is unlikely you will be able to use any of these embedded features. Some manufacturers do provide a means to convert their proprietary formats to another, either internally or externally, but this is more the exception than the rule. Many systems provide a means to transfer these formats to other manufacturers' digital storage devices; however, you



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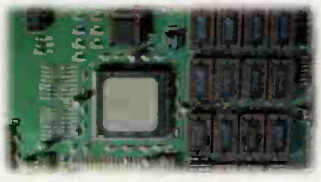

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will need to verify this with the respective companies.

Although there are several good digital audio data formats (such as MPEG), most digital workstations will only allow import and export of the traditional waveform audio format (.WAV) files, normally found on all Windows operating systems since version 3.1. The .WAV format supports multiple data encoding and compression methods and follow the Rich Information File Format (RIFF) specification; the .WAV format can also work across other platforms, i.e. PC to/from Mac.

Although not a specification for sampled digital audio, The Music Instrument Digital Interface (MIDI) is a serial data format widely used to permit electronic-based musical instruments, processing and other devices to communicate how and when the various devices produce sounds. This format can be valuable for use in the collaborative environment.

In a perfect world, you should have your choice of production tools or storage systems without worrying about compatibility. Avid Technologies, a manufacturer of digital TV workstations and storage systems, along with other audio and video equipment manufacturers, has created the Open Media Framework (OMF) file format in order to address this problem. The OMF is an open standard that permits a seamless interchange of digital program material (audio and/or video) and all related formatting, effect, timing and layering information between digital-based equipment from different manufacturers. To date, only a handful of broadcast digital audio manufacturers have included OMF compatibility in their products.

Transporting the data

Once an appropriate file format has been established, you have several choices for getting these data files from point A to point B. In the opening paragraph, I used the term "reliable" to describe a method to get data to its destination. In data communications lingo, a *reliable* data transport protocol describes a method in which the destination provides confirmation to the originating source that data has indeed been delivered. (An example of this would be a point-to-point T-1 data circuit.) In contrast, a *non-reliable* transport protocol does not perform this level of confirmation. Frame relay and even Internet protocol are considered non-reliable.

The reason for making this point is that audio that is delivered in real-time should generally use reliable data transport protocols, in part because the high bandwidth demands of such circuits require the data streams arrive in sequence so that they can be decoded properly.

Applications utilizing a non-reliable protocol perform some method of error checking. However, this takes place within the application and can cause slow or out of sequence data to be transmitted between the source and destination. A data file transmitted over

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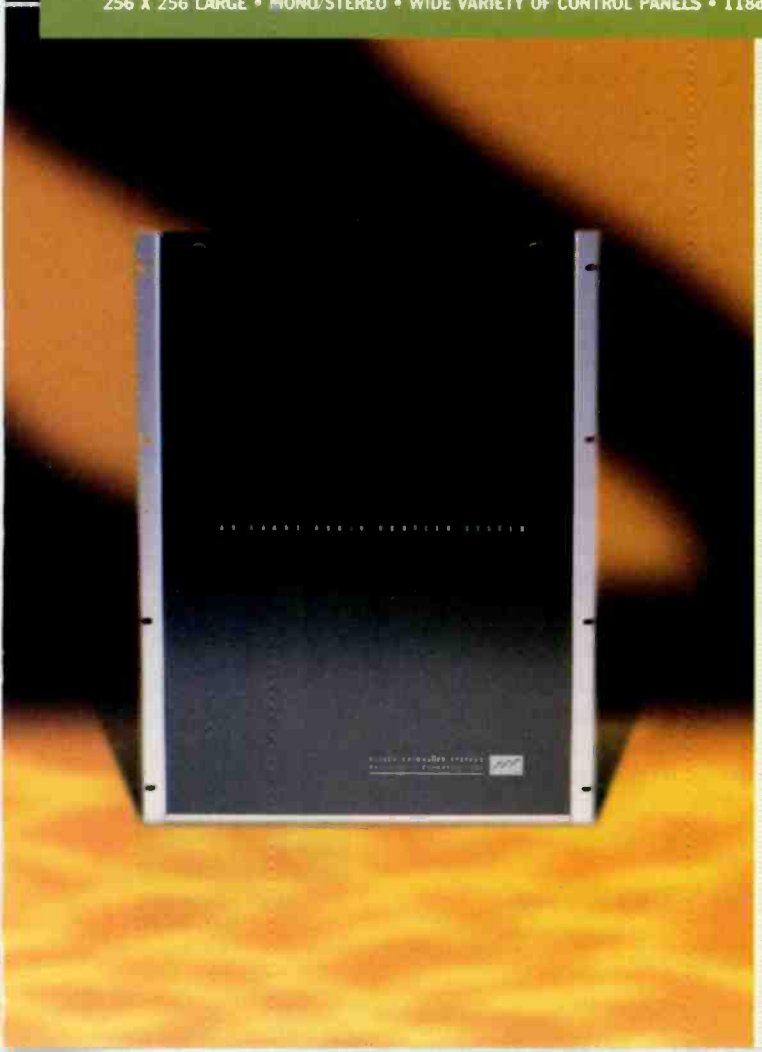

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a non-reliable data transport protocol doesn't need to arrive at the destination in sequence, because the application will ultimately handle the task of reconstructing the file in its original form. This process doesn't lend itself to real-time file delivery.

The obvious choice for sending your files between facilities is as a simple e-mail attachment through the Internet. Many stations now have dedicated full-time high-speed Internet access, but even if you don't have that luxury, most dial-up connections will give you more than enough speed for most transfers.

Once exclusively stand-alone units, DAWs are increasingly network-capable. (Photo courtesy of Orban)

Serious work

If you are serious about connecting your facilities for collaborative production, you may consider a dedicated connection to a *frame relay* network. The frame network can be a private or public network service that is leased from one of the many telephone companies. The cost of frame relay service varies with the speed required (in 64kb/s blocks up to 1.544Mb/s) and, in some cases, the actual amount of data traffic used, but expect to pay at least $350 per month (excluding installation charges) for the lower speed service. Another option to consider is called a Virtual Private Network or VPN. Your Internet Service Provider (ISP) establishes the VPN and it works like this: the ISP creates a virtual point-to-point TCP/IP connection between any two or more Internet addresses (usually addresses hosted by the particular ISP.) The connection performs much like a direct connection and the cost varies, but it can be cheaper than using frame relay.

Of course, there are several other methods to connect and consolidate broadcast facilities, but the ones mentioned in this article will provide a reasonable starting point for your consolidation.

Kevin McNamara, CNE, BE Radio's consultant on computer technology, is president of Exegesis Technologies, a consulting firm in New Market, MD. He can be reached at (888) EXE-GESIS; e-mail: exegesis@unidial.com.

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AF or RF ?

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

On the face of it there is no difference between audio and radio signals, except for their vastly different speeds, i.e. frequencies. Each type of signal is more or less a sine wave, but usually at quite different power levels as well as frequencies.

It is in the initial generation, treatment and ultimate application of AC energy that determines whether it ends up as AF or RF energy. Almost any AC signal can be radiated as RF under the right conditions. Generally, frequency and power level indicate whether the signal is AF or RF.

Drawing the line

In radio, a voltage's generation is basically similar by means of a tube or solid state oscillator. The days of rotating alternators for RF generation ended at about 30MHz, some time after the last spark transmission occurred. However, a purist might argue that aircraft power generators operating at up to 1kHz are generating AF power. These are certainly very much in the area of AF generation, but not really within the scope of this article.

The range of human hearing extends from about 10 to 15Hz, the feeling or sensing range, to as high as 20kHz for some very acute-eared (young) people. The horizontal oscillator in TV receivers can be heard by some people who have sensitive hearing, as well as by some animals that can hear that low. We know from experience that this 15kHz (approximate) signal is operating at RF because of the tunable fundamental and harmonic signals that it generates in adjacent RF equipment.

We know that animals can hear well above the human range, and the early ultrasonic remote controls were detected by many household animals. In medicine, ultrasound has been used for years to avoid potentially dangerous X-ray radiation and produce useful internal images.

It is not possible to lay down rules as to what is audio frequency and what is an RF frequency. Very low frequencies (VLF) are used in submerged submarine communications. The first transmitter design job I had was for the old Federal Electric Company in 1946. This was a 13 to 30kHz, 500kW transmitter using an antenna mounted on mountaintops with the transmitter in the valley between. This was certainly within part of the audio range but was demonstrably producing RF.

Over the years, different groups of frequencies have been more or less categorized and put into convenient bands. The submarine communications transmitter mentioned earlier falls in the VLF band.

It is very important to differentiate between RF and AC (AF) electromagnetic energy. In the final analysis, determination of a voltage's eventual use or application depends on its planned usage, i.e. will the final transducer be an antenna (RF), or some form of loudspeaker or ultrasonic applicator (AF)?

Frequency (Hz)	Effective skin thickness (copper)	
	Centimeters	Inches
1	6.62	2.60
10	2.10	0.826
100	0.662	0.260
1,000	0.210	0.0826
10,000	0.0662	0.0260
100,000	0.0210	0.00826
1,000,000	0.00662	0.00260

Table 1. The skin effect. As the frequency increases, electrical current is concentrated to the surface of the conductor.

Depending on the transducer used, our VLF submarine communication equipment can produce either an ear-piercing, high-pitched, shrill squeal (AF) or a soundless long-distance communication deep in the ocean (RF). At the same time a transducer in the field of the 13kKz RF signal could respond to it and emit an audio (AF) signal at 13kHz.

It is interesting to realize that the wavelength of the 13kHz signal when used as audio is approximately 0.08m, whereas the 13kHz RF signal has a wavelength of approximately 23,077m. The 60Hz power line voltage that we use every day has a wavelength of 5,000km in round figures.

Around the station

Audio has been conducted around the studios for years quite comfortably by means of shielded twisted pair cable. Not much attention was normally paid to line impedance, except to check for 600 or 150Ω impedance transformer connections. This type of cable is low in cost and could be run almost anywhere in the station in convenient lengths without paying too much attention to line characteristics. High-frequency attenuation could be compensated for with an equalizer, and it was not necessary to consider signal wavelength and attenuation

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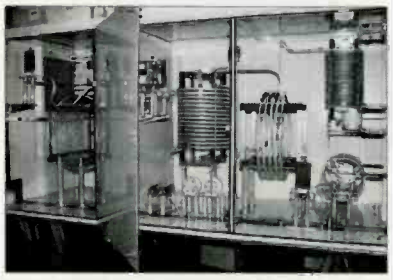

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caused by anything other than very long lines. It was never normally necessary to consider wavelength effects such as standing waves or resonance effects. However, these problems do exist in the field of the RF engineer.

This is a completely different story when handling RF voltages where frequency/wavelength becomes critical. A pair of parallel wires running side by side can extend quite a long way before the wavelength has to be considered. But as soon as the length of the line becomes an appreciable small portion of a wavelength, or equal to a number of wavelengths, trouble arises.

Depending on a number of factors such as frequency, line length, wavelengths (or a fraction thereof), the voltage at the far end may be more or less than the input. Standing waves and resonances may occur. Frequency sensitive effects such as attenuation or oscillation may occur because the line is no longer "flat" and precautions have to be taken.

As far as RF is concerned, our methods are pretty well cut and dried. The introduction of coaxial cable has made life far simpler for the RF engineer than the days when open lines had to be used.

Of course, coax and open line are not the only means for carrying RF — waveguide is used for UHF frequencies and above. It is a far cry from the usual copper wire conductor which most of us use.

Skin effect

This phenomenon normally does not have to be considered when dealing with AF signals. It is produced by the effect of the electromagnetic field that surrounds a conductor carrying RF. This moves in three directions, along the conductor, at right angles and parallel to the conductor.

Actually the lines of the E field are not strictly perpendicular to the surface of the conductor and the H field lines are parallel to it. The progress of a signal along the conductor seems to resemble the effect of ground on RF ground waves where the "drag" of the ground slows down the wave near the surface and causes the wavefront to tilt.

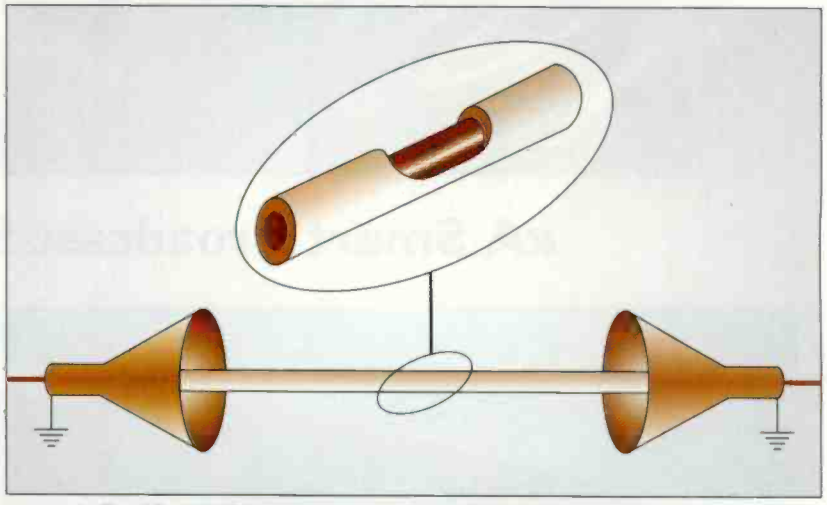

Figure 1. The "G string" is a conductor covered by a dielectric material, forming a surface wave conductor. The funnel tapers determine the matching impedence.

As the E field enters the conductor it is slowed considerably, in effect these lines are shorted by the metallic material of the conductor. This creates a current in the conductor which causes I squared R losses (heat). The current flow produces a magnetic field within the conductor that opposes the H field.

Therefore, the current is high at the surface and decreases as we go in toward the center. As we go further into the conductor, the current density decreases still further. This results in a situation wherein a half-inch copper tube has the same RF resistance at 1MHz as a solid half-inch copper wire. The RF resistance of a conductor is proportional to the

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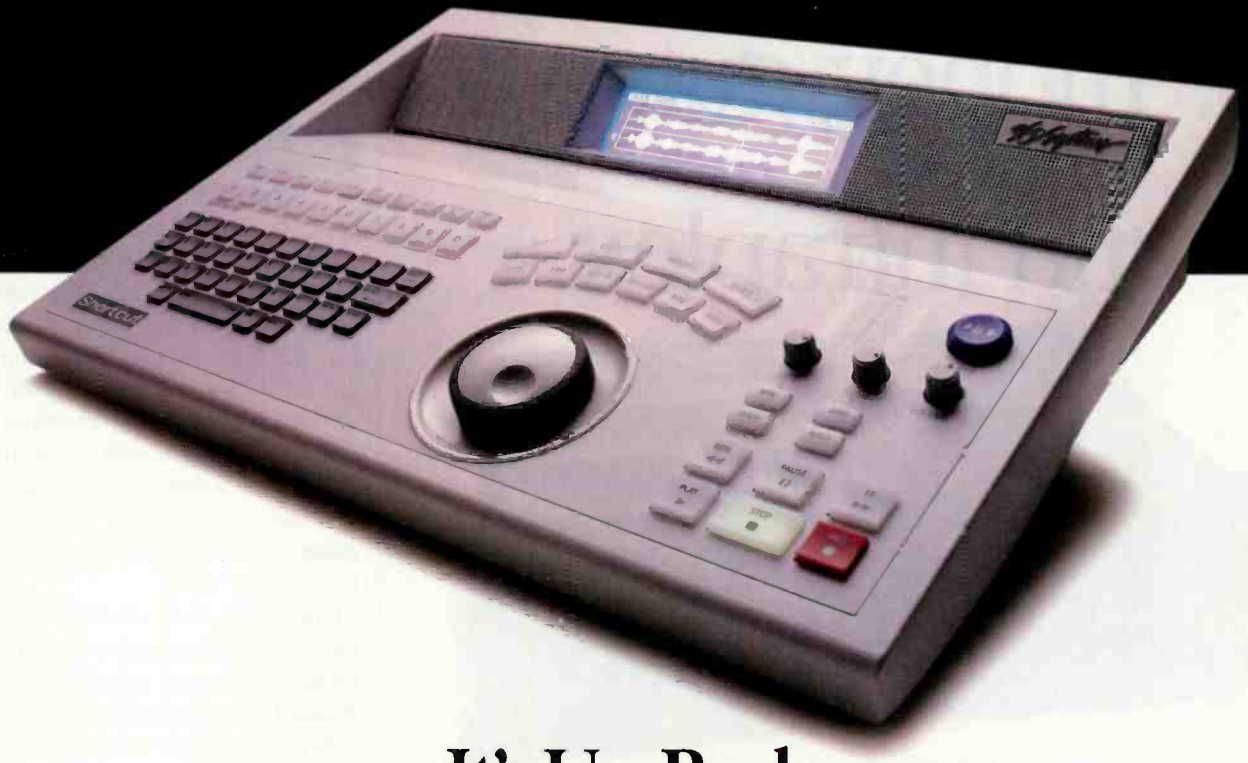

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square root of its permeability. It is this skin effect that allows us to use copper-clad cable for RF.

Another approach

The development of radar produced the "G String." This is named after its inventor, Dr. George Goubau. Normally used for work at UHF and above, it is a surface wave conductor that relies on the skin effect for its efficiency.

Impedance matching is accomplished by means of a horn feed at each end as shown in Figure 1. The G String itself consists of a copper conductor surrounded by a dielectric. Because its dielectric constant is greater than the surrounding air, the electromagnetic wave travelling on the wire's surface will move more slowly than a wave in air. Because of this, the energy tends to converge inward so that its tendency to radiate is counteracted.

US Radio Frequency Allocations:
www.ntia.doc.gov/osmhome/allochrt.html

I have not seen this in use in a broadcast transmitter, but that doesn't mean it has not been used. One reason for its rarity is that as much as 20% power can be lost by undesired radiation.

The advent of digital transmission has brought a great change to the audio engineer's handling of audio around the station. It is not in the purview of this article to go into detail concerning digital audio handling in studios and audio equipment. Digital audio handling has created a need for audio cable capable of handling what amounts to a series of pulses instead of sine waves. There are certain restrictions controlling the length of twisted pair carrying digital audio, and the cable manufacturers have produced excellent new cables designed especially for digital use.

E-mail John at batcom@bright.net.

Editor's note: *For more information on cable requirements for digital audio signals, see the March (p.26), May/June (p.78) and July (p.10) issues of* BE Radio.

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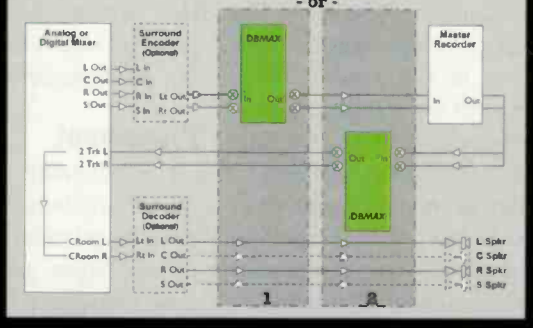

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Optimizing audio monitoring

By Chip Morgan

Design of audio monitoring in a radio station is a complex science. Optimization of monitor systems has a profound and long-lasting effect and is appreciated, even if subconsciously, by every member of the staff. When a facility has poor monitoring facilities, the staff is unable to identify and correct problems with the product. Talent suffers from hearing desensitization and is easily fatigued. Ratings and morale suffer and nobody really knows why.

Critical listening

The definition of optimized audio monitoring differs depending on the function of the monitor system. In radio, audio is monitored at various stages of the broadcast, from the rawest recordings to the final performance as received by a radio set. Audio monitoring equipment in a radio facility must have the flexibility and accuracy to sample the product in a consistent, controlled environment.

In a radio production room, monitoring means listening for technical problems in a recording as well as listening to the mix itself. Conversely, in an air studio, audio monitoring is primarily a function of making sure there is no dead air, of mixing elements together and as a background function during production of the show. But when the talent puts on headphones and speaks into a microphone, audio monitoring in the control room becomes critical. Elsewhere around the station, audio is monitored in offices and in hallways to listen to the final program as well as to be sure the station is on the air.

In order to optimize the ability to monitor audio in its progression through the radio facility, each monitoring position should be designed specifically for the intended purpose. For example, the requirements of newsroom monitors are not the same as those of production room monitors.

Some equipment operators in a radio facility may have hearing damage, while others may have very sensitive, yet untrained ears. In certain cases individual staff members may have "golden ears." These people may have special training and knowledge, or they may be the ones who care enough to complain about obvious audio problems.

An awareness of the normal characteristics of audio in various stages of production comes with experience and attention to detail. It is this awareness that separates professional performers and engineers from amateurs.

Accurately monitored audio should be a primary concern in any radio facility. Near-field use has increased in recent years.

Monitoring standards

Facility monitoring standards should be established in order to achieve consistency and stability throughout the plant. For example, the same type of speakers and headphones (although personal preference affects this) should be used in all critical monitoring systems. Typically a physically small, integrated power amplifier system, perhaps with a sub woofer, is used for loudspeakers to maximize line-of-sight and minimize space requirements.

The importance of appropriate acoustical design has been stressed in radio for more than 75 years, but the realities of the business rarely encourage it. Rather than reiterating details that can be found in many textbooks, it is more practical to concentrate on easily achievable design solutions. One important thing to remember is that studios should be designed primarily to achieve good acoustics for the microphones, and secondarily for the loudspeakers.

Placement

It is generally recommended in radio that near-field monitoring be used to minimize cross-coupling between studios and to simplify acoustical requirements within the rooms. Since proper positioning of loudspeakers requires no more than a 15-degree elevation above the listener's ears, mounting speakers high on walls is hardly optimization.

In the majority of radio stations, critical listening should be done on good headphones, because it is very rare to find consistent room acoustics in a radio facility. The headphone monitoring system in a radio studio can be much more important than the monitor speakers.

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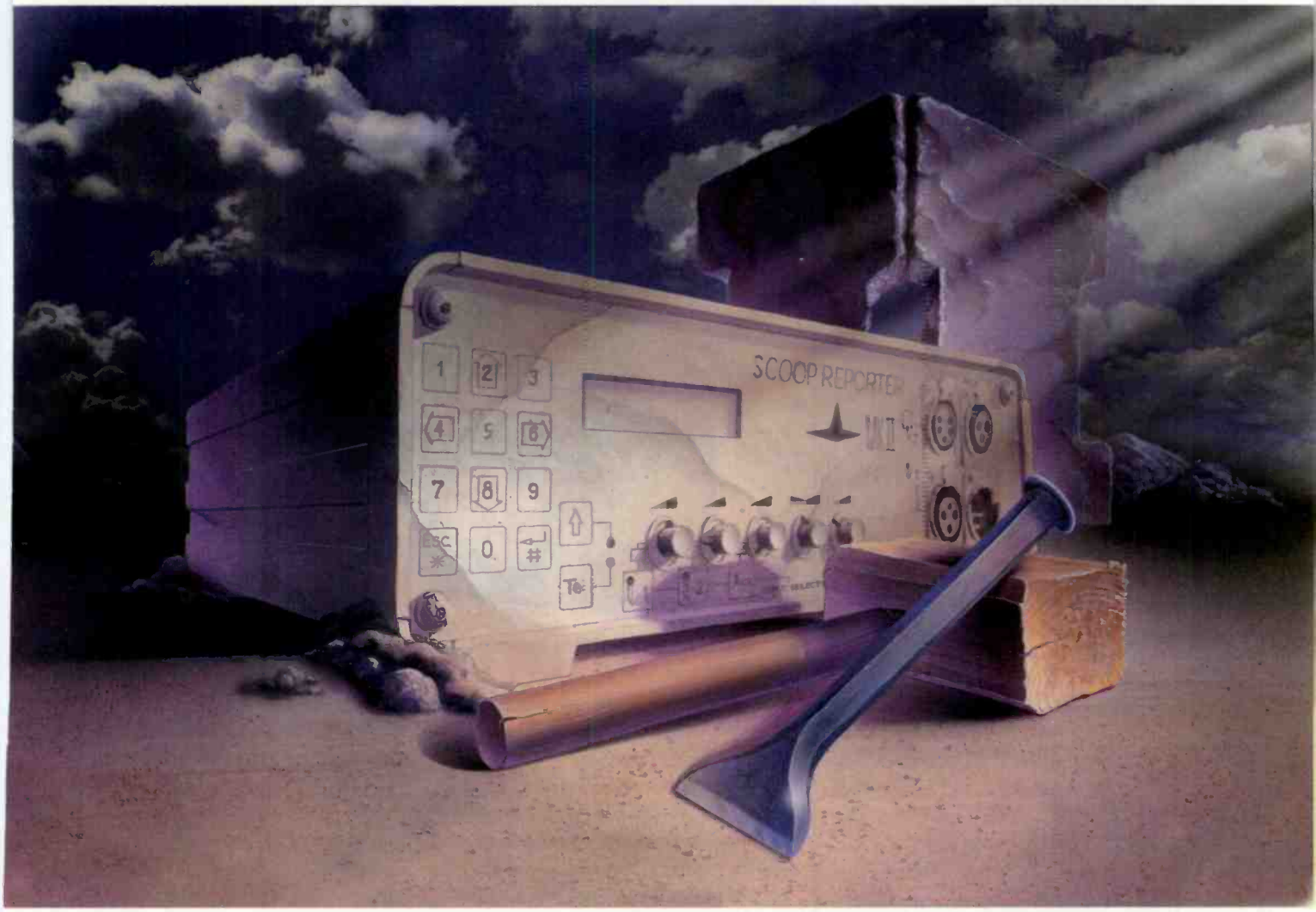

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Next Wave

Various environments

Most field recording is done in harsh acoustic conditions. The environment for monitoring, whether on loudspeakers or on headphones, is poor. Many times the engineer or talent is operating the equipment as well as performing, so they have little time to worry about the quality of the recording. Whenever possible, monitoring should be performed in a quiet area. Field monitoring in radio is done almost exclusively with headphones.

primarily a function of being able to hear how the on-air mix sounds to the average listener. In addition, live microphones, telephone calls and various other audio sources are used, requiring that the show's talent be able to perform critical mixes under great pressure. Sadly, even with the best off-air monitoring systems, the talent hears artifacts of the STL system, the transmitter and the receiver used to drive the air monitor — not the pure sound being sent from the studio.

The Yamaha NS-10M is commonly used in near-field monitoring applications.

In a newsroom, the priority is speed and accuracy of material. The audio quality is of secondary importance – though good news audio is well appreciated by listeners, especially ambient sound and background audio to establish location or situational positioning. News staffs deal almost exclusively with raw audio that has not been processed or treated in any way. Monitors should be designed for critical speech monitoring.

In a production room, quality audio is the main ingredient in the production of commercials and station image materials. The sound of the materials is as important as the actual message. Many budding production directors and all new hires at a station are amazed at the difference between the way audio sounds in the production room and the way it sounds on a radio. Use of a duplicate airchain in the monitor system is a major secret of optimizing production room monitoring. Be sure to have a mono and a phase-reversal function as well as a good scope or phase meter.

Various pre-produced items are brought together in an air studio for the final program and monitoring is

In your head

When listening on headphones while talking on the air, talent mainly wants to hear the live voices. If the unwanted artifacts from the signal path are severe, alternative monitoring tactics can solve many problems. For example, feed the main processing output to the headphone monitors, but also have an auto switchover to a receiver in case of transmitter failure. The studio loudspeaker system should still be fed receiver audio at all times. This keeps the risk of unknowingly being off the air low and the talent will be much happier.

The air monitor system is one of the most frequently overlooked areas and has the greatest potential for improved performance. It is also advantageous, although not always practical, to have several sets of monitors in an air studio to provide quality audio to all performance areas.

The engineering room needs monitors for overall performance monitoring of transmitted audio as well as critical testing and evaluation of subjective tuning of the entire facility. When the audio processing is adjusted, the engineer needs a place to monitor the audio at various stages in

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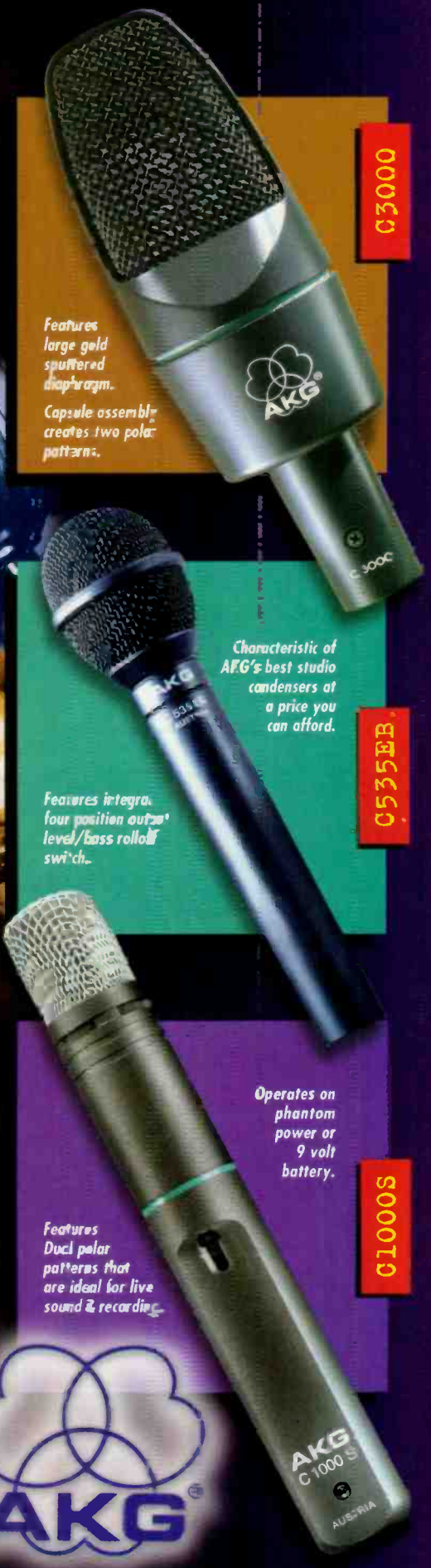

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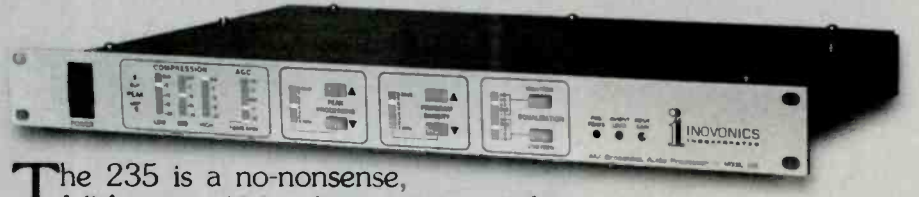

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the program chain as well as to hear exactly what the audio sounds like upon reception. The monitoring system should have the capability to select the input of each major portion of the audio chain, including every studio, to isolate problems.

Active monitors with built-in power amps and the addition of a sub-woofer can improve the accuracy of monitoring.

Off-air monitoring

The air monitor system is vital to the station operation and should be carefully designed for maximum accuracy as mentioned earlier. Poor reception of the off-air signal cannot be compensated for in other ways. The air monitor system starts with the receiving antenna, which should be a log periodic for FM and a large metallic loop antenna for AM. Most air monitor problems are related to the antenna and RF portion of the system. The main receiver should have a pleasant and realistic sound that reflects the average consumer radio. This is more important than technical purity. Use an accurate and carefully aligned modulation monitor for engineering tests and monitoring.

One final word of advice: give the managers good radios. Make sure an outside antenna system is installed and connected to every radio in the facility. There's nothing worse than hearing complaints about your audio because you didn't give the station department heads and managers a good radio.

Chip Morgan is President of CMBE, Inc., a radio design and integration firm specializing in performance engineering in Sacramento, CA.

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FCC adopts auction procedures for broadcast stations

By Harry Martin and Richard Estevez

After much anticipation, the FCC has announced the adoption of rules and procedures to govern broadcast station auctions. The auction rules will extend to virtually all mutually exclusive applications for commercial TV, radio, low-power TV, FM translator and TV translator stations. The rules will also apply to mutually exclusive major modification applications for broadcast stations not resolved through negotiations.

For most applications for new stations, interested parties will be required to file a short-form application (FCC Form 175), in a designated filing window, with enough engineering data to allow the FCC's staff to determine which applications will be included in the auction. Only the winning applicant will have to file the long-form application.

For pending mutually exclusive applications, applicants who wish to participate in the auction must file a Form 175. Applicants who do not wish to participate may request a refund of their filing fees. Prior to the deadline for filing the FCC Form 175, applicants may enter into settlement agreements that comply with the FCC's settlement rules.

The rules specifically do not apply to cases involving frequencies reserved for noncommercial broadcast services for which only noncommercial entities may apply. In addition, the rules will not apply to comparative renewal cases. The FCC intends to resolve such proceedings on a case-by-case basis. In an effort to avoid these lengthy and costly renewal proceedings, the FCC will continue to waive certain settlement rules.

FCC denies waiver for low-power unlicensed FM operation

An unlicensed, Hispanic radio station in New Haven, CT, recently sought a waiver of the Commission's rules in order to allow a low-power, unlicensed FM operation pending resolution of court cases involving unlicensed operation and the establishment of a new low-power FM service pursuant to the Commission's pending rulemaking proceeding. The unlicensed station asked for a stay on enforcement actions against it in the interim. The Commission's staff denied this request and refused to authorize the unlicensed station.

The operator of the station had argued that its broadcasts should be allowed because the station provides news, information, and entertainment for the Hispanic community. It further argued that since the station was operating with a power of 100 watts, it would not cause interference, and that its operations were consistent with FCC Chairman Kennard's statements concerning the potential benefits of low-power FM stations.

The Commission found that it did not have authority to waive its rules to allow such an unauthorized operation. The Communications Act requires a license in order to broadcast, and the Commission has no authority to waive the statutory requirement. The Commission's staff further stated that it could not consider a request for waiver of its rules except in the context of a written application for license, nor would it consider a challenge to the validity of the rules without a petition for rulemaking to change the rules. The Commission also noted the recent decision by the US District Court for the Northern District of California, which upheld the constitutionality of the license requirements embodied in the Commission's Rules and the Communications Act.

Accordingly, the Commission's staff denied the requests of the unlicensed station and forwarded the matter to the Compliance and Information Bureau for possible further action. However, it should be noted that the Commission's staff pointed to the pending rulemaking with regard to a potential low-power FM service as an assurance that the Commission is actively examining the issue of low-power FM stations. This ruling points out two trends in the FCC's activities with regard to low-power FM operations. One of those trends is toward cracking down on pirate stations so that unlicensed FM operations will be eliminated to the extent possible. Another, however, which is less comforting to broadcasters, is the close examination of the possibility of microstations in the FM band.

Harry Martin and Richard Estevez are attorneys with Fletcher, Heald & Hildreth, PLC., Arlington, VA. E-mail: martin@fhh-telcomlaw.com *and* estevez@fhh-telcomlaw.com.

dateline

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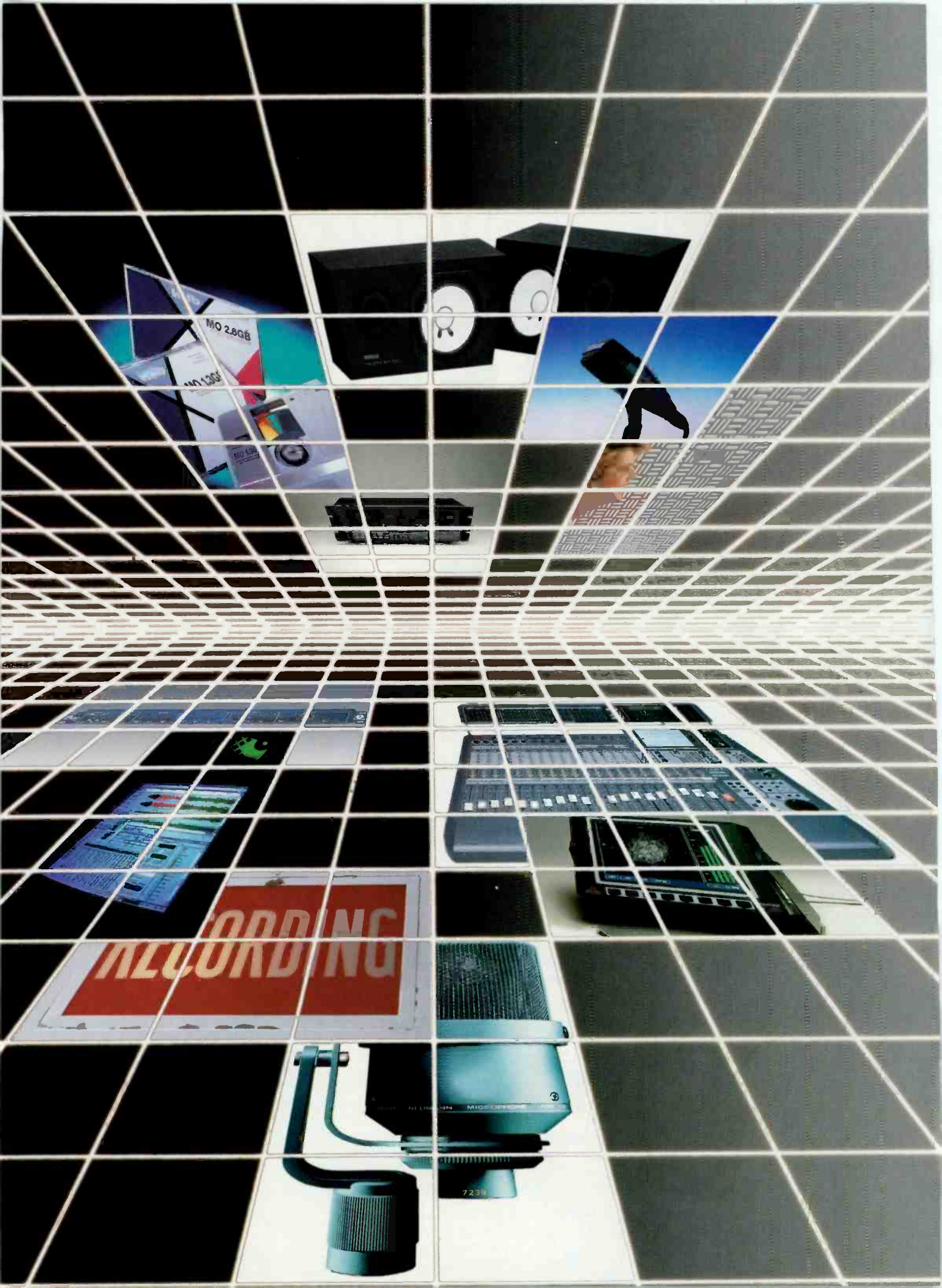
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RADIO PRODUCTION

The proper tools for creative content

By Chriss Scherer, editor

Great sounding production can make your station stand above the rest. The right tools used properly can help you get there.

Making a station successful takes many things. The right music or a good host with good topics can carry the programming a long way. What happens between these elements can make it all work together or bring it all to a screeching halt.

Production in radio is a broad area that covers anything for on-air use that is not done live, although the duties and values of production may include some live aspects. Whether it's putting together liners and sweepers, concert and station promos, commercials, or full-length programs, the right tools can save time and aid creativity.

Long or short

Production work can typically be divided into two areas: long-form and shorts. Long-form recording and production of talk shows, features and elements lasting more than a minute or so may not have the same needs as a studio for shorter work like commercials, liners and promos. While either arrangement will require the ability to record, mix and edit material, some of the creative tools and room designs may vary.

The operational center of most modern production facilities used to be the console, but the introduction of cost-effective digital audio workstations (DAWs) is shifting this focus. In some studios, smaller consoles are being installed strictly for source routing and level control, and the monitoring position is being set up around the DAW work surface. This certainly makes sense when most of the producer's time is being spent at the DAW. The listening position at the console may be supplemented by a secondary monitor system if necessary, but many times this position is only for recording or transferring audio into the DAW. Critical listening is usually not essential for this step. The critical listening is done with the final product. (For more on the listening environment, see *Next Wave*, p.28.)

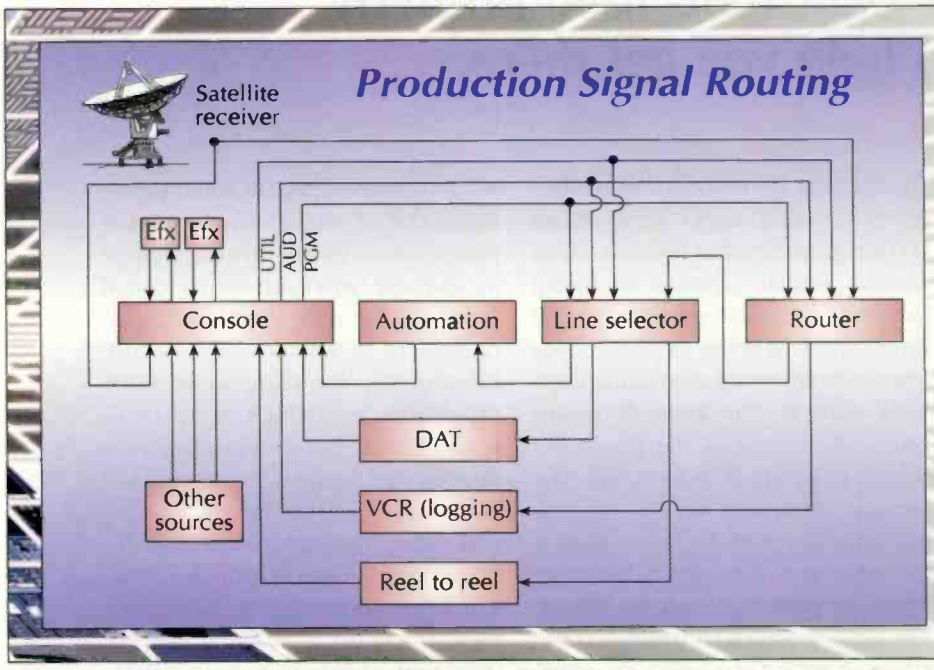
There are many DAWs available today with features, capabilities and price tags for any application. In selecting a DAW, it is a good idea to first lay down the requirements and expectations of the system. There are a few things to keep in mind.

- **Technical complexity:** The most powerful system available will be worthless if it is too complicated to use or actually takes longer to complete a task than the system it is replacing. Some early systems were plagued with this problem and this is still a common obstacle when selecting a DAW. If you have made a list of prospective systems, try to arrange an in-house demo and even a loan, if possible. The spec sheets and demonstrations at a trade show or SBE meeting may showcase some of the capabilities, but being able to actually produce in-house with your production staff pushing the buttons will help decide what system is best for you. Also, run the demo with in-house material and not the demo bits that came with the unit. Sometimes these demo bits are chosen because they work well with the capabilities of the particular system.
- **Interfacing:** The input and output (I/O) options are an important consideration for any piece of equipment. Analog and digital signals are supported by nearly every system available. Also look for additional sends and returns or output buses if there will be external processing or mixing. Consider how the DAW will transfer a completed audio file to your on-air delivery system. Some systems work together well on this so that a finished production is transferred to the on-air system — like copying a file on a PC. If not, you may need to play the production back and record it into the on-air system in real time.

• **Specific features:** The options that make each system unique will also influence your decision. Is audio stored on a fixed drive or removable media? Is it stored as linear data or is it compressed? How quickly can you switch between productions? How fast is the system? Does it use standard or proprietary components? Some systems are completely self-contained and occupy only a small amount of desk space. Others are built around computers and may have additional external components. Some work in a network configuration. Whatever system you are considering, keep your future needs in mind.

Having an effect

Effects processors are a staple of the production environment. Almost any studio has at least a basic compressor or leveler to keep audio levels in check. The home recording boom has also worked its magic in this area to bring some amazing effects possibilities into very economical packages. While some of these semi-pro units may not have the highest audio specifications on their own, they can produce some great sounds. A flange, reverb or echo effect can usually tolerate less than perfect performance, especially when the effect is being used at a level that is 10dB or lower than the source.



Audio routing in a typical production facility. Creative signal routing can greatly enhance flexibility.

• **Hardware:** Just like any other piece of equipment in the station, the DAW will require periodic maintenance. If the system is centered around a PC, take note of any special hardware considerations that, if a problem arises, can be addressed with a trip to the local computer store. Also, look at the sound cards. There are varying levels of performance and features for sound cards. You wouldn't use a cheap consumer equalizer in your main air chain, so why use a basic consumer sound card for your production? The same is true for the on-air delivery system.

Many of these semi-pro effects units have unbalanced I/Os. It's likely you will need to install a level-matching interface to tie these into a production room.

There are many different ideas on how effects processors should be accessed. In cases where there are many effects to choose from, your console may not have enough sends and returns to wire them in directly. If the producer also likes to shift the usage of gear to different sources, this adds more to be considered. Making a processor available to a source, a patch point or a bus mix can get very complicated. This is one area of routing where patch bays have always excelled: great flexibility in a small space with minimal cost.

General signal routing is always a concern in a facility. In production, the need for flexibility is even greater. Multiple sources will no doubt be a consideration. Again, standard audio routing techniques like routers and patch bays can simplify this process.

Production rooms are always being pushed to do more and more. Recording of feeds and dubbing material can take away precious time from a studio. In these instances, apply the same signal routing ideas to the recorder inputs that you do for the console inputs. By feeding your recorders (DAT, automation, cassette, reel, cart, etc.) from a patch bay, audio router or line selector, a room can easily be used for multiple tasks. Figure 1 shows an example of how this routing can be done.

More processes

One item that is easily overlooked (or under-thought) is microphone processing. The human voice is capable of a wide dynamic range. Even the most controlled voices can have peaks, pops and transients that can overdrive a mic preamp or digital input. There are many mic processors available, so finding one that fits your needs should be easy.

The physical placement of this processor should also be carefully considered. Many inexperienced producers will heavily compress a microphone for a very full, thick sound — especially if the voice they're producing is not very strong. While this may have an effect that is appropriate when used wisely for effect, constantly running mics like this is very fatiguing to a listener's ear.

Physical needs

A good sounding room is really the beginning of a good studio. Securing isolation from outside sources and minimization of colorations is always a primary concern. This is not to say

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that top-notch work cannot be done in a closet, but taking care of acoustic problems first is a good start. (For more information on the importance of good acoustics, turn to *Architectural acoustics: A primer for radio*, p.46, April, 1998.)

The basic layout of a studio can help or hinder its function. When laying out a room, keep in mind basic ergonomic considerations. Computer monitors are popping up more and more. Placing them in a comfortable position is important to reducing eye and neck strain. Ideally, everything being used should be at an arm's length from the operator. In the heat of a session, having to constantly wheel back to adjust something does not help — especially if it is during a mix and the producer must leave the sweet spot to make an adjustment. A good model is a drummer sitting behind a kit. Everything is set around him. This is not to say that you build a cage that only one person can get into. Function will lead the way.

Outboard equipment should be placed where it accessible to the operator. Equipment that is accessed more frequently is at the top.

Another design consideration is the voice booth. There are mixed feelings about having them at all, and if they are used, about how best to use them. A small room for one or two people can usually be added to a design. The biggest advantage is obvious: sound isolation. Having an open mic in a production control room can easily pick up equipment fan noise or other mechanical sounds from equipment. The control room was also primarily designed to be a good listening environment. While close mic-ing can reduce the effects of an open room, a smaller, deader voice booth can be built which also allows the producer to move about freely as he records the track.

Tying the voice booth into the rest of facility takes some planning too. Some form of communication needs to be set up between the booth and the control room. Most production consoles already have some form of communications bus built into them that might be sufficient. If not, a larger, dedicated IFB system may need to be installed.

Running mic level signals directly into the production studio may work (provided the runs are not too long), but limits the use of the room to only one purpose. If justifying the space is a problem, why not use the room for morning news or some other periodic function? With so many morning shows having a break for some kind of news, being able to put the news announcer in a separate room can free up the on-air control room for a few minutes and allow the hosts to perform a few tasks without interruption.

If the voice booth is being used to feed more than just the production

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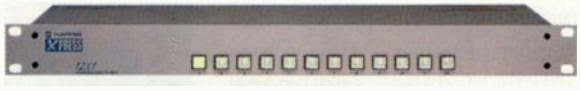

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Sometimes an interim step is needed before going fully digital. Here, a cost-effective analog mixing console has been installed in a production room. This facility will be rebuilt and will go fully digital in the coming months. Note by the placement of the monitor that the listening position is already set up around the DAW and not the console.

studio, the mic routing should be line level and feed either a distribution amp or an audio router. There will also need to be a way to select alternate monitoring sources in the voice booth.

Analog or digital?

There are many equipment decisions to be made when outfitting a production room. It is possible to create a fully digital room today, though chances are that there will be a mix of both sources installed.

Besides some of the obvious analog choices like mics, monitor speakers, monitor amps and cassette decks, there are other pieces or equipment that go either way, depending on your needs. Digital consoles have made great advances in features and prices over the last few years. The choices for a digital production console specifically designed for radio uses are still somewhat limited, with the requirements for stereo inputs usually setting the limits. Many of the professional digital consoles offer enough inputs, but a stereo feed requires two faders panned left and right. Moving two faders for one source is inconvenient and not always very accurate. There are a few out there, but look for the number of choices for a digital radio production console to increase in the near future. In the meantime, a digital on-air console or digital professional console can easily be used. The alternative is an analog radio production console, most of which still have impressive audio specifications.

Getting on the air

Once the final production is completed, mediums for playing it over the air need to be considered. When walking a cart or a reel of tape down the hall was the normal routine, There was not much to consider. Now that many stations are using some form of digital delivery on-air, getting the final product into the system must be considered.

In the case of long-form productions, the completed work may be transferred to some form of removable media, like DAT, MiniDisc, MO, or CD. The interface will probably be recording the project to the new medium in real time (another good use for record input selectors).

For shorter items, transferring it directly to the on-air system will be the goal. Many DAW manufacturers have worked with digital delivery manufacturers to develop interfaces between different systems. These interfaces may already work in compatible file formats so that a file transfer is all that is needed (with some data entry for spot number, name and run dates). It can be a pop-up screen on the DAW or an import utility on the digital delivery system that retrieves the file.

At the very least, it may be necessary to dub the spot from one system to the other, again in real time. This method may be fully digital or, at worst, require the dual conversion from digital to analog and back.

Tied In

Consolidation continues its demands on existing resources, and production is no exception. With so much computer-based work being done, the sharing it with a sister station is much easier. There have been situations where stations that are across town from one another have installed dedicated telco loops to transfer audio back and forth.

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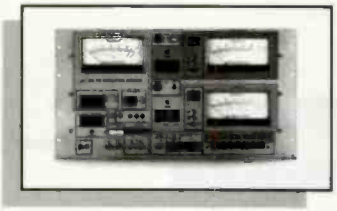
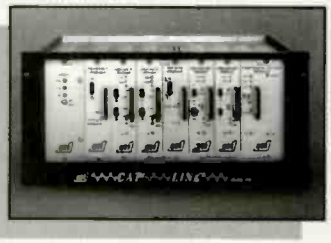
Depending on the level of integration and simplicity that is needed, file exchange can be as basic as sending an e-mail attachment for smaller, occasional files. If small files are seldom exchanged, this may work fine for you. In larger applications, the ability to completely link multiple facilities together may be answer. The DAW you are using is already built around a computer, so adding a network card and the necessary drivers is not that difficult. Several systems are now available that work well in a networked environment. There are also stations that have tied facilities together that are across town or across the country with a WAN or extranet. (*See Managing Technology, p. 16*)

The DAW has become a center point of focus in most production rooms. (Photo courtesy of SADiE.)

The equipment selection process should have input from anyone that will be using it. Sometimes it's easy to agree upon a layout or piece of equipment; sometimes extra diplomacy will be needed. The important thing to remember is that the equipment is really just a collection of tools. The most important link in any production environment is the people that make it happen. Just having the best tools is not enough. Knowing how to use them well and wisely can make all the difference.



Modulation Monitors



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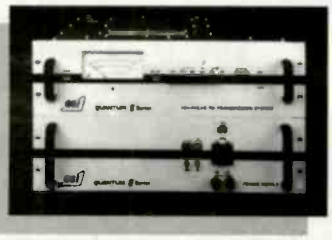

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FACILITY SHOWCASE

A look inside some of the nation's newest facilities.

Even with the introduction of new technologies, the basics of studio design for acoustics, ergonomics and aesthetics are still important considerations.

By the BE RADIO *staff*

Radio is constantly in a state of flux. New technology, new ownership, new formats — all these and more can be the impetus behind designing a new facility. The design and installation process, with proper planning and implementation, can be a smooth process. The results of a job well done can make a facility a true showcase. *BE Radio* visited three installations to see what it takes to make a great looking — and functioning — studio.

KRES/KIRK - Moberly, MO

The facilities at KRES-FM and KIRK-FM in Moberly, MO, shows that you don't need to be in a major market to have a showcase facility. Moberly is a town of about 13,000 people in the heart of Missouri. KRES is a full-service station providing news and information, talk and music to the listening audience. KIRK, which signed on only one year ago, has an easy-listening format and is automated most of the time.

KWIX, KRES and KIRK are located in the center of Moberly, MO.

Both stations are co-located with sister station KWIX-AM, in a nearly 100-year old builidng that was originally built for a bank. Remodeling began two years ago, first with the exterior and then last year with the interior. Some of the original building materials were saved and reused for cosmetic designs. For instance, some of the the glass blockfrom the original exterior is now placed throughout the office area.

The original vault now houses the engineering shop. The heavy steel door is still in place, but the lock has been disabled.

KIRK

The air studio for KIRK is not used as often as other studios because of the automated format. However, the control room is still very functional. The glass wall makes for a stunning view upon entering. Murphy Studio Furniture built the foundation of the studio, and you

The control room for KIRK offers a magnificent entrance to the studio area.

ployment of close-proximity microphones also helps to reduce some of the background noise.

The control room area is a single step up to help separate it from the newsroom. Looking out the large front window not only gives the operator a view of the street, but gives passersby a glimpse into the station as well. Murphy Studio Furniture again provided the work surface for the Audioarts console and Computer Concepts delivery system. Other equipment in the room includes four Sony CD jukeboxes, Tascam cassette decks, Crown D-75 power amplifiers, SAGE

may have seen it on display on the NAB98 show floor. Automation is handled by a Computer Concepts Maestro system, with music and commercials stored on hard drive. An Audioarts R-60 console is the center focus. Other equipment includes Tascam CD players, a Gentner Telehybrid, an Electro Voice RE20 mic and an Aphex Compellor.

The studio also looks into the control room for KWIX-AM. A UPS backs up power to the automation system, and the console is usually bypassed to prevent on-air accidents.

The large windows and direct access to the newsroom give full-service KRES strong ties to the public and news.

KRES

A full-service station, Superstation KRES offers a wide variety of music, news and talk. The open newsroom is manned 24 hours and adjoins the control room, as you can see here. Because news plays such an important role in the on-air delivery, the station wanted this immediate interaction to be available. You might think that noise would be a problem for the on-air talent, but it actually is not. There aren't any severe noise generators in the room, and the occasional printer or telephone in the background serves to enhance the on-air effect of a news source. The em-

FACILITY SHOWCASE

Endec, Orban 8200ST and XT-2 chassis, Belar modulation monitors and a Tascam CD player. The station also owns its own Doppler Weather Radar system.

The studio microphones are Sennheiser HMD 25-1 headset mics that have several advantages. In addition to the close proximity to the announcer's mouth, the supercardioid elements help reduce background noise. Another advantage to the headset mounting is that the mic element does not change its relative position to the announcer's mouth while he turns his head to read a screen or check a temperature. While the frequency response is also not as great as a large diaphragm microphone, differences in sound quality are not apparent.

The overhead soffit holds additional computer monitors for the Computer Concepts Maestro, a wind and temperature display, the Sine Systems on-air light and warning system, and the recessed Yamaha monitor speakers. The soffit mounting helps to keep the countertop free from clutter and allows an unobstructed view of guests and the outside.

The old bank vault now houses the engineering shop.

KVIL-FM - Dallas, TX

The studios are built on raised computer floors, with a wall construction of six layers of drywall with staggered studs. The large windows have a second layer of glass installed to keep the noise of the city from getting on the air.

In the control room, the RAM SS9300 console is the centerpiece for the opera-

The control room of KVIL offers a panoramic view of the Dallas skyline.

You get a bird's-eye view of the city from the control room at CBS-owned KVIL-FM, Dallas. The flagship station of the Dallas Cowboys radio network is on the 16th floor of an office building, so the operators have a true feeling of broadcasting to the city.

Originally built in 1993, the studios are home to the Marconi award-winning station and their AC format.


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FACILITY SHOWCASE

tion. The studio plans originally called for the computer monitors to be placed in a soffit overhead. But because of their distant location, those plans were modified. The function had to lead the form. The clear view outside had to be sacrificed, but there is still enough to see to know what is going on.

The monitors display the digital delivery system, a Broadcast Electronics AudioVault (dual servers with dual 23GB storage), a multi-function PC for AP NewsDesk and Internet access, and the Kavouras weather radar display. All music and commercials are stored on hard drive.

On-air telephones are handled with a Telos 1A2 interface and edited on a VoxPro.

The production studio serves as a back-up control room and adds a DigiDesign ProTools system to its operation. There are also two Otari MTR-10s, which, as is the case in an increasing number of stations, don't see as much use today as they once did. Other studios at KVIL include a secondary production room, which is slated for an upgrade in the near future, a dubbing room, news studio and sports network control.

The engineering shop has seven racks to house the nervous system of the facility. Benchmark DAs and patch bays currently handle all the routing requirements, and an upgrade to a digital routing system is in the plans for next year.

The production studio also serves as a backup control room. The engineering racks are the nerve center of the operation.

Emmis Communications - Indianapolis, IN

Here's a glimpse into a facility that will be completed later this year. This will become the headquarters for Emmis Communications and the home to WENS-FM, WNAP-FM, WTLC-FM, WTLC-AM, WIBC-AM, Network Indiana and AgriAmerica. Occupying seven floors with 142,000 square feet of space and located on the ring around historic Monument Circle, the ground level will house two showcase studios that can be used by any of the stations at any time. This added public interaction will certainly add to the already close ties these stations have with the community.

The opening foyer will serve as a grand entrance and can be used for receptions and gatherings.

The building is all poured concrete, which adds stability and tremendous sound isolation from floor to floor. The front entrance is a grand, open area that can also be used for public or private functions.

The on-air and production facilities will house an impressive equipment list, including 20 PR&E Integrity consoles, SAS 64000 routers,

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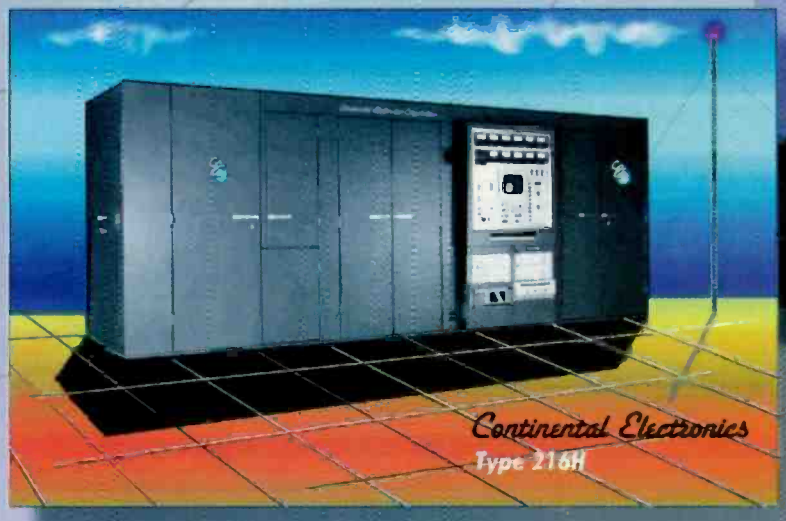

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FACILITY SHOWCASE

The proposed finished product shows how the entrance will add to the grandeur of Monument Circle.

Broadcast Electronics AudioVault, SADiE DAWs and ESE clocks.

The drawings and photos shown here are just a preview. *BE Radio* will come back to showcase the finished product in an upcoming issue.

Making sure your architect gives you sound advice

Working with an architect who knows the ins and outs of designing a radio broadcast facility can be a real advantage

By Steven Risting, AIA

All buildings are not created equal. In other words, design processes that work for one building type will not always work for another. This is especially true in the case of radio broadcast facilities where specific working relationships and numerous technical issues must be addressed. If you are considering hiring an architect to help design a facility or studio space, make sure that architect is experienced and has a solid understanding of what is involved in the design process.

The best kind of broadcast facility, whether it houses multiple stations or only one small station, is one that is designed specifically for you. It should consider your image, personality and personal relationships, be cost effective and easy to upgrade, operate, and maintain. Here are just a few important things an experienced design team, specifically the architect, should bring to the table:

- The architect should know the importance of a station's identity and image and to what degree the management of that organization wants to promote its image through its building or interior design. Corporate and station images change over the years and architects should provide designs that are flexible and allow for future change.
- They should know and understand the relationships between the various departments within the organization. For instance, they should be aware of the interrelationships of programming, promotions, sales, business, and technical personnel and in what capacities they work together. The design should recognize the desire for privacy, yet allow or encourage team interaction.
- The design and construction of studios requires a specific knowledge. It involves knowing how to integrate specific broadcast and computer technology and furniture, understanding the acoustical requirements, and providing space for multiple guests. The team should understand specifics about the new digital systems, how they require expanded computer systems, and what their unique acoustical requirements can be. Architects should be familiar with how stations often shift from having strictly music formats to having more interactive program broadcasts, requiring the need to address things like the relationship and sight lines between the operator, host, and guests.

Designing a broadcast facility is not a simple endeavor. It is the result of a communications entity's management and technical staff working with an experienced design team that understands the intricacies of the broadcasting facility.

Steven Risting, AIA, is a design principal with Ratio Architects, Inc., Indianapolis, IN, and the designer of the Emmis Communications World Headquarters, the Radio/Television Building at Indiana University and other technology-related facilities.

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MP-3-6	6	3,000W	5.2	$2,740

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GP-2	2	4,000W	0	$1,350
GP-3	3	6,000W	1.5	$1,900
GP-4	4	6,000W	3.4	$2,600
GP-5	5	6,000W	4.3	$3,150
GP-6	6	6,000W	5.5	$3,700

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SGP-3	3	10,000W	1.4	$3,595
SGP-4	4	10,000W	3.3	$4,500
SGP-5	5	10,000W	4.1	$5,300
SGP-6	6	10,000W	5.2	$6,100

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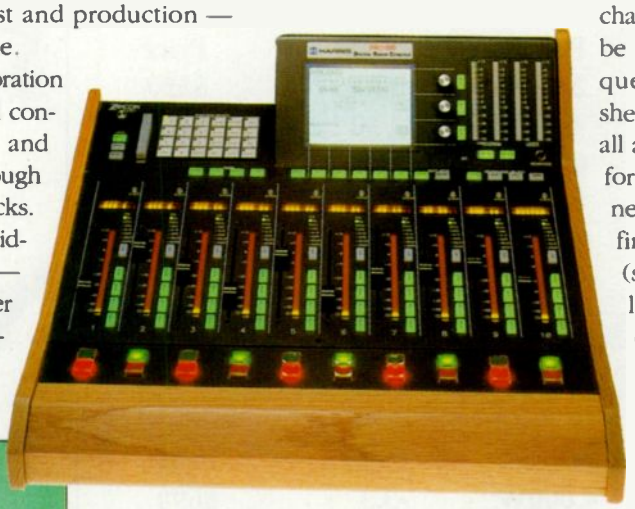
Harris DRC1000

By Russ Mundschenk

With all the digital source devices on the market today, it only seems natural to tie them together with a digital console. That was part of the logic behind WBEB's decision to incorporate a totally digital signal path in its new studio design. But when it came time to rebuild in 1995, nobody had a digital console specifically designed for radio broadcast and production — at least an affordable one.

Along came Harris Corporation with the DRC1000, a digital console designed for radio and packed with accessories enough to fill a couple equipment racks.

In August 1996, B101 decided to install its first console — and DRC1000 serial number one — in its first new production room. We felt that a shakedown cruise in a production room was a good idea because equipment failure there meant just redoing a spot. But there were no failures, just a few minor growing pains. Soon after, a second DRC was installed in the new on-air studio and then a third in another production room.



Performance at a glance

- Built-in effects
- Sample rate converters on each input
- Up to 22 AES3-ID (75Ω) or analog inputs
- 32, 44.1 and 48kHz sampling rates
- Programmable routing matrix
- 32-bit processor

Why digital?

OK, so what's so great about a digital mixer, in general, and this console in particular? After all, a truly excellent analog console's specs can easily exceed that of 16-bit digital — at least when it's new. Digital's versatility is key and a digital console's audio performance won't change over time.

The DRC1000's standard configuration consists of a programmable control surface with 10 faders and on/off buttons. Other buttons allow instant selection of bus routing and console programming. This "board" (which can be expanded in increments of 10 for a maximum of 30 faders) then talks (by RS-422) to a remotely mounted audio processing unit. The APU does all the number crunching necessary to mix and effect multiple sources, and comes standard with 11 unbalanced 75W AES/EBU inputs and seven AES3 and seven analog stereo outputs. Up to four internal stereo A/D converters may be optionally added. Another APU may be linked to the first, for a maximum of 22 AES inputs.

The board has numerous programmable effects. Each channel's five-band equalizer can be set for multiple types of frequency adjustment, including shelving, cut, boost and notch, and all are bandwidth adjustable. Ditto for compression, limiting and channel panning. Another feature we find useful is the gain-riding AGC (separate from the compression/limiting). Many a screaming DJ or loud phone caller has been automatically faded by this feature. Reverb is available as an option. Multiple effects setups and routing configurations may be saved in the board's internal memory or on an external PCMCIA card.

The ability to co-locate multiple processors in a central equipment room provides more versatility and allows for better control of factors such as primary power and environment. Video-type patch bays have been installed here (and in the studios) to maximize routing versatility for normal and emergency operation.

The DRC1000's flexibility is matched by its quality. All digital is *not* created equal, and buzzwords like quantization, sampling rate and synchronization really are important.

The works

Quantization denotes the size of the digital word used to describe an audio sample. The Harris Console can mix and effect 20-bit digital words, which theoretically corresponds to a dynamic range of 120dB. Since CDs and DATs are only 16-bits (96dB), why bother? They have already been processed — live sources should be recorded with as much dynamic range as possible, to maintain headroom without losing low-level resolution. A number of modern A/D converters (including the optional internal units) can supply a 20-bit word for that added range. The mixed products of those 20-bit samples can get very large, and the DRC's 32-bit mix bus floating-point proces-

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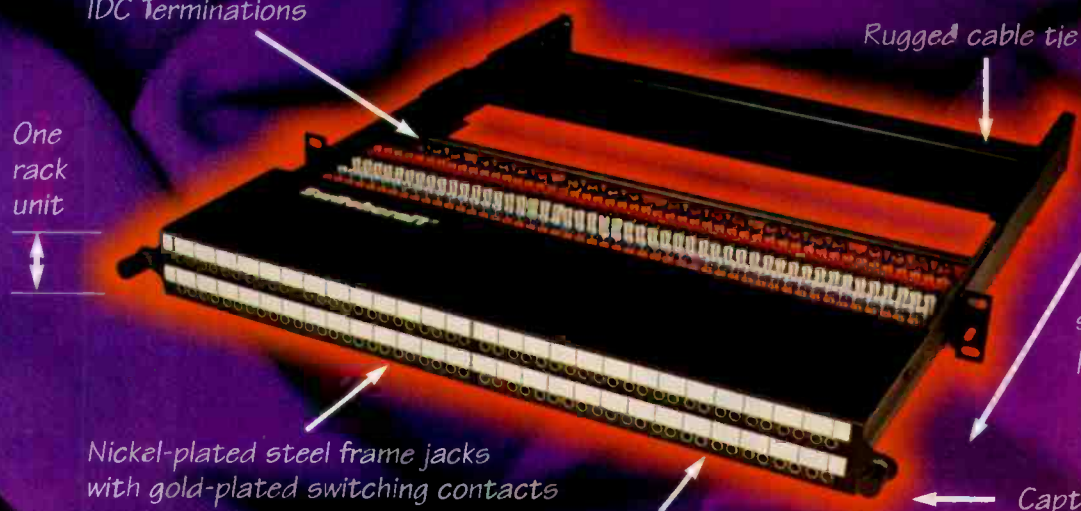

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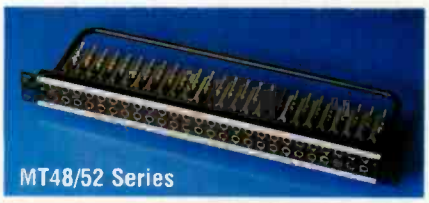

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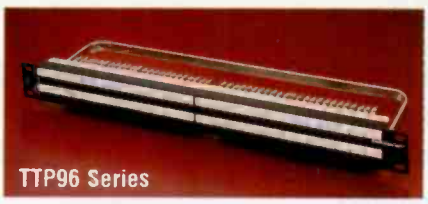

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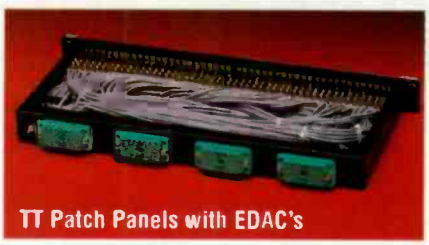

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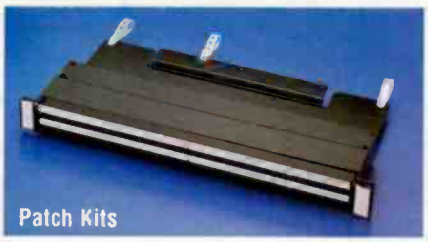

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sor handles the number crunched results with no chance of clipping.

The console accepts 32, 44.1 or 48kHz bit streams on any input and rate converts them to its own standard sample rate, which is selectable internally or may be externally referenced. Also, unless a source is at the same sample rate and is synchronized to the output of the console or a house standard, the mixer has to rate-convert anyway. WBEB uses external, synchronizable A/D converters and rate conversion is not needed, thereby allowing better quality.

Happy users

Flexibility and quality are great, but in practice, the people who use the equipment must be comfortable with it. WBEB's production director is thrilled with it and refers to it as a cozy console. It allows him to do several jobs at once. The DRC has opened up a whole new level of creativity for him.

The announcers are amazed by the console's ability to meet their needs immediately. The board can be personalized to the talent with a few keystrokes. That ability has become especially important for our fast-paced morning show.

Engineering has found that the ability to give the announcers and production people what they want while still delivering to the listener the best quality digital source material is the unit's critical capability.

So what is the down side? Nothing, except for the fact that most digital devices (including this console) are *serial* in nature. Most analog units are *parallel*. If something fails in a digital system, the chain breaks and silence reigns. That is why B101 has the ability to instantly bypass any link, including the console. Luckily (knock on wood), that has yet to happen.

Since the introduction of the DRC1000, Harris unveiled another console in this series, the DRC2000, which has a different control surface, 20 faders and is optimized for on-air operation. It operates with the same APU.

Russ Mundschenk is chief engineer at WBEB-FM, Philadelphia.

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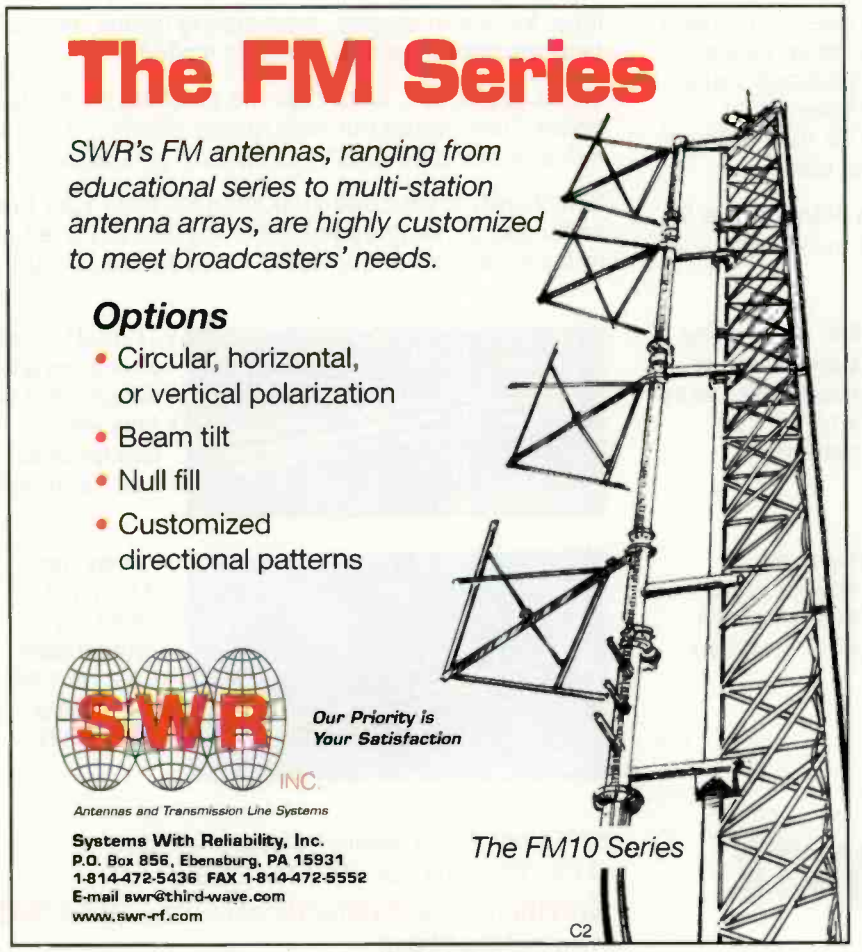

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MUSICAMUSA RoadRunner

By Wendell Craig

In recent years, there has been a dramatic change in the voice-over business. To be competitive, the VO artist must be prepared to service clients ranging from radio and TV stations and networks to film studios, production houses, animation studios, CD-ROM and DVD producers, A/V houses and others — via the now ubiquitous ISDN lines — almost anywhere in the world. There are a lot of technical "standards" in this field, promulgated by various manufacturers, and most of them are, to a greater or lesser degree, incompatible with each other.

As a free-lance announcer in New York City, I need to budget my equipment dollars very conservatively, spending as little as necessary to get the capabilities I need. That means avoiding the purchase of specialized, dedicated single-use equipment whenever possible and instead searching out those hardware solutions that fit a wide spectrum of my remote clients' specifications. Like any small businessman, I demand a lot of bang for my buck.

Performance at a glance

- Small, light, rugged. Easily portable
- Built-in, configurable autodialer
- Factory set for most common algorithms
- Relatively inexpensive
- Knowledgeable tech support
- Quick, easy set-up

The MUSICAMUSA RoadRunner is a compact (4.5"H x 11"W x 13"D, 9.4lb.) audio codec/mixer housed in a rugged all-metal case, complete with fold-away carrying handle. Its clean front panel features two balanced XLR mic inputs (an additional balanced input, mic/line switchable, is located on the back panel); two 1/4" stereo headphone jacks with separate local/return level controls for each (you are warned specifically in the manual not to connect two-conductor monaural headphones); a 24-button keypad for dialing and programming the different configurations; and a back-lit two-line LCD panel.

Using the keypad, the user can quickly enter up to 256 speed-dial addresses, along with configurations for each. An AC power connector (100-240VAC, 50/60Hz) and a 12VDC connector are located on the back panel, as are the main power switch and fuse. A low-impedance microphone can be connected directly to either front-panel XLR connector, or to the mic/line input on the back of the unit. Phantom power is not supplied by the RoadRunner.

Trying it out

Setting up the RoadRunner essentially consisted of unpacking it, plugging in the power cord and XLR cables to and from my mixer, connecting to the ISDN line with the (supplied) RJ-45 cable, punching in MUSICAM's pre-set phone numbers for a live test configuration and pressing the s-dial (speed dial) button. Five seconds later, both lines were connected at 56K and I was hearing fat, solid sound. The process took approximately eight minutes from start to finish, including a two-minute search for a pair of right-length cables to go in and out of my mixer. It was just a test though, so I pulled out the manual, looked up the configuration tables, called a friend across town who has a studio equipped with a codec from a different manufacturer and punched in the numbers found in the manual. Seconds later I was talking to him through my mic and listening on my headphones as he fed me his talkback output. The setup and dialing was so simple that I booked a remote session the very next morning and everything worked perfectly.

Versatility

As with most non-intuitive keypads, there is a modest learning curve before one can quickly and easily program the RoadRunner for connecting to dissimilar codecs at the other end. You'll likely find yourself spending a bit of time with manual in hand as you navigate the several menu layers. But along with this complexity comes the ability to make a successful connection with almost every codec you're

likely to encounter. Out of the box, the RoadRunner can be easily configured to use any one of three common audio compression algorithms, ISO/MPEG Layer III, ISO/MPEG Layer II (including MUSICAM), and G.722, one of the original standardized digital audio coding algorithms (not surprisingly, the lowest quality of the three). G.722 does, however, ensure compatibility with most any other codec when all else fails.

Layer III can deliver full-duplex, 15kHz audio using just one of the ISDN B channels, and when using both channels, transparent 20kHz audio is possible and sounds sensational. There are drawbacks when using this algorithm, however; long coding delay times and poor cascading characteristics. MUSICAM's enhanced Layer II algorithm can also deliver 20kHz with lower delay, less-noticeable artifacts and better cascading results, particularly when connected to another RoadRunner. G.722, aside from its near universality, offers very low delay times and full-duplex, 7.5kHz audio over a single B channel.

One especially useful feature is the ability to use different algorithms for the send and return audio. It's easy to configure the RoadRunner to use the higher quality Layer III or Layer II to send program audio to the studio and use the low delay G.722 for the return cue feed. This is a real lifesaver for me. This method of mixed codings is also a common practice for radio remote broadcasts.

Overview

The RoadRunner's compact size and light weight precluded the use of massive heat sinks. Instead, it uses a fan, with all that that implies. You wouldn't quite call it a noisy unit, but I was slightly disappointed that I couldn't keep it inside the confines of my tiny home recording booth. Until I got a chance to build a baffled box for it, I managed just fine keeping it just outside the door. Once the levels are set, I find there's very little reason to keep it nearby anyway.

I only need a monaural signal for my voice-over work, so the RoadRunner's mono-only limitation was of no concern to me. The unit was designed for remote voice applications.

More features

Periodic software upgrades are made available by MUSICAM, and can be either downloaded to a PC and then transferred into the RoadRunner via serial cable. Tech support tends to be knowledgeable and somewhat better than average.

The manual is well thought out and, given that this is an unusually versatile and complex piece of equipment, the user will usually find answers with only a modest amount of digging. The unit can be quickly and easily reset into factory default configuration if your early experimentation should go awry.

All in all, MUSICAM's RoadRunner is well-placed at its price point for anyone who finds they need a basic ISDN codec for broadcasting or recording, and who chooses not to buy or lease expensive dedicated equipment for occasional connections to many different remote codecs. Its versatility and ease of setup and use, along with its portability make it an excellent choice in these situations.

Wendell Craig is a former producer/studio owner, and now a voice-over announcer and a staff announcer at CBS, New York. He can be reached at anncr.man@intercom.com.

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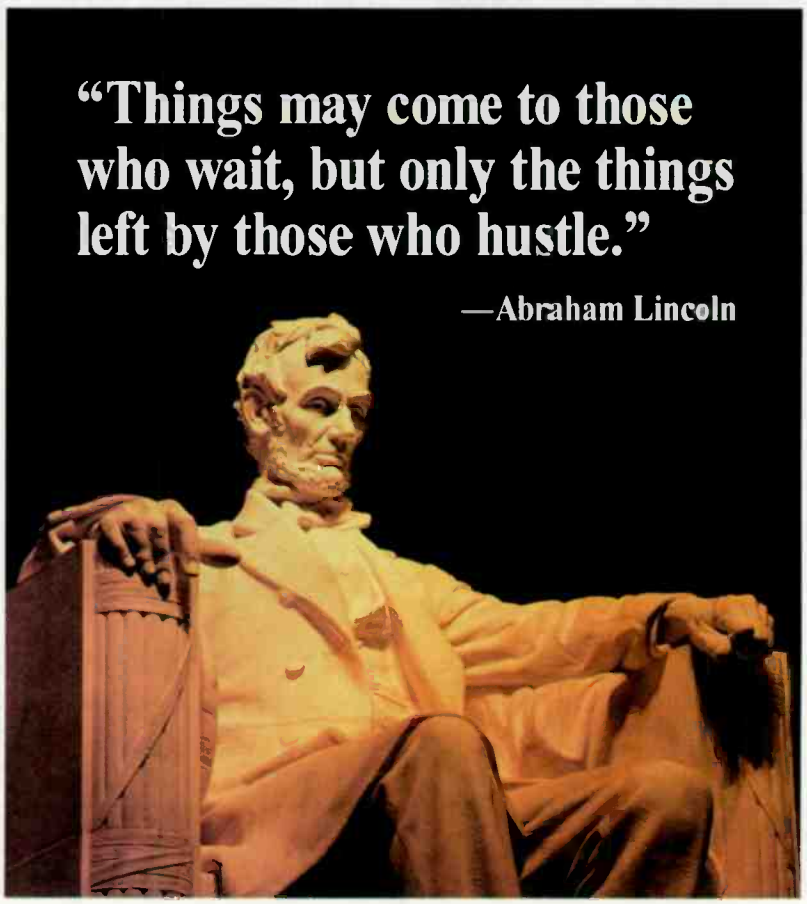

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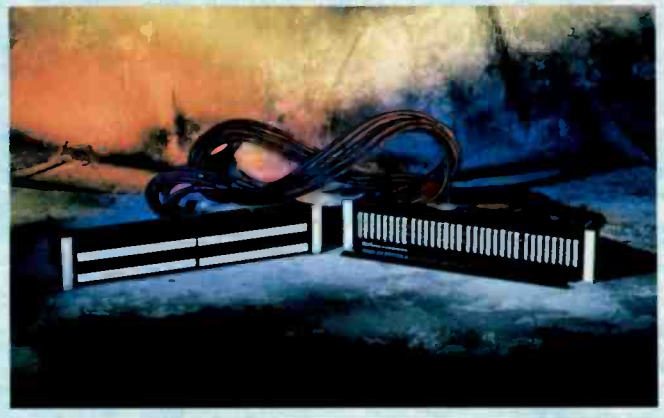

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◀ **Umbilical Cable Harness Audio Patch Panels:** new family of panels provide extra versatility by handling analog and digital signals in the same panel; Telect backs each system with its lifetime warranty; panels feature the highest quality jacks and cabling components available to ensure strong, reliable performance; units allow users to maximize application space and gain convenient rear access with the panels; units are designed so that the traditional front and rear of the panel are individual units connected by a cable harness; cable lets users place the front and rear of the panel on top of one another or in different locations to gain access to both sides of the unit for easier wiring.

800-551-4567; fax 509-926-8915
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▲ **Ultraflex Series:** low-profile, off-the-shelf series features universal input with power factor and harmonic correction, and offers up to ten fully regulated, independent outputs that can be used as positive or negative polarities; the line also provides systems interface and a full array of signaling options, including AC power or module fail notification and global and module inhibit, and active current share; users can select from 2V to 48V DC output modules to power any combination of logic, analog or ancillary circuits.

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▶ **Copper Bus Plate:** an economical and flexible solution for users who require grounding for mounted electronic components; provides easy grounding system integration for new design applications, as well as existing standard-depth enclosures currently in use; unit can be used as an isolated ground or a common ground, and is equipped with 14/10-32 tapped grounding points; compact ground plate is constructed of durable copper material measuring 8 ¾" x 2" x ¼"; bus plate can be mounted vertically or horizontally anywhere within the enclosure for maximum use of space.

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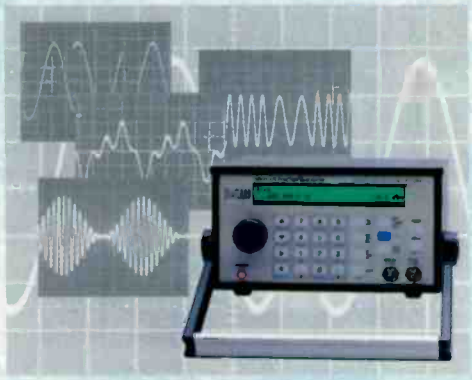

Benchtop signal generator
Berkeley Nucleonics

◀ **Model 625A SmartARB:** unit provides function, arbitrary waveform and pulse-generation capabilities; modes include not only the standard sine, square, ramp, triangle and random waveforms, but also AM, FM, PM, SSB, FSK, BPSK signal modification, DTMF generate, DTMF detect, voltage and power measurement, data and word generation; unit has a DC-power option for field work.

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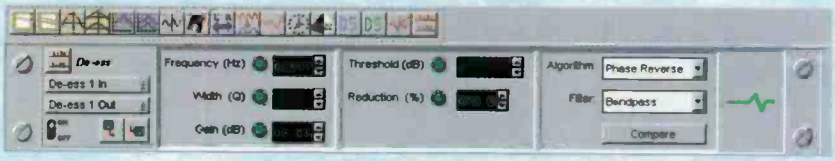

De-esser
Studio Audio & Video Ltd.

◀ **SADiE V3.6 De-Esser plug-in:** features ducking and phase reverse algorithms and can be set to *shelf* or *bandpass*; latter filter has a variable bandwidth (Q) control allowing the reduction of narrow bands of audio frequency spectrum; the unit presents a different set of dynamic controls depending on the de-essing algorithm selected; although unit is primarily designed to remove sibilance from vocals or voice signal, it is a frequency-conscious compressor that can be used to attenuate any troublesome frequency in an audio signal.

615-327-1140; fax 615-327-1699
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Automatic mixer
Shure Brothers

▶ **AMS8100:** designed for use with Shure's AMS mics and equipped with direction-sensitive, mic-activation technology; unit automatically gates only on mic per sound source; other features include a defeatable last mic lock-on function, internal power supply and adjustable peak limiter.

800-25-SHURE; fax 847-866-2279
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Fiber certification tool
Jensen Tools

▲ **CertiFiber:** unit will automatically run the length, propagation delay, and dual fiber loss measurements for 850nm and 1,300nm, and provide Pass/Fail analysis based on the fiber standards along with the amount of headroom available over and above the P/F margin; up to 1,000 time and date-stamped autotests can be stored and then downloaded to a PC with the included ScanLink software; kit includes CertiFiber tester and remote (both with three AA alkaline batteries), ScanLink diskette, PC serial interface cable, and a soft carrying case.

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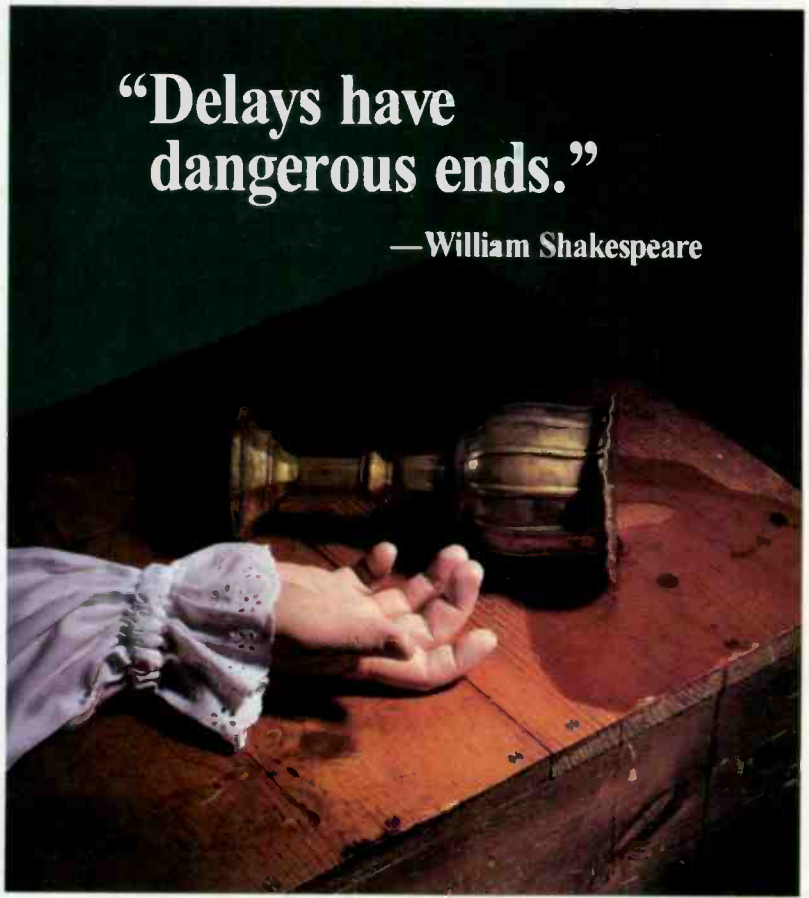

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◀ **SRPT-40E Transmitter/ SR10E Receiver:** frequency-agile line of MARTI transmitters and receivers are now available in the VHF band; transmitter and receiver offer 16 factory-programmed channels within a 4MHz band with a frequency step separation of 12.5kHz; channel selection can be made from front-panel push-button, or for relay and repeater operation with channel selection made remotely; both units can be operated from a battery, as well as 110/220VAC; transmitter standard features include four mic inputs, power output of 40W, a monitor jack, and sub-audible decoder; receiver features superior selectivity with a monitor speaker, double-balanced mixer, and sub audible decoder.

217-224-9600; fax 217-224-9607
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Mics
Audio-Technica

▶ **30 Series:** includes the AT3525 and AT3528 cardioid condenser mics and the AT3527 omnidirectional condenser mic; models have a frequency response of 30Hz to 20kHz, with a handling capability as high as 148dB-SPL; other features include a switchable 10dB pad, 48V phantom power operation and a switchable low-frequency roll-off.

330-686-2600; fax: 330-688-3752
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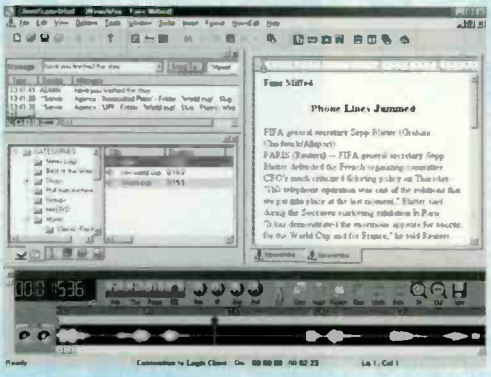

Newsroom modules
Dalet

◀ **TeamNews:** newsroom automation unit integrates sources of incoming information, including wire services, online products and the Internet, sorting and filtering stories according to flexible parameters which can be set daily by journalists; streams acquired material on to a desktop designed to meet the needs of working journalists on a tight deadline; frames can be resized to create personal workspaces for any phase of production; package allows reporters to create stories incorporating text and sound via drag-and-drop; also offers scheduling, automatic archiving, contact management, e-mail, and internal messaging capabilities.

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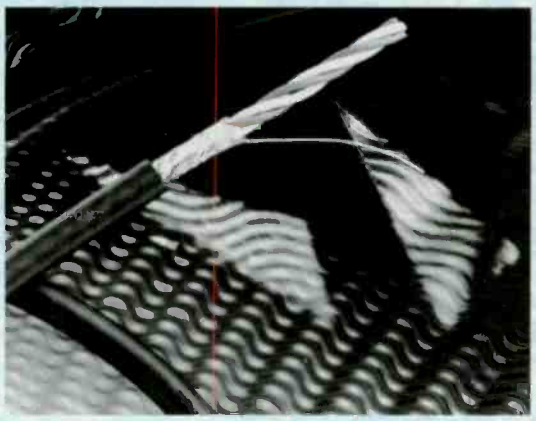

Mic cable
Belden Wire & Cable

◀ **1172A:** four-conductor cable mic cable delivers inherently high rejection of noise and interference; noise levels are greatly reduced through the use of Belden's French-Braid shield – a 95% coverage shield is of a double-spiral design by which two tinned-copper spirals are tied together by one weave; cable also uses a drain wire, which greatly simplifies grounding by eliminating the practice of pigtailing the shield; features four 26AWG stranded (30 x 40) bare copper conductors, two-color-coded with blue polyethylene insulation, and two with white.

800-BELDEN-4; fax 765-983-5294
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Subwoofer system
Westlake Audio

▶ **BB-10SWP:** subwoofer system features dual-tuned port enclosure coupled with a 51lb integrated crossover; designed to be flexible, the network allows the complete system to be powered by a single stereo amplifier or passive bi- or tri-amped configurations without any need for an outboard active crossover.

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▲ **NewsDAD32:** product will be marketed by ENCO and includes all of the features and functionality of the NewsReady 32, but is optimized for seamless integration of sound-bites and other audio cuts as recorded and edited within DADpro32 into a news script as prepared within NewsDAD32; final product is a news script embedded with sound bites that can be used for on-air prompting and execution at any DADpro32 workstation sharing data access on a LAN or groupwide WAN.

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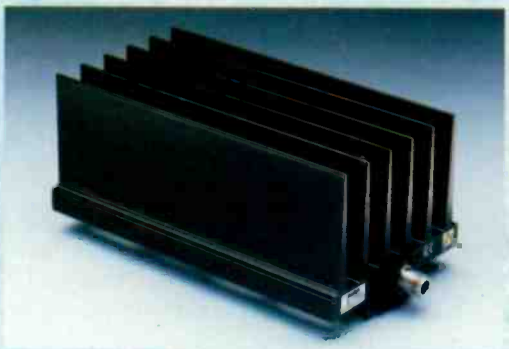
New Products



Dry load
Bird Component Products

◀ **500WT Series:** includes models to either terminate or attenuate up to 500W of RF energy with a frequency range for DC to 2.5GHz; dry, convection-cooled devices weigh approximately 7.9lbs; loads measure approximately 10.38"L x 5.4"W x 4.3"H, and attenuators are approximately 11.2"L x 5.4"W x 4.3"H; units offer considerable placement flexibility because they can be mounted in any position except mounting surface up; all 500WT series loads and attenuators are 50OHM devices rated for 500W (uni-directional) at 25°C ambient temperature derated linearly to 50W at 125°C; maximum VSWR is 1.10 at DC to 1GHz, and 1.25 at 1 to 2.5GHz.

317-346-6600; fax 317-346-6601
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Dynamics processor
dbx Professional

▶ **DDP:** combines gating, compression, limiting, de-essing and other functions into a single 1U programmable digital package; the true stereo/dual-mono unit comes equipped with 50 factory presets; custom presets may also be designed and saved to the DDP's 50 user designable spaces; saving a preset also saves what makes that particular preset work behind the scenes, such as sample rate performance, MIDI setup and optional digital output information, as well as any of the other utilities, like sidechain setup and monitor, EQ settings and SysEx functions.

801-568-7660; fax 801-568-7662
Circle (164) on Free Info Card

CD Rack
Spacewise Broadcast Furniture

▲ **CD-240 Orbiter:** Holds 240 CDs in jewel cases in eight vertical rows on a 15° back slant; overall size is 26" x 26" and fits most standard studio surface tops; standard construction features lightweight oak-finished plywood and solid oak front trimming; columns are easily labeled.

800-775-3660
Circle (165) on Free Info Card

Mixing Card
Yamaha

▶ **DS2416:** When installed inside a PC, the DS2416 digital mixing card offers the mixing power of the Yamaha 02R digital mixer, including: a 24-channel, 32-bit digital mixer with 10 bus outputs and six aux sends; 104 bands of parametric EQ; 26 dynamics processors; two effects processors equal in quality to Yamaha's REV500; channel delay on 20 channels; comprehensive metering; digital cross-patching for channel I/Os; a two-channel 20-bit A/D and D/A converter; stereo digital I/O with 20/24-bit resolution; and multichannel analog and digital I/O with optional interface hardware. In addition, the card offers 16 tracks of hard disk recording with up to 32-bit resolution. Two DS2416 cards can be linked to create a larger system. Additionally, the card includes an audio streaming engine that provides eight tracks of simultaneous recording to, and 16 tracks playback from the disk drive.

714-522-9011; fax 714-739-2680;
Circle (166) on Free Info Card

For direct links to these New Product manufacturers, check out www.beradio.com

The online version of radio's technology magazine.

BE Radio .com

• Manufacturer's links

BERADIO.com provides direct links to all the players in the radio broadcast arena, including those for the makers of our monthly New Products, equipment and technologies featured in our helpful columns, and our advertisers. Make it a regular stop on the Web.

• Product Source

Get a look at who BE Radio featured in its annual Product Source guide. It's a comprehensive list of who's making waves in the product marketplace.

• Take part in the radio survey.

Every month, BE Radio will conduct a survey pertaining to an issue of interest to the radio broadcast industry. The results of the survey will be published in the following month's issue of BE Radio. Take the survey online and then see the results here.

• Do you have an on-air or production facility that is a showcase?

Tell us about it. The Studio Spotlight looks at a new facility every month with images and a description of the site. We are looking for facilities to show. Look online for the details, or contact us:

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beradio@intertec.com
fax: 913-967-1905

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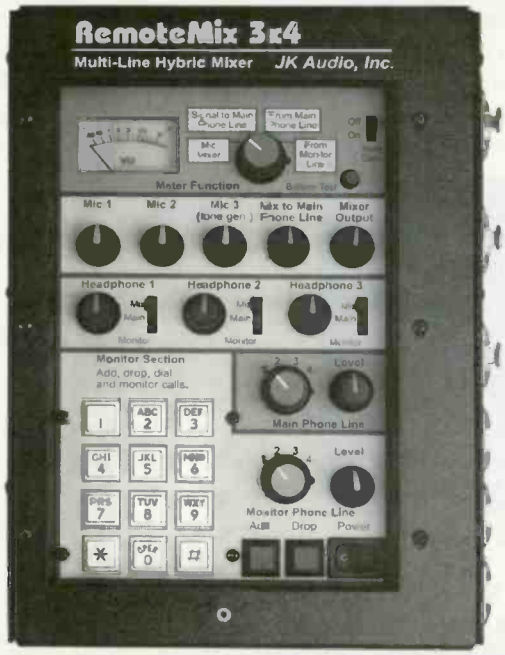

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800-552-8346 Fax: 815-786-8502

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Antitrust action against JSAs

The Department of Justice's Antitrust Division is investigating a joint sales agreement (JSA) between two radio stations in the Colorado Springs market. This investigation is the latest signal by the DOJ that it believes JSAs can potentially lessen competition and may therefore violate the antitrust laws. In 1996, the DOJ alleged that a JSA between American Radio Systems and Great Lakes was illegal. In that case, American Radio Systems was required to terminate the agreement.

Not all JSAs are illegal. The DOJ has stated that "the Department recognizes that JSAs differ both in their terms and in their potential for realizing pro-competitive efficiencies." In cases where the stations involved in the JSA cannot point to a pro-competitive benefit of the agreement, theDOJ may consider the JSA illegal regardless of the market share of the stations at issue. In cases where the stations can demonstrate a pro-competitive benefit, The DOJ will only consider the agreement illegal if the stations involved have market share of approximately 35% or more and the anti-competitive effects of the JSA outweigh the pro-competitive benefits

SBE board elections commence

Ballots for the election of the 1998/1999 officers and board of directors for the Society of Broadcast Engineers were recently mailed to all voting members. To be counted, ballots must be returned by mail by 5pm, September 17. Candidates for the four officer positions and the six available seats on the board include:

Miller

- **President**
  Edward J. Miller, CPBE (I);
- **Vice President**
  Troy D. Pennington, CSRE (I)
- **Secretary**
  Thomas P. Weber, CPBE (I)
- **Treasurer**
  James (Andy) Butler, CPBE (I)
- **Board of Directors**
  Raymond C. Benedict, CPBE (I)
  Nicholas Cap, CBTE
  Sam E. Garfield, CPBE
  Albert Grossniklaus, CBT
  Chester L. Grubbs, CPBE
  Robert P. Hess, CPBE
  Mario K. Heib, CPBE
  Jeffrey A. Keith, CPBE
  Mark Krieger, CBT
  Barry D. Thomas, CSRE
  Jerry C. Whittaker, CPBE

(I) denotes incumbent

Ballots will be tallied beginning at 6pm on September 17 by members of Chapter 25, Indianapolis. Official results will be announced on September 18.

NAB offers Uplink Seminar

The National Association of Broadcasters is offering its tenth annual Satellite Uplink Operators Training Seminar October 5-8 in Washington, DC.

As in previous years, Norman Weinhouse of Norman Weinhouse Associates will conduct the course. Mr. Weinhouse has over 30 years of experience in the design, construction and management of satellite communication systems, and a textbook written by Mr. Weinhouse will be used as a basis for the course.

Satellite uplink operators and engineers, as well as engineering managers, are encouraged to attend the seminar.

During the four-day course, attendees "will gain an understanding of satellite communications systems, equipment, operating guidelines and safety and interference management techniques." Additionally, the program offers hands-on training with Earth station equipment, Mr. Weinhouse's 300-page *Satellite Uplink Handbook*, and a new section covering digital transmission.

Those interested in attending can get an application online at http://www.nab.org/SciTech/uplink.asp. Completed applications should be mailed or faxed to Courtenay S. Brown, NAB Science and Technology Department, 1771 N Street, NW, Washington, DC 20036-2891, Fax: +1 (202) 775-4981.

ARMA announces show date

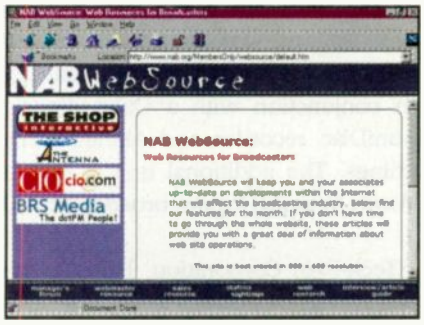
A.R.M.A

After a successful first gathering in early June, the American Radio Manufacturer's Association (ARMA) has set a date for its next show. The Expo will be held June 7-8, 1999 at Trump World's Fair Casino in Atlantic City, NJ.

Details regarding booth space, registration, and conferences and seminars have yet to be released, but interested parties can contact Donna Detweiler at 609-653-6130, e-mail mail@armagroup.org, or seek out the group's website at www.armagroup.org.

NAB debuts Websource

The NAB has announced an online resource for its members. *NAB Websource* is an interactive guide designed to keep stations up to date about Internet developments that will have an affect within the broadcast industry.



Websource will feature interviews and articles each month focusing on Web-based developments in all aspects of broadcasting. The site is designed to appeal to all levels of web users – from beginners to the more technically savvy.

The NAB has partnered with *CIO* magazine, *The Antenna*, and *The Shop Interactive*, to give stations the newest information possible.

"The dynamics of broadcasting are constantly changing," NAB President/CEO Edward Fritts stated recently. "If you don't stay ahead of the curve, you create the possibility of being blindsided. 'NAB Websource' keeps us ahead of the curve.

The site is accessible to NAB members only, but will be made available for prospective members and interested parties for a one-month trial period. Interested nonmembers should contact the NAB at 202-429-5300. NAB members will find the Websource in the members-only section of the NAB site – www.nab.org.

FCC sinks 15 pirates

The FCC, in conjunction with the US Marshal Service, seized radio equipment by court order from 15 unlicensed broadcast stations in the Miami metropolitan area. Thirteen of those seizures occurred within a five-day period from July 27 to July 31.


Kennard

FCC Chairman William Kennard said, "The operation in Miami was CIB's (Compliance and Information Bureau) most successful, large-scale, enforcement action against unlicensed operators to date. This Commission has enforced and will continue to vigorously enforce the law against unlicensed broadcasters."

The actions included the seizure of equipment from broadcasters operating on 104.1, 97.7, 89.1, 91.7, 95.3, and 99.5 in Miami, 94.5MHz in North Miami, 107.1MHz in Miami Beach, 88.7MHz in North Miami, 90.9MHz in Davie, 90.3MHz in Homestead, 92.7 and 101.1MHz in Coconut Grove, and 104.7MHz in Hialeah. The FCC's action was part of its on-going enforcement efforts against unlicensed broadcast stations. Other agencies assisting in this action included the US Marshal Service, US Customs, the Drug Enforcement Administration, US Coast Guard, the US Attorney's Office, and local law enforcement officers.

Jacor completes acquisition

Consolidation giant Jacor Communications recently completed its $620 million acquisition of the radio broadcast properties of Nationwide Communications, Inc. The transaction was originally announced in October of 1997 and has been pending regulatory approval since.

The company also announced several related transactions, including the partial closing of a multiple station swap with CBS. The remainder of the transaction will close when CBS receives a "one-to-a-market" waiver from the FCC. The waiver would permit CBS to own radio stations and a TV station in Minneapolis. CBS, who already operates a TV station in Minneapolis, is scheduled to receive two Minneapolis radio stations from Jacor as part of the swap.

New! Stereo Mixer!

Stereo Mixer is an 8-input 'mini-console' that can mix 4 stereo or 8 mono line sources. Both stereo *and* mono outputs. Ideal as an input expander or source combiner. Balanced inputs and outputs, with superb specs. *Dozens of uses...keep one on hand!*

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Business/ People

BUSINESS

Neutrik, Lakewood, NJ, acquired UK-based **REAN Ltd. Products** and US-based **REAN Inc.** at an undisclosed price from Lilleshall PLC. REAN manufactures a wide array of control knobs, jack connectors and ¼-inch and bantam long-frame patchbays, which up to now had not represented core business activities for Lilleshall. Neutrik plans to further develop REAN with existing and new products and make changes only when necessary to do so for the sake of REAN and its personnel.

Digital Generation Systems (DG Systems), San Francisco, recently introduced iAudio, a new service for transmitting broadcast-quality spots via the Internet. The new service complements DG System's current nationwide, value-added digital network by enabling agencies, advertisers and studios to link directly.

Canada-based **Davicom Technologies** announced the establishment of a US office. Davicom Technology Ltd. Will be located at 10 Princeton Avenue, Egg Harbor Township, NJ, 08234. US customers can call DTL toll-free at 877-DAVICOM; fax 609-653-1075.

ABC Radio Networks, New York, recently purchased 13 *Pro*Tracker eight-channel, in-line, multitrack recording mixers from **Spirit By Soundcraft**, Rocklin, CA. Twelve of the units are going into a dozen new digital edit workstations, which reporters will use to edit news feeds for air. Each workstation will featrue a *Pro*Tracker used in conjunction with a Dalet digital edit system, Sony MiniDisc recorder and Marantz CD and cassette machines. The additional unit is to be used by the *Gary Nunn Business Report*, broadcast by ABC from New York.

Tech-Sym Corporation, Houston, announced plans to sell several businesses to improve its overall performance and sharpen its corporate focus, including **Continental Electronics**, Dallas, and its subsidiary **TELEFUNKEN Sendertechnik GmbH**, Berlin, Germany. Tech Sym mangement believes there will be significant interest in Continental and its subsidiaries due to their technological advances in digital audio broadcast, as well as their established market presence in AM/FM transmitters. The company expects the sales to be completed within the next twelve months.

PEOPLE

Donald C. Naab has been named president of Pacific Research & Engineering, Carlsbad, CA.


Wershba

▶ **Don Wershba** has been promoted to vice president – music, Eastern region, for Solid State Logic, New York.


Beeler

◀ **Scott Beeler** has been promoted to director, North American sales, for the Harris Corporation, Richmond, IN.

Dielectric, Raymond, Maine, announced several personnel developments as part of a reorganization: **Kerry Cozad** has been appointed vice president, advanced broadcast operations; **Dr. Oded Bendov** has been promoted to senior vice president, advanced technologies and chief scientist; and **Andre Skalina** and **Ernie Mayberry** have both achieved senior director positions in antenna engineering and antenna RF systems respectively

Howard Elovitz has been named to manage international satellite and broadcast communications sales for Andrew Corporation, Orland Park, IL.

Steve Johnson has been appointed to serve as vice president of marketing for Shure Brother's, Evanston, IL.

Ray Bennet has joined the analog design group as an analog audio design engineer for Rane Corporation, Mulkiteo, WI.

Stephen S. Sampson has been tapped to be sales director for the Digital Universe line of products at CBSI, Reedsport, OR.

Steve Keating has been appointed manager, domestic marketing for Continental Electronics Corporation, Dallas, TX.

Jerry Gollub has been appointed vice president and general manager of Lambda Electronics, Mellville, NY.


Moet

▶ **Karl Moet** has been named product training manager for TASCAM, Montebello, CA.

The National Association of Broadcasters announced the selection of Lowry Mays, chairman and CEO of **Clear Channel Communications**, San Antonio, TX, as the recipient of the 1998 NAB National Radio Award. The Association cites Mays' "remarkable business sense, "incredible achievements," and "tremendous influence on radio" as factors in the his selection for the honor. Clear Channel now owns or programs 219 radio stations and 18 TV stations in 48 US markets. The company also owns Heftel Broadcasting, the largest Spanish-language broadcaster in the US, and has a 40% stake in Grupo Acir, which has 164 radio stations in 72 cities throughout Mexico.

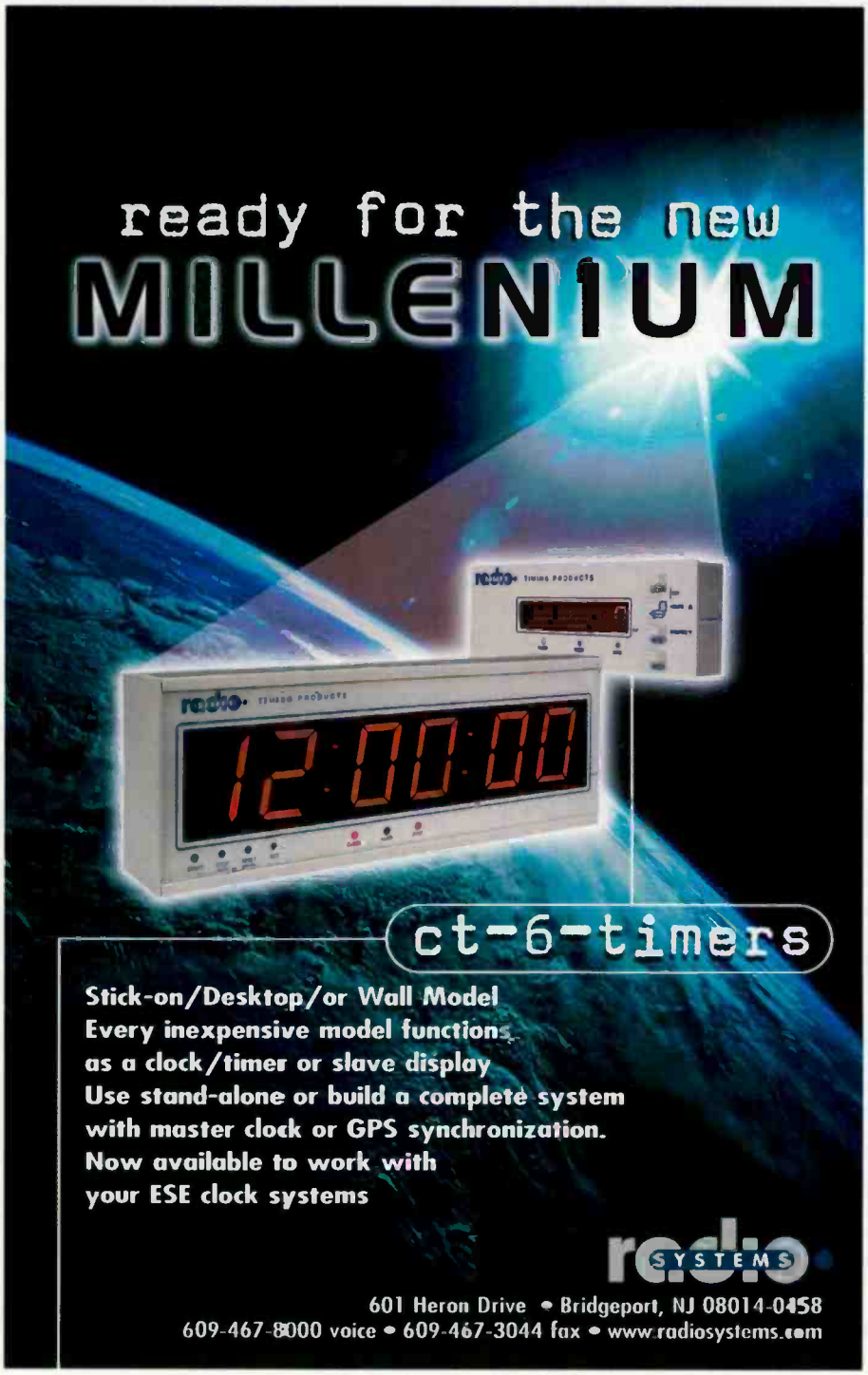
Radio Data Group, the largest Internet services company exclusively for radio, recently added stations in five of the country's largest markets to its list of clients. KZLA-FM, Los Angeles; WLUP-FM and WMVP-AM in Chicago; WMGK-FM, Philadelphia; WEGQ-FM and WBMX-FM, Boston; and WWZZ in Washington, DC are all new or recent RDG station affiliates. RDG currently provides services to 110 ratio station clients and radio-related organizations.

Intraplex, Westford, MA, has signed a lease for new commercial space in Littleton, MA that will double the size of the company's facilities. Intraplex currently plans to take occupancy and move its company offices in September, following the completion of construction work currently underway.

Leitch Technology will reorganize European and Asian operations to consolidate Leitch and **Tekniche** sales and customer service. The combined forces will promote and support all Leitch group brands in their respective regions.

Gibson Musical Instruments, Nashville, TN, announced the purchase of **Opcode Systems**, Palo Alto, CA. Opcode, best known for its Studio Vision Pro software and line of MIDI hardware, will be run as an independent subsidiary. Chris Halaby will remain the company's president and will serve on Gibson's board of directors.

Aphex Systems, Sun Valley, CA, announced the sale of its 2020 FM Pro broadcast processing system to WJPL-FM, Peoria, IL, KSJL-FM, San Antonio, and WOPO-FM, Harrisonburg, VA.



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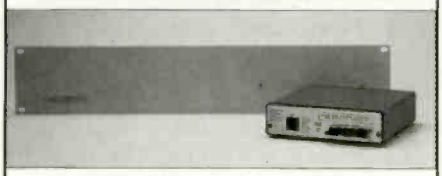
SINE SYSTEMS
Innovative Solutions

DAI-1 DIAL-UP AUDIO INTERFACE



The DAI-1 Dial-up Audio Interface provides an array of features unparalleled in the industry. It combines an autocoupler, a dial-out alarm, two AGCs, a DTMF operated equipment controller and an audio switcher into one affordably-priced device. Common applications are emergency broadcasts and "dial-up" remote broadcasts when the studios are unmanned.

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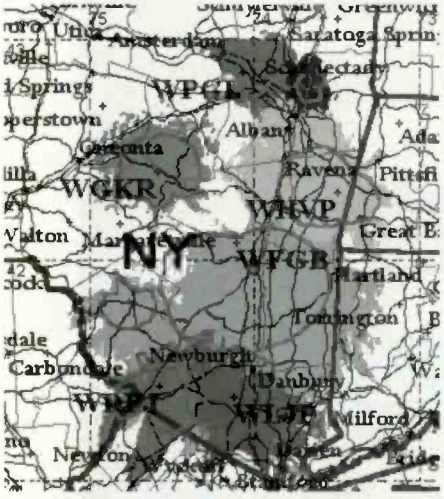
ComStudy V1.50



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Reader Feedback

What's in a name?

The debate over the use of the title "Engineer" continues in both social and legal discussions. Here are two more responses to our call for reader input on the topic. —CS

Chriss:

I read the comments from Mr. Keith of WMJI-FM in the April BE Radio with some interest.

In the State of Illinois, the State Registration and Licensing Laws are very specific. If one wishes to use the title "Engineer" it is necessary to pass the state registration examination. To be allowed to take the exam, one must complete a course of study leading to at least a Bachelor of Science degree at an accredited university and then obtain an additional four years of experience past the Bachelor's level. It may then be possible to take the final examination and become a Registered Professional Engineer. Unless that license is obtained, it is illegal to use the title "Engineer."

This is really not any different than a number of other occupations. For example, it is illegal for someone to claim the title "Attorney" unless they have passed the bar examination. In fact, it is even illegal in Illinois to use "Barber" unless you have passed the state examination and are licensed to practice as a barber.

If you notice, the FCC has always referred to those who work at transmitting facilities as "Operators," not as "Engineers." The Association of Federal Communications Consulting Engineers has objected in a number of states to the use of the term "Engineer" by those who were, in reality, technicians. This complaint has also been raised for years by the National Society of Professional Engineers. Unfortunately, too many states have simply ignored the obvious problem.

I disagree with Mr. Keith in his claim that it boils down to "buyer beware." You should not have to check the true credentials of someone claiming to be a licensed professional. The state is supposed to take care of that by its examinations. When one visits an attorney, they may do so safely assuming that the attorney has at least passed the bar examination. When one visits a medical doctor, it can safely be assumed that the person has passed the state boards.

Mr. Keith is in error when he is worried that somebody might tell a Ph.D. that they cannot be called "Doctor." That is the D in the Ph.D. However, they certainly would not claim to be physicians.

The bottom line is very simple. If you want to be identified as an engineer, go to college, get the degree and then get the necessary experience and pass the exam. Otherwise, use a legal title. There is certainly nothing wrong with being known as a "broadcast technician," which is more accurate and appropriate.

Sincerely yours,
Donald L. Markley, P.E.

Chriss:

The subject of the use of the title "Engineer" is much too complicated to be addressed in a short letter. Between the time that I learned what the pitfalls were and the time I managed to get registered I made a point of using an alternate title and correcting those who tried to call me an "engineer." Even today when I go into a state where I am not registered to do routine work that does not require registration, I make a point of telling all concerned that I am there as a technician. I think that many others would do the same if it were explained to them.

David M. Raley, PE
Laurel Hill, NC

IBOC Concern

I agree completely with Skip's comments [*Editorial*, May/June, 1998, "Still tied to the mast"]. I would however like to add another fly to the IBOC ointment, one of which I have heard no one speak.

Here in Tampa, and most of the south, we have completed week eight of a temperature inversion that is wreaking havoc on the FM and VHF-UHF band. Nearly every FM and TV channel has been homesteaded by a distant station, including those channels occupied by local stations. My concern with IBOC is the reaction not only to a skipping analog FM, but yet another carrier: the skipping FM IBOC. Although our latest period of skip is unusually long, it occurs regularly for a week at a time. I am assuming this is a problem in many hot, flat areas such as Texas and Oklahoma. I would very much like to see *BE Radio* contact all the developers of IBOC and quiz them on the durability of IBOC with skip; are any manufacturers testing this scenario? Will people just lose their FM digital signals for a week at a time? Will a receiver's confusion created by receiving a skipping IBOC signal along with a local analog signal be more difficult to listen to than two analog signals alone?

David Solinske
Tampa

The three companies currently developing IBOC technology, USA Digital Radio, Digital Radio Express and Lucent Technologies, are working independently on an IBOC solution. BE Radio *will continue to cover any new developments in the IBOC arena as they develop.*

Hi, Skip:

I just read your editorial on IBOC DAB in the May/June issue of *BE Radio*. I, too, have been following IBOC development for many years and wondering when more successful demonstrations would happen. I've been wondering if some thought should be made to giving up this challenge. If we can't get IBOC DAB to work, what alternatives do we have? Enjoyed seeing you put many of these thoughts in better focus in print.

Regards,
Roger Chesser
General Manager
WUKY, Lexington, KY

Roger,

Yes, there's not much alternative for US DAB without going back to the drawing board. That's why I'd recommend focusing more on Internet services. Cyberspace may be US radio's (only) digital broadcast environment where broadcasters can go for both quantitative and (eventually) qualitative improvement. Once Teledesic and the AutoPC/PalmPC become part of the normal landscape (5 years or less), there will be little difference between the accessibility/cost/convenience of on-line radio and conventional broadcast radio, but the functionality and service choices will be much richer. That could be the silver lining in all of this for US radio, in that it pushes us toward the real future, while TV and other countries' radio work toward mere incremental change in traditional, linear distribution systems.

Skip Pizzi, editor-in-chief

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Online Survey

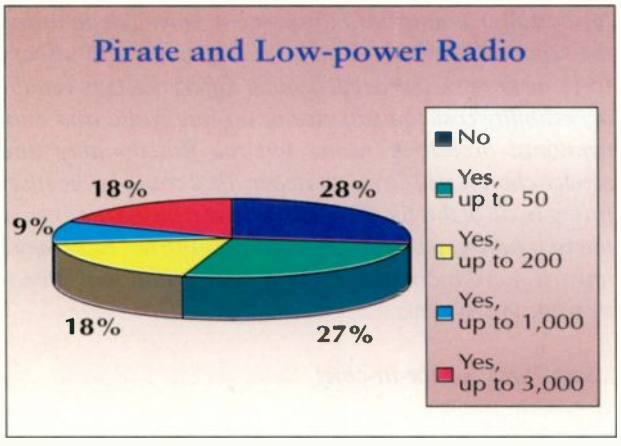
Micro- and low power radio

By Chriss Scherer, editor

Unlicensed radio operations have made headlines recently, from Free Radio Berkley (FRB) to Florida. There are currently three proposals for a new, licensed low power service. *BE Radio* asked for your opinions on the subject.

Survey question

Is there justification for some type of licensed and regulated low-power radio service in the US? If yes, what power level should be set as a maximum?

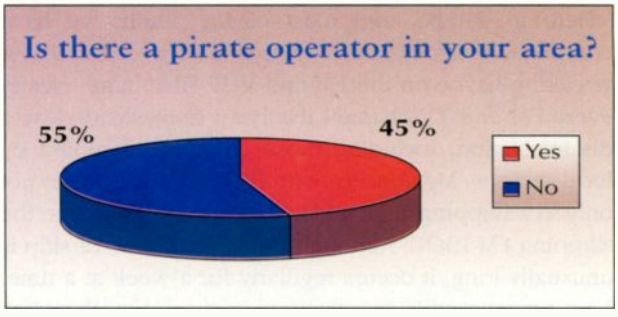


We also asked if there were other power levels that should be considered other than those listed on the survey form. Most of the respondents felt the levels given were acceptable, but there were two write-in answers with alternate recommendations. The write-ins were 10 Watts and 5,000 Watts.

After the news of FRB being shut down came out, some unlicensed operators themselves ceased operations. The FCC is continuing their crackdown on these stations. Since many unlicensed operator are running at very low power levels, it's not always known that they are even on the air until the word gets out or interference is caused.

Survey question

Is there a pirate station currently operating in your area?



Look online at **www.beradio.com** for the next survey. The results will appear in the November/December issue of *BE Radio*.

Coming in the October issue of BE Radio®

- ***Cover Story: Transmission***

Higher efficiency components and designs are proving worth the investment.

- ***Feature Story: Remote site control***

Multiple-parameter monitoring and more precise control of other devices make for some unique integration. The addition of computer control can simplify much of this.

ALSO:

Maintaining the multi-transmitter site • Buying a new transmitter
RF combiners • Datacasting update
And News, Business, People, New Products and the results of the online survey.

We're thinking "in the box."

With all the "out-of-the-box" thinking going on these days, we thought it was time someone put some thought in the box.

That's what we've been doing at Crown. The result? An improved FM exciter. An exciter that delivers the clean, accurate audio quality that you expect from Crown.

Quality FM Exciters

Performance

You've got to see our latest specifcations. You'll find wide stereo separation, a low signal-to-noise ratio, and a host of other specs we've not previously published.

New, impressive specs! Call for all the details.

Power Levels

Crown exciters are available in 30–watt, 100–watt, 250–watt, and 500–watt versions—each in an attractive, compact, and rugged chassis.

Applications

A Crown exciter makes an ideal link in your broadcast chain. Whether your installing a new system or replacing the driver stage of your tube transmitter, these boxes can do it all.

Service/Support

We put more in our boxes than a quality product. Each one comes with a 3–year warranty and fast, friendly technical support (24 hours a day).

Customer Corner

"Everytime I open up a Crown box, I am amazed at the reliable and elegant design. P.S. The new exciter board looks great!"

—Glenn Finney, Chief Engineer, Macon, Georgia

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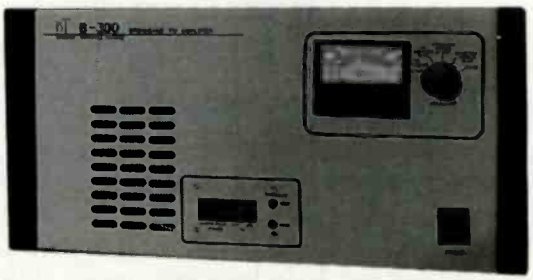

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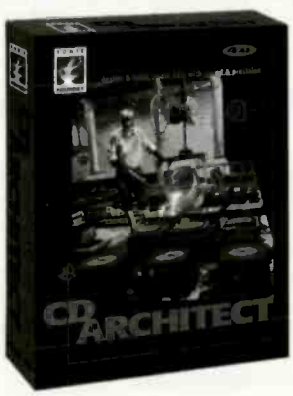

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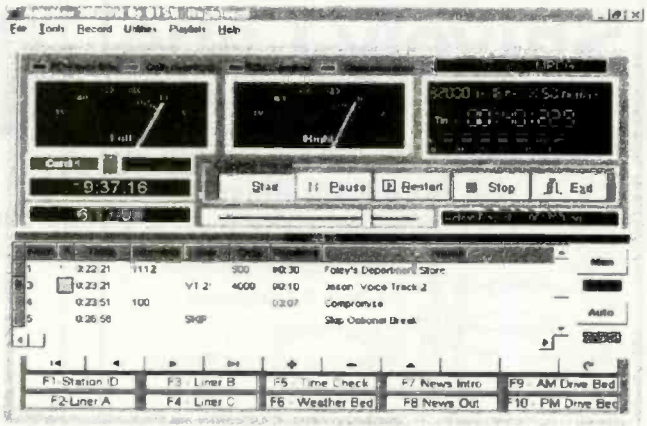

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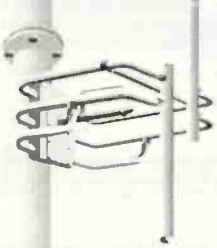

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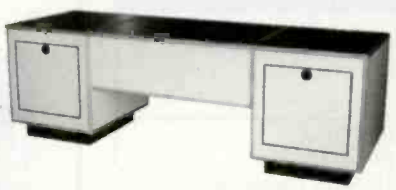

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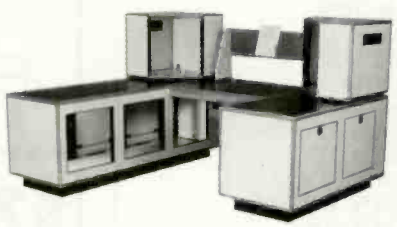

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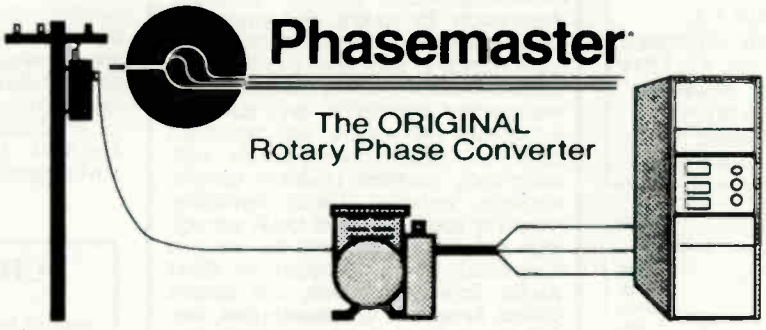

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PCs unplugged, part 2

By Skip Pizzi, Editor-in-chief

In the July issue, this column discussed the mobile application of PCs (the *AutoPC*), which has recently begun its deployment. The next step in moving the PC off the desktop will come with handheld devices and other similarly portable PCs. With this migration and the coming availability of cheap and ubiquitous wireless Internet service, access to the Web will also become portable — an increase in functionality no less important than the development of the "transistor radio" of the 1960s.

Dedicated devices

Unlike the general-purpose computing devices that PCs (including the AutoPC) represent, many of these handheld/portable computers will be more limited appliances, dedicated to specific tasks. Among them may be the "web-phone," a cellular phone-like device that can access the Internet, converting and displaying HTML data on a smaller, graphics-equipped LCD display. Regular-production cellular phones offer this kind of text-display capability today at reasonable prices. HTML-like operation on such a device is not far away. Prototypes of a dedicated web-phone have already been demonstrated.

The synergy between on-air and on-line service will be most potently realized in a portable computing environment.

Adding audio to this functionality is also not much of a stretch. Headphone or speaker output of web-based audio makes this the on-line equivalent of the portable radio or boom box. The real obstacles to realization of this aren't in hardware or software, but in connectivity and content. High-speed wireless Internet access at low cost has yet to become widely available, but this is likely to change soon as consumer demand for it takes off. Terrestrial wireless service providers will also be compelled to improve the value of their offerings as new, satellite-delivered competition arrives.

Key components are already here

Codec capability continues to increase, allowing more fidelity in less bandwidth. Witness the performance of the latest on-line media players: audio-only streaming at 30 to 40kb/s (single ISDN B-channel) has begun to truly rival FM stereo, particularly on the smaller and less critical reproduction systems likely to be found on portable systems. Audio at 24kb/s (typical POTS line) meets or exceeds AM quality — even offering stereo in some cases — and suffers no impulse noise from electrical interference.

Other critical hardware improvements include some recent breakthroughs in battery and display technologies that will allow significantly longer operation of a "portable browser" between battery recharges or replacement. New chip technologies will also require less power, especially for dedicated, limited processes. Development time and cost for such application-specific chips (ASICs) also continues to decline.

Radio integration and impact

There is no reason that portable web-browsing devices equipped for audio couldn't also contain radio tuners for one or more broadcast bands. In fact, the actual migration may start from the other direction, with high-end portable radios offering web-audio capability.

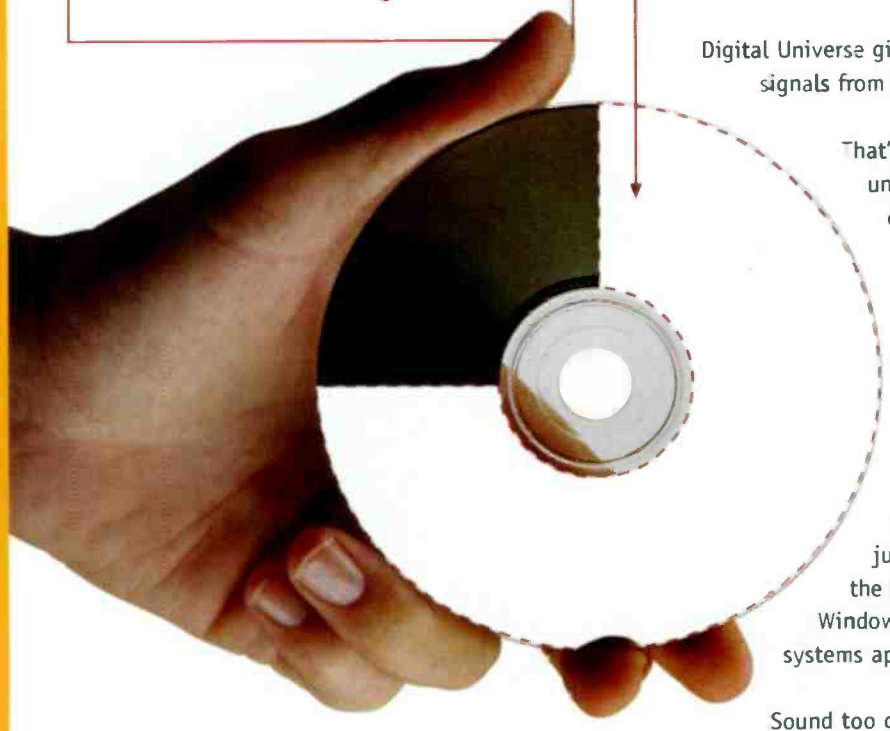
Like cellular phones, such portable web-browsers will require connectivity that could be purchased along with the receiver. Similarly, the hardware cost to the consumer could also be subsidized by the wireless connectivity company whose service the buyer agrees to purchase on a long-term basis.

This has great implications for content-providers, both on-line and on-air. Streaming media on-line will likely grow in its variety, offering live and on-demand services of many stripes. But the cost of reception will always be higher for on-line services than for on-air services to a web browser/radio. Therefore the value of on-line audio will have to be perceived as more worthwhile than on-air service.

On the other hand, a web/radio receiver also can add value to the wideband and freely available on-air broadcast channels through high-speed downloads of HTML-based content via FM subcarriers or auxiliary DAB data to a portable browser — even while listening to main-channel audio. The synergy between on-air and on-line service will be most potently realized in such an environment.

Today the Web is working its way into the everyday lifestyles of many modern consumers who access it via fixed, wired terminals. Tomorrow, a new generation of portable browsers may induce consumers to adapt wireless use of the Web into their normal routines. In five years, pocket Internet access may be as commonplace and expected as cellular phones and fax machines are today. If radio broadcasters are smart, they will continue to provide audio content for an increasingly mobile, high-tech and leisure-oriented society.

How much audio does your digital system throw away?



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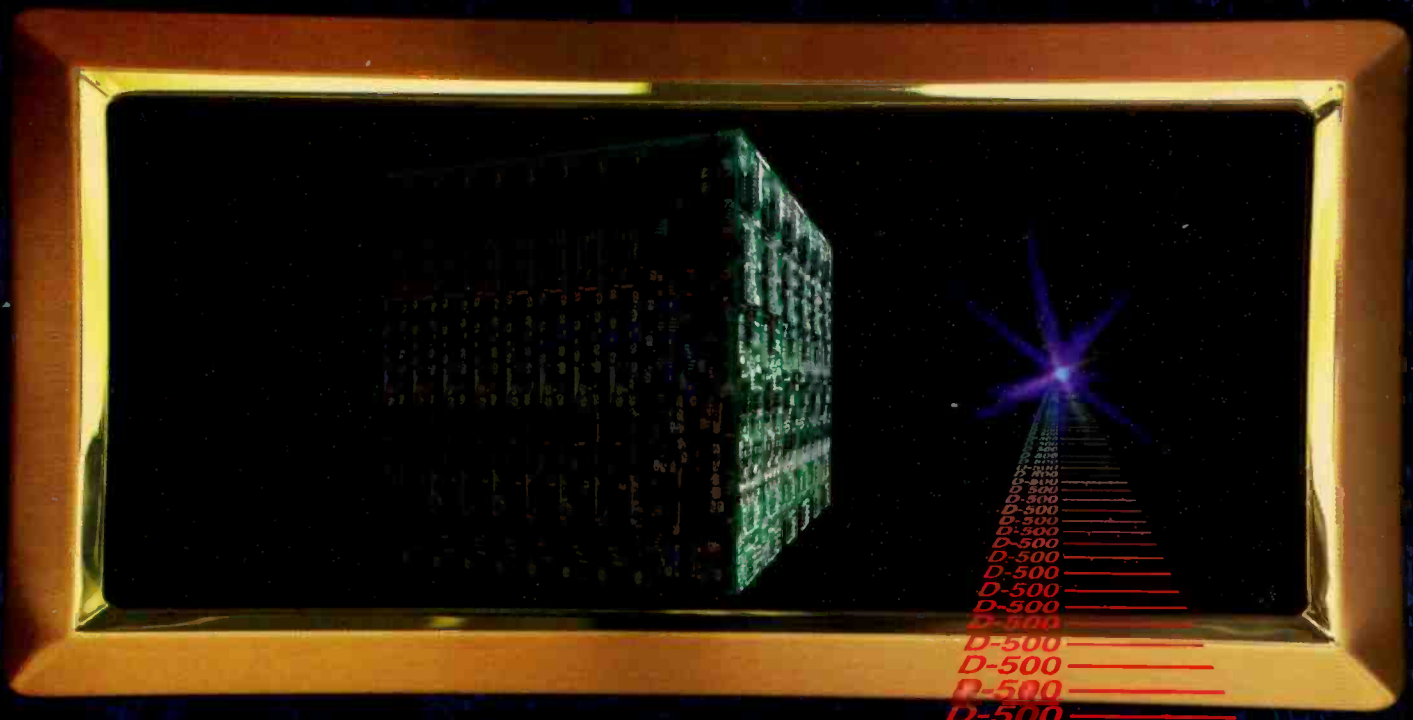

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