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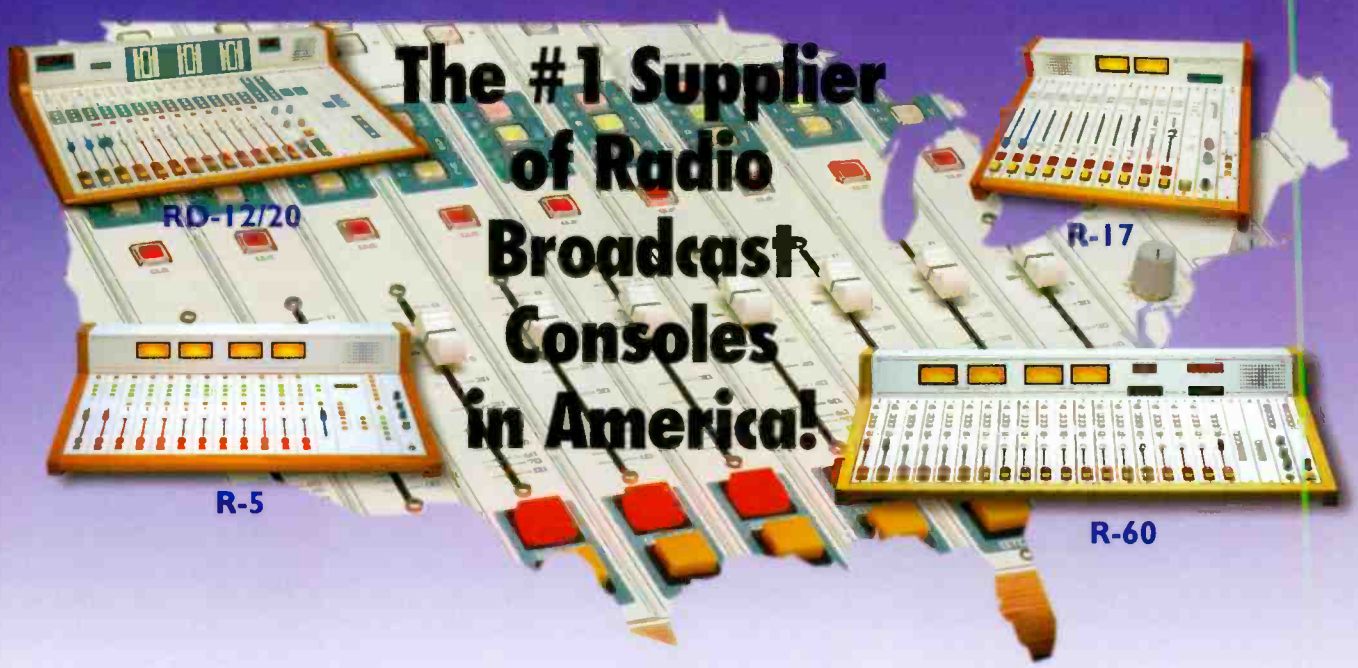

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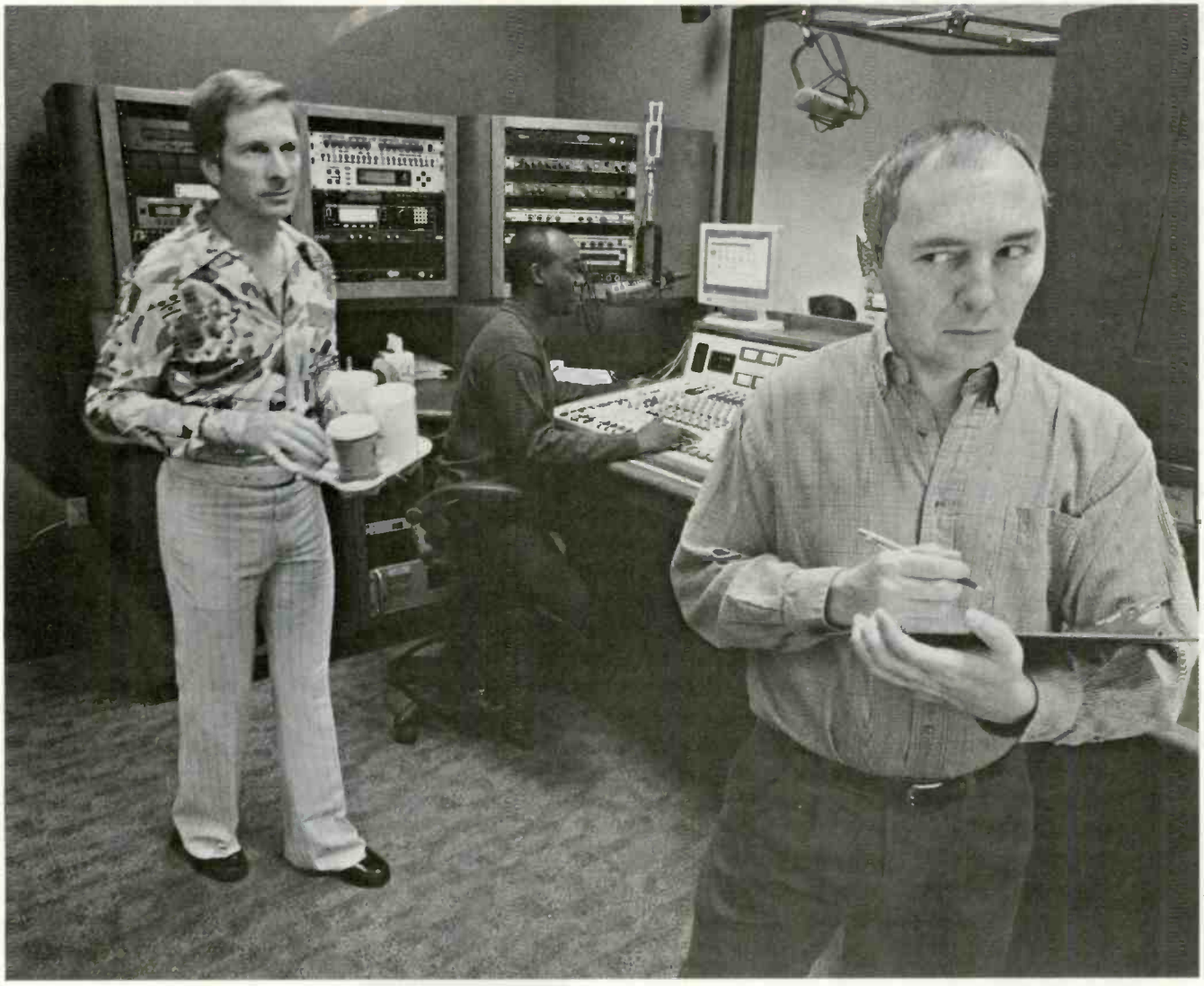

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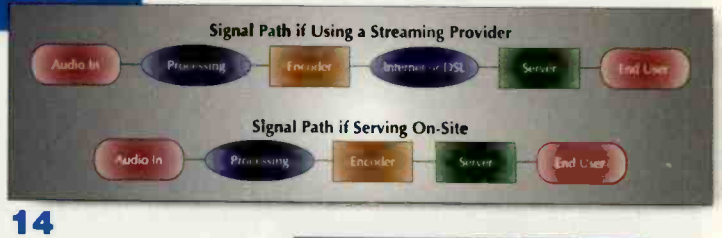

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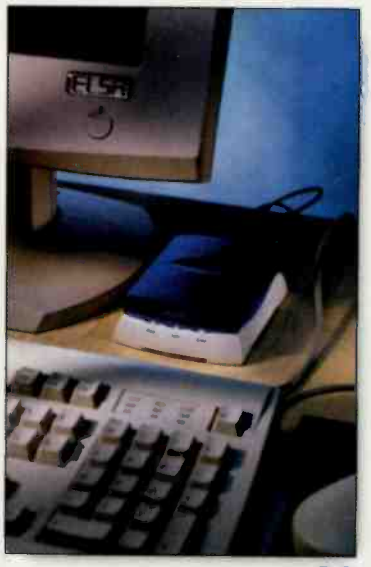

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ON THE COVER: Planning a digital facility involves more than just considerations for the physical space. Cover design by Michael J. Knust. Photo of WLTW-FM by John Farrell and courtesy of Meridian Design Associates.

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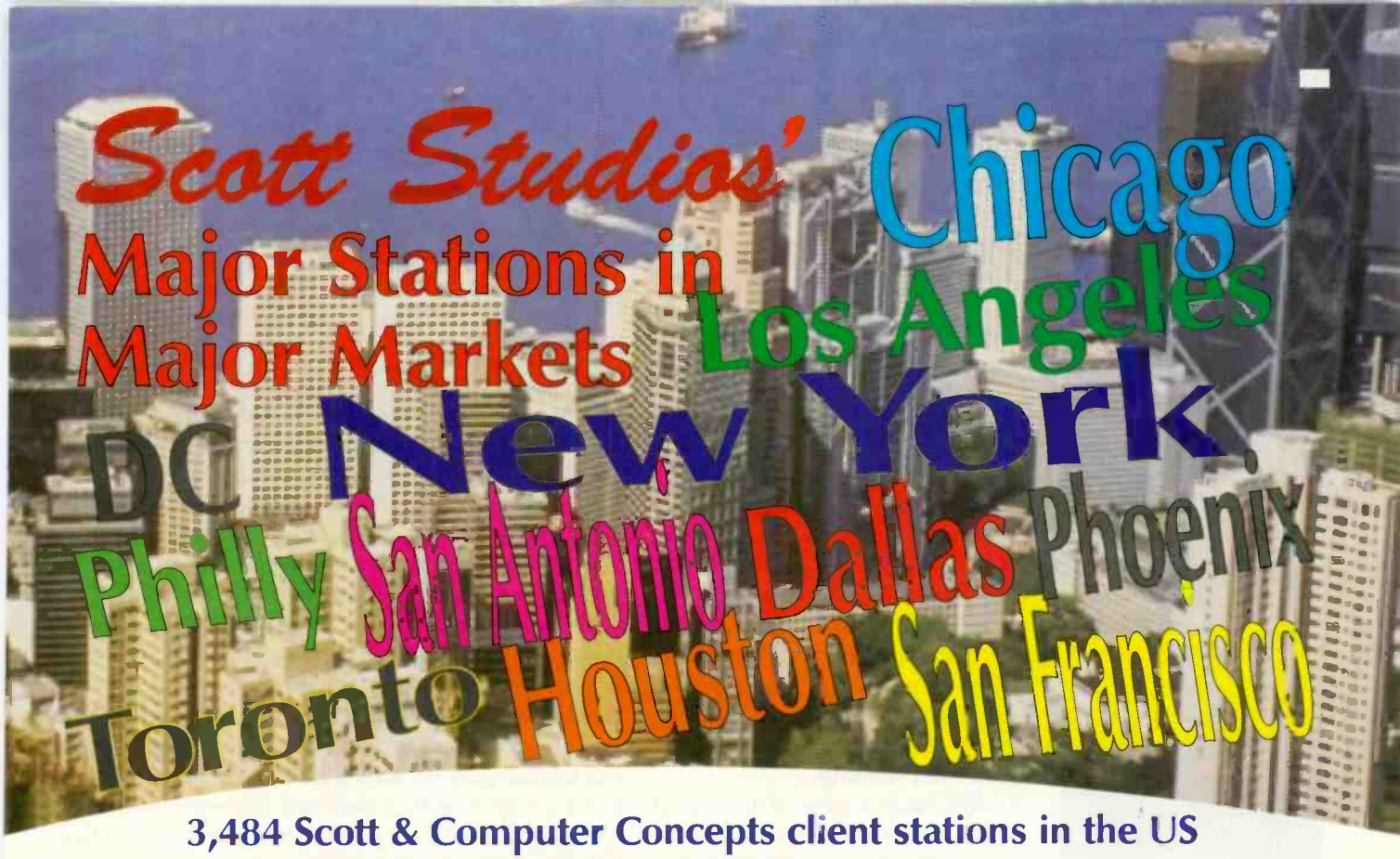

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One year later

Almost one year after it was initially created, LPFM has been reduced to a sliver of its original idea. The matter has raised both strong support and fierce opposition over the past year. Individuals, large corporations and community interest groups have voiced their concerns over the service and the help or harm it will create.

The general idea of diversity on the airwaves is a good one. The situation we have now, with too many stations held by too few owners, is the result of the Telecommunications Act of 1996. Many—especially LPFM supporters—believe that the consolidation of ownership has resulted in a greatly reduced variety of entertainment and information offerings.

Looking back at some of the original goals of the Act from 1996, it was stated that reducing the ownership limitations previously established would stimulate private investment, promote competition and protect diversity of viewpoints and voices among the media. I don't think that happened. Instead, the frenzy of buying and selling has made many stations money machines to recover the purchase price. Broadcasting in its true sense is the only way to maximize revenue potential for many stations. The niche has been lost.

LPFM was created in part as a reaction to the 1996 Act and also from the increasing popularity of unlicensed broadcasters (also called microbroadcasters and pirates). The FCC did not help matters by eliminating Class D FM stations. (Isn't it strange that the low power stations previously classified as Class D were deemed an inefficient use of spectrum—until LPFM was introduced?)

The LPFM supporters feel that the extra stations will provide opportunities for additional voices to be heard. The LPFM opposition does not want to clutter the existing spectrum with even more signals than were created with the 80-90 docket. The two sides are throwing apples at oranges. To provide diversity in an already crowded situation, don't add more voices, change those already speaking. I support some of the principles behind LPFM. In most markets, station formats have been reduced to homogeneous levels. The station names may change between borders, but the content is the same.

On the technical side, is third-adjacent protection necessary today? Is second-adjacent protection necessary? I have heard arguments on both sides, and to be honest, I don't know what the answer is or whose test results to believe.

LPFM was pushed through too quickly without sufficient information to satisfy existing broadcasters. I was never convinced that LPFM would be able to successfully serve the niche audiences that were proposed as listening audiences. We are a highly active and mobile society. To assume that the targeted audience will always be within the limited LPFM service contours is not realistic.

The contest over LPFM is as diverse and intense as our last Presidential election. When I learned of the Radio Preservation Act being incorporated into the budget legislation, I was concerned. It does not belong there. The larger legislation carries some important changes, and it was almost certain that it would pass, but adding the Radio Preservation Act to it was a final effort by a dedicated opposition movement.

While all the budget legislation banter was taking place, I also received information from audio streaming providers touting their services as an easy alternative to the LPFM hassle. I think this is a wonderful idea and could be quite economical for many potential niche broadcasters. It may not be perfect, but it is an available route.

There is considerable activity in every aspect of media. Kennard wants broadcasters to spend less time fighting LPFM and more time embracing digital. I think most broadcasters are prepared (perhaps reluctantly) to accept digital when a standard is created. It is the FCC who is creating obstacles it seems.

I look forward to the nine-market test mandated by the Radio Preservation Act because it should settle the potential interference second- and third-adjacent channel issue. Then again, I guess I shouldn't worry about it too much. In a few years, no one will remember LPFM anyway.

Chriss Scherer, editor
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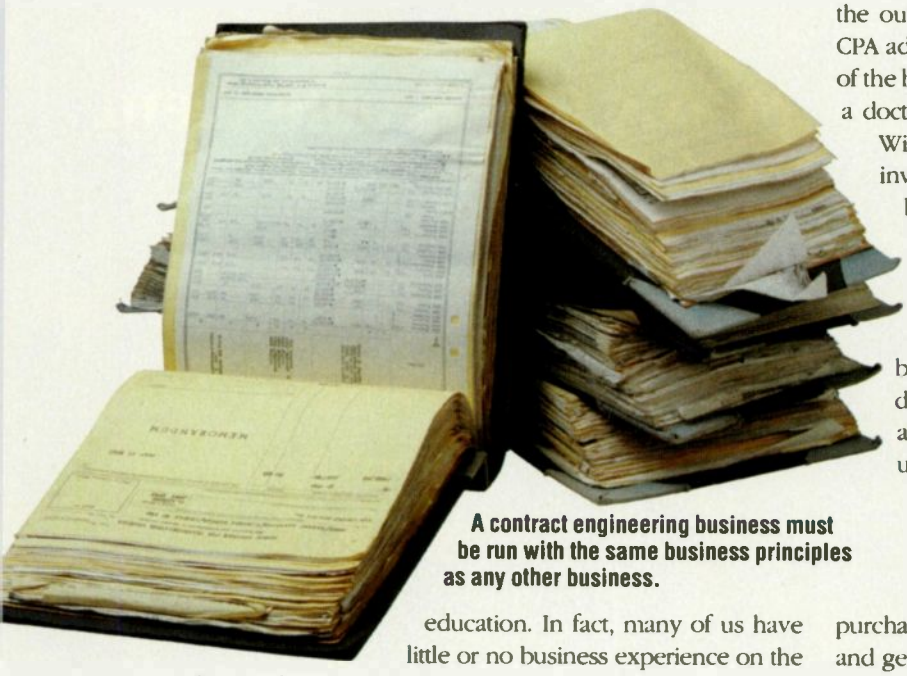
Bookkeeping basics

By Mark Krieger, CBT

While it may be an article of faith that broadcast engineers tend to be analytical, does it follow that we are naturals when it comes to business principles? Of course not, because business sense isn't a sense at all. It is a skillset that has to be learned, refined and progressively updated. Unfortunately, most broadcast engineers don't have the benefit of a background in business education. In fact, many of us have little or no business experience on the day we first decide to hang up the "for hire" sign.



A contract engineering business must be run with the same business principles as any other business.

So just what do we need to know? To get answers, I spent some time talking with Tom Scheiman, a CPA with years of experience in small business accounting and tax issues. Although his observations don't qualify as breaking news, his points are emphatic and specific. No matter what structural form your company takes, be it sole proprietorship, partnership, or corporation, the essential ingredients of a successful business are the same with discipline acting as a recurring theme throughout.

A genuine commitment to establish and run your business requires the development of a business plan. Such a plan need not be elaborate, but it has to address two key areas:

- What is the basic mission or objective of the business, and what types of products or services will be provided? It may sound ludicrously simple, but the parameters established here will shape the structural form of the business and the amount of capitalization required. Don't overlook retirement savings as an important part of this plan.
- Who will keep the books? Again, the answer seems simple. Most engineers are born record-keepers. Yet, this trait (or lack thereof) is not the sole determinant in the accounting equation. As was pointed out earlier, effective accounting practices are an acquired and refined skill. While you might save some money on accounting fees up front, failing to retain professional accounting and tax advice at the outset could ultimately prove to be very costly. Our CPA advises that seeing an accountant after making a mess of the books is as common and counterproductive as seeing a doctor after experiencing your first heart attack.

With the second point in mind, let's take a brief inventory of the basic checklist for small business bookkeeping, with tax issues and good business practices as guiding principles. Keep your personal finances segregated from business finances, and avoid any temptation to cross the line that divides them. A separate checking account for the business is a must. All business income and expenditures should ultimately move through this account, allowing the checking account record to serve as the ultimate back-up to any manual or software-based ledger system. Like so many other fundamentals, this sounds obvious in theory, but is difficult to completely enforce on a day-to-day basis.

As an example, let's say that in a hurry you purchase $4 of hardware for a client project. You pay cash and get a receipt because it's convenient. Do you remember to pay that petty cash out of the business account and record the details of what the materials were used for?

The same thing holds true for a business credit card, which Scheiman suggests using as sparingly as possible. The problem with credit cards is that their ease of use allows budgets and fiscal reality to get tossed out the window in the heat of the moment. Further complicating things is that a credit card statement and a pile of receipts are no substitute for good records of how and for what purpose the materials or services purchased were ultimately used. Naturally, the card balances must always be paid with a company check.

On the road

Vehicle use is another area demanding close attention. If we choose to use our personal vehicle jointly for work, we need to keep a logbook recording business mileage on a daily basis. These records will be required in any IRS audit that might befall us. If we have a separate company vehicle that is used only for the business, this may simplify

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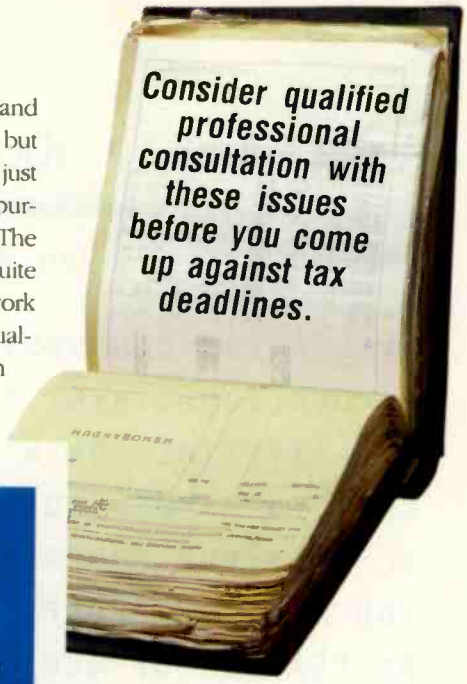
things somewhat, but does not relieve you of the burden of keeping accurate, detailed records of vehicle-associated expenses. In tax terms, the options of taking the higher of either the standard IRS per-mile deduction or actual recorded expense of vehicle operation are both open. This can get tricky when a vehicle is jointly used, so don't run any red lights on the road or on the books.

Capital expenses, depreciation and office space can be thorny issues, but the IRS will allow you to deduct just under $20,000 annually for the purchase of equipment and tools. The office deduction issues can get quite complicated, especially if you work out of the home. Again, consider qualified professional consultation with these issues before you come up against tax deadlines.



Likewise, income must be carefully recorded and managed. When you receive any funds from a client, sell parts, or even old equipment, keep records of all invoices or bills of sale along with contact information for the client or purchaser.

Record format

Scheiman offers the following observation about the business software packages that are quite popular in the trade. While they give a nice, professional look and great convenience to the bookkeeping chores, they may also lull the user into a false sense of security. Even the best software cannot reach beyond cyberspace in gathering the facts and information essential to the success and legal health of a small business. The adage "garbage in/garbage out" applies doubly here.

Bookkeeping basics are the same as they have been for centuries: Keep thorough records, seek good counsel and treat your books with the care and attention they deserve.

If you are a contract engineer and would like to provide input to Mark for upcoming Contract Engineering columns, contact him directly at mkrieger@drfast.net.

Mark Krieger, BE Radio's consultant on contract engineering, is based in Cleveland.

Contract Engineering in March:
Business 101 for Engineers

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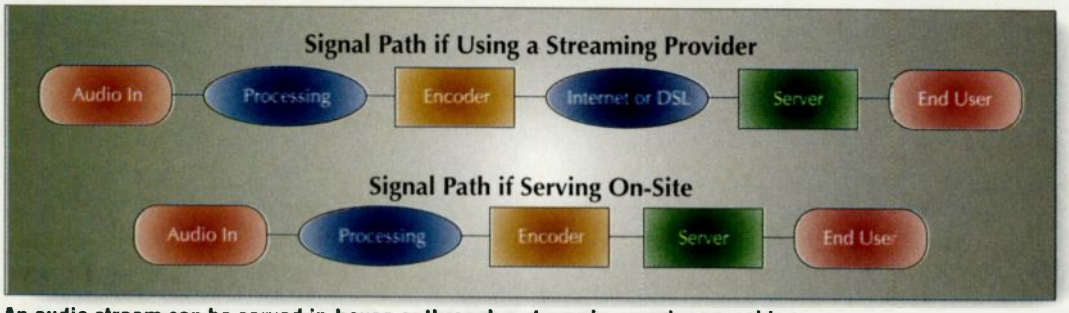
How to stream

By Chuck Leavens

As the Internet continues to play a larger and larger role in our lives, the role of the radio station must change to suit the times. With the introduction of audio streaming, listeners can access stations around the world. For a minimal investment, we can grab those listeners. Radio can take advantage of this new medium with two types of streams: static and live.

Static streaming takes a pre-recorded sound file and delivers it on demand. The file is recorded, then encoded and archived on the server hard drive. Good examples are demos, feature length programs or archived programs. This type of streaming does not require the use of a dedicated audio stream server. It can be streamed right off of your Web server to the client player. Some players begin playing the file before it is done downloading (quickstart), which is helpful for large sound files. Static streaming is supported by a variety of common audio file formats including .WAV, RealAudio, Quicktime, .WMP and .MP3.



An audio stream can be served in-house or through a streaming services provider.

Live streaming is a continuous audio feed that is always being encoded and delivered. The transmission side of a live streaming setup requires two main pieces of equipment: the encoder, which converts the audio signal to the delivery format, and the server, which accepts the single stream from the encoder and distributes it to the end user's client software.

Choosing a system

There are a growing number of streaming systems competing for dominance in the marketplace. Choose a system that compliments your audio and has players for every possible combination of hardware. Any system you choose will sound good at high bandwidth, but the trick is to choose a system that sounds good for low-speed users. It may pay to optimize your audio stream to the lowest common denominator.

Once a system has been chosen, decide how your stream will get onto the Net. There are a variety of ways in which to stream live audio.

1) Encode the audio at your facility and send the output of the encoder to a streaming provider. This is usually done with an encoding computer at your facility and a fixed Net connection — either a DSL or fractional T-1 to the provider. If you send your stream to a provider via DSL, remember that Net congestion and outages can affect streaming to all of your users. Some streaming providers insert advertising or picture clips in the player before the audio plays. Read your agreement carefully to be sure any ad insertions are appropriate for your station.

2) Encode the audio at your facility and send the output of the encoder to an in-house server. This requires at least a full T-1 access to the Internet. *Top level access*, providers that give direct access to the Internet backbone, is available through carriers such as UUnet, Verio, Digex, AT&T CERFnet and Exodus.

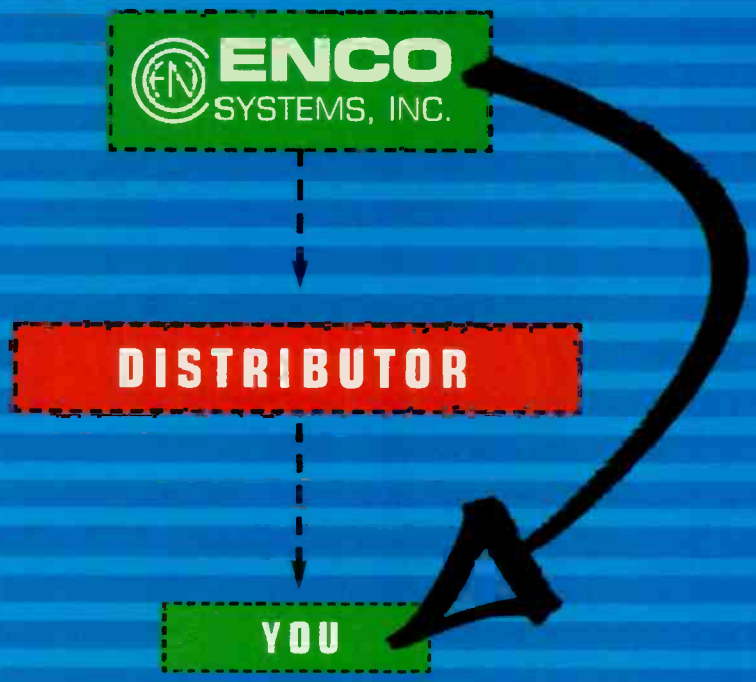
3) The third choice is to send your audio to a facility or ISP and have them handle the whole thing. This was the most common way to stream in the beginning. In many cases, a tuner was placed at the ISP and streamed directly to the Net. This method is the simplest, but a tuner feed of your air signal is usually a disaster unless you have a classical station with little to no processing on-air. Limiter by-products that are of little consequence to the air signal wreak havoc with the encoder. The extra harmonics and information cause distortion and noise in the decoded audio stream.

Nuts and bolts

Let's go through an on-site streaming system with Apple's Quicktime, and RealNetworks' Real Audio 5.0 and G2. These are the three systems we serve at WDUQ.

Prepare the audio with proper processing and equalization. Processing for the Net is different than processing for on air. Avoid traditional air-chain limiting and processing because heavy limiting does not work well with the encoder algorithm. Equalization ahead of the AGC is important, not to change frequency response, but rather to remove the frequencies that the encoder cannot pass. By placing the EQ ahead of the AGC, the AGC will not react to the frequencies that will not be heard anyway.

Eliminate the Middle Man.



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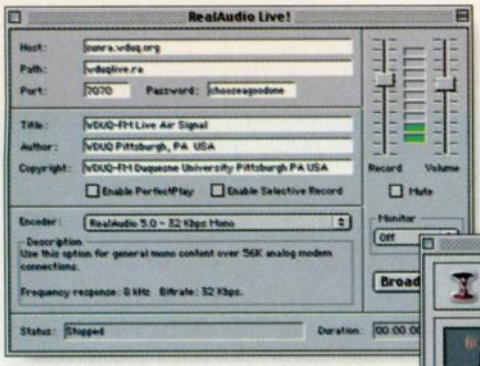
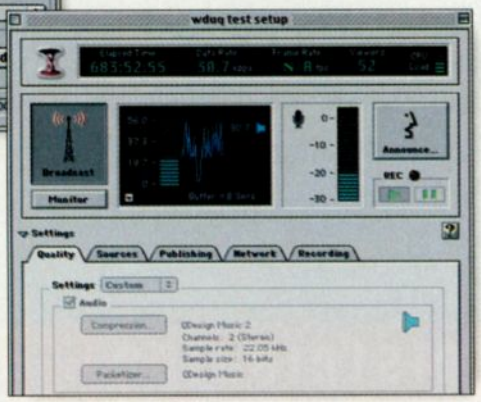
E Casting

Listen on the player that your listeners will most commonly use. Adjust the processing while listening to a decoded signal. You want to hear the effects of the algorithm path. Hear what the user hears, just like adjusting air chain processing while listening carefully off air. There can be a considerable delay between the encoder input and audio decoder output, so take your time with adjustments. Many new processors are designed just for Internet encoding and have the settings and processing power needed for clean streaming.



The RealAudio encoder screen shows the current settings.



The Sorenson Broadcaster used with the Q Design PRO codec at WDUQ.

Setting up an encoder

PCs and Macs work well as encoders. PCs should have a fast, modern CPU (Pentium class and at least 128MB RAM), a good sound card and *network interface card* (NIC). Older PowerPC Macs work well (128MB RAM and 100MHz PowerPC minimum). We encode on leftover Macintosh 8100s. Since Macs have very good on-board audio, a separate sound card is not needed. We use RealProducer software for our RealAudio streams and Sorenson Broadcaster with a Q Design PRO codec for our Quicktime streams.

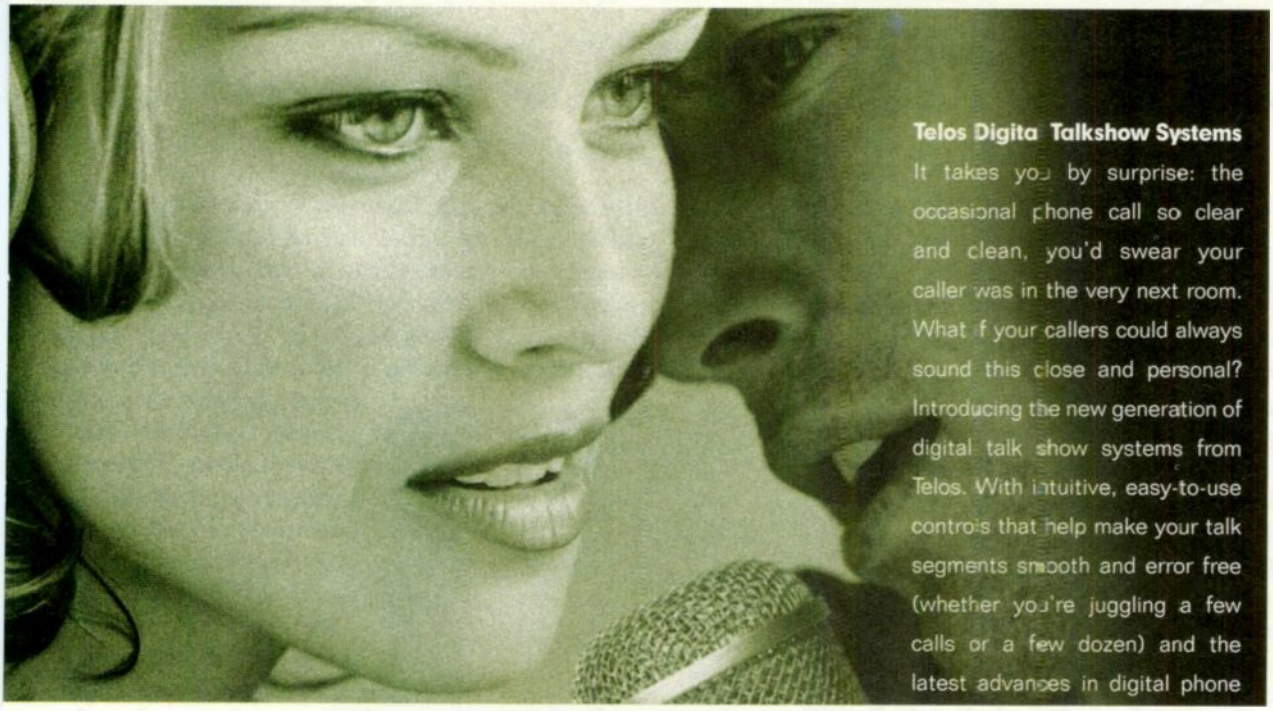
The bit-rate speed is set at the encoder. Setting the speed too high will prevent modem users from receiving your stream. Setting it too low degrades audio quality. While cable modems and DSL are becoming more popular, a typical radio station will serve most of its users by POTS modem. Most of these users are still connecting at 28.8- to 33kb/s despite the availability of 56k modems. Some encoders, such as RealAudio's G2, are able to provide both higher speeds to users who can handle it and lower speeds to modem users. This is a great advance for streaming and really helps give you better choices.

Setting up the server

You have a choice of several server platforms. We chose UNIX because it is a mature, reliable and well-established operating system. I obtained a refurbished Sun Microsystems workstation for $50 and went to work. I was amazed to see how the older, smaller and slower 50MHz UNIX machine could handle the Real 5 server without being overtaxed. We later upgraded to a larger multiple processor, a Sun SparcServer1000E. We also added the Quicktime server and Realaudio G2. One workstation runs all three by setting the input and output control to different ports for each service.

I recommend downloading the free versions of the server software to determine your needs and get a sense of how many users you will have. RealNetworks offers a free 25-user G2 server, and Apple offers a free 1,000-user Quicktime server. Buying a streaming server license based on concurrent users may not be wise because it may be overkill. It does not take much traffic to saturate a T-1.

Chuck Leavens is director of engineering of WDUQ-FM, Duquesne University, Pittsburgh.



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Parasitic radiators

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

In the October 2000 issue of BE Radio, this column discussed parasitics and touched on several aspects of parasitic reradiation that are of concern to radio engineers. I mentioned reradiation from power line towers, undesired parasitic reradiation from towers that were part of an array and briefly discussed desired reradiation from parasitic towers. This month, I will look at the theory of controlled parasitic reradiators and possible directional arrays using parasitic elements.

When a vertical conductor is placed in an RF field, a current will be developed in it. The magnitude depends on the length of the conductor. As the conductor length approaches the resonant length, the induced current increases. Because there is current flow, a voltage will be induced and small I^2R losses will occur, which can cause heating in some cases. The remainder of the induced power is reradiated at a different phase from the original signal from the driven tower.

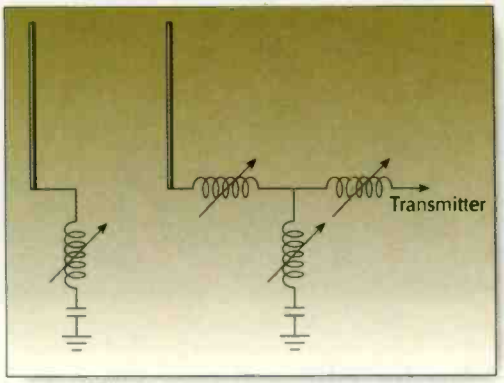

Figure 1. A typical two-tower array with an insulated parasitic radiator.

We already know the unfortunate, and sometimes unexpected, effects produced by cell and similar towers on operating directional antenna systems. However, we can turn this reradiation effect to our own use in some limited cases.

A simple parasitic array

The difference between a driven and a parasitic tower is that there is no connection between the transmitter and the antenna, and the only power that it radiates is that which is induced in it by the surrounding RF field. But if no critical constraints are placed on the system, and it is properly designed and adjusted, there appears to be no reason why such an array should not be used for limited purposes. If a simple pattern resembling a figure eight or a broad suppressed radiation direction is required, it is possible that a parasitic radiator will meet the coverage requirements. Unfortunately, no one has a licensed parasitic array in use in the US at this time.

When a single vertical radiator is fed with RF, it normally radiates more or less uniformly in a circular pattern, unless there is a reradiating conductor in its field. In the driven directional-antenna system one or more *driven* radiators combine vectors to produce the desired pattern.

In some instances, the driven element is used to *draw* power from the array and reinsert it into the total radiated power. These negative towers exhibit a negative resistance when measured in an operating array. But they exhibit normal positive resistance characteristics when measured as individual nonenergized towers.

In this discussion, we'll assume the use of a 90 degree base insulated tower because it simplifies calculations. If a similar, but grounded tower is placed about a quarter wavelength away in any direction, a radiation increase in that direction will occur. There will also be a decrease in radiation in various other directions. The pattern shape produced depends on several factors. With a grounded tower located as described above, patterns similar to those in Figure 2 will be produced.

If the shape requirements of the area to be covered are not too complicated, it is possible to produce a usable pattern to cover a desired area. Very deep nulls cannot be obtained, and the range of possible patterns is quite restricted. Nevertheless, for international broadcasting organizations operating in countries that do not have the high broadcast engineering standards imposed by the FCC, parasitic arrays could be very acceptable.

A typical installation can be derived by locating the parasitic tower on the side of the driven tower towards the desired covered area and properly matching the

DRIVEN VERSUS PARASITIC ARRAY CHARACTERISTICS

FEATURE	Parasitic Array	Driven Array
COST	One ATU and one transmission line; No phasor; could use one grounded tower.	Phasor required, two or more ATUs required and more equipment required, also two base insulated towers.
SYSTEM	Very little adjustment	Wide phasor control of phase and ratios
PATTERN	Few patterns, broad lobes and poorly formed nulls	Many patterns

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driven tower base impedance to the transmission line with a TEE or L network. Figure 2 shows the ground layout of such a station.

Such an antenna system would be quite economical. No expensive phasor is required, nor is a coaxial RF drive transmission line to the second tower, and maintenance requirements on ATU equipment are reduced.

In actual construction a few specific changes should be made. For instance, an insulated base tower slightly shorter than 90° would normally be used. In such an array design, limited pattern adjustment is easier if the height of the grounded parasitic tower, somewhere around 85 degrees, has approximately zero reactance at the carrier frequency. It should be noted that, although the parasitic tower is said to be ungrounded, it is actually grounded through a phasing reactor.

A simple tuned circuit at the base of the parasitic tower makes limited pattern adjustment easier and smoother. When the base operating impedance of the driven tower is determined, the pattern can be adjusted and simple pattern shape adjustments made.

Once the tower characteristics are known, the pattern can be calculated using vector addition and, within certain limits, can be adjusted as desired. It simplifies calculations if a driven tower base current of 1 amp is used with zero phase angle, and parasitic tower current will depend on self impedance and distance from the driver tower. Great care is required when planning and constructing a parasitic array because when an array is built it sometimes differs a little from the original theoretical plan. If a major mistake is made in construction or design, there is not much leeway for adjustment with a parasitic array.

Directional antenna systems

Most engineers have become accustomed to seeing phasors in directional antenna systems. An operating two tower array can be built without a phasor using only the phase differences produced by the varying transmission line lengths. I recall one such system operating at 1.4MW using the different line lengths and a tap down the transmitter output to obtain a simple semi-cardioid pattern. The administration operating the system did not require a proof such as the one required by the FCC. Sufficient field strength measurements at specified locations to prove coverage were all that was required to satisfy the client. Skywave radiation was not considered.

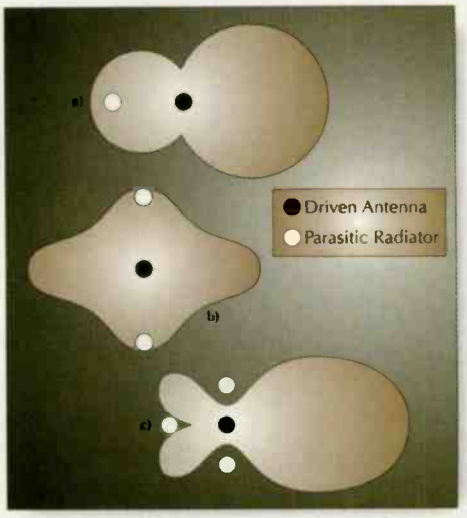

Figure 2. Possible parasitic patterns. a) Quarter-wave spaced single parasitic. b) Two parasitic radiators quarter-wave spaced from antenna. c) Three parasitic radiators quarter-wave spaced from driven antenna

It becomes immediately apparent that there was no means of adjusting the pattern as operating values changed. But the original specification did not require any tight pattern control. However, it was blown up before such matters required attention.

The technique of controlling unwanted reradiation within antenna fields draws quite heavily upon parasitic radiator and coaxial line theory. A future column will deal with detuning parasitic radiators, and it will be seen that the electrical characteristics of open and shorted coaxial lines play a large part in such operations.

E-mail John at: batcom@bright.net.

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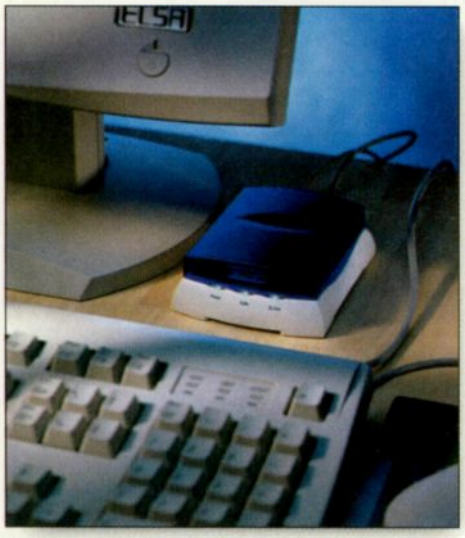
About wireless WANs

By Kevin McNamara, CNE

Wireless LANs have been around for a few years, but a lack of standards required that only components from the same manufacturer could be used. Today, we have two standards, *Wi-Fi* and *Home RF*; a third standard, *Bluetooth*, is expected to hit the market in early 2002. In order to understand this technology better, let's discuss the fundamentals behind it.

In 1997, a standard, known as IEEE 802.11, for wireless LANs (WLANs) that defined both the physical and the IEEE-approved Media Access Control (MAC) layer (part of the Data-Link Layer) was approved. This was recently updated to 802.11b.



Wireless LANs provide network connectivity without wires.

802.11b Basic Theory

The Data-Link layer, comprised of the MAC and Logical Link Control (LLC) sub-layers, is responsible for packaging data for transmission and error checking. The LLC ensures the integrity of the data sent, while the MAC layer monitors and controls how the data accesses the transmission medium.

In a traditional wired-Ethernet environment, data packets from each attached device are randomly transmitted and, in the event two devices transmit simultaneously, the devices will wait and retransmit until successful. In this scheme, the devices detect the collision and provide a means to get the data across reliably. This protocol is called *Carrier Sense Multiple Access with Collision Detection* or CSMA/CD. In a wireless environment, the process would get a little more difficult, since we're dealing with a radio system, and it would be impractical for all radios in a network to be transmitting at the same time. The creators of the standard felt the price of the radios would be too high if all the radios worked on different frequencies in full-duplex mode. In addition, there could be some physical limitations to the amount of nodes a wireless network can handle in a point-to-multipoint network.

The 802.11b standard pertains to radios operating in half-duplex mode (the radio is either transmitting or receiving.) The transmission protocol used is called CSMA/CA; the CA in this case stands for *Collision Avoidance*. 802.11b uses this protocol to create a wireless network that can transport data between other wireless and wired devices on a network. Here is how it works: a wireless station (device) intending to transmit sends a Request to Send (RTS) data packet over the network during a quiet time on the network. The RTS consists of a data packet containing source and destination addresses and length of transmission. The destination device responds with a Clear to Send (CTS), informing the originating station that it exists and is ready to receive data. Other stations listening on the network set a Network Allocation Vector (NAV) that tells them to remain quiet until the transmission is complete. This is also called Virtual-Carrier Sensing.

The radio systems

Another point to consider with the implementation of WLANs is the need to make sure the data is transmitted and received reliably under such conditions as weak signals, noise and interference. Perhaps of even greater concern is the ability of a potential hacker to read network traffic without being physically attached to a cable. The simple and economical solution is to use the spread spectrum modulation scheme developed by actress Hedy Lamarr. This solution has provided secure communication for government and military applications since World War II. There are two specific types of spread-spectrum methods defined by the IEEE: *Direct Sequence* (DSSS) and *Frequency Hopping* (FHSS). DSSS spreads a signal over a range of frequencies using a signal rate of 1 or 2Mb/s. FHSS breaks the signal into smaller (shorter) packets and sends each burst sequentially over different frequencies. FHSS tends to be more spectrum efficient, although DSSS systems are superior with weak signals and have more noise immunity than FHSS. It should be mentioned that the 802.11b standard also supports optical media, such as the infrared port. These systems typically operate on the unlicensed 2.4 to 2.48GHz Industrial Medical Scientific (ISM) band, although future systems will operate in the 5GHz band.

Configuration

Simple WLANs consist of an *Access Point* (AP) and a wireless NIC (client adapter.) The access point has three primary functions: 1) Communicates with other wireless devices. 2) Manages the wireless communications process 3) Acts as a router, routing data to the wireless network from the wired network and vice versa.

Since access points are, in most cases, limited to only a few

Access points are typically limited in useful range. Several APs may be needed in large areas.

hundred feet of useful range, it is customary to install several APs in large areas designed to serve wireless clients. Most access points contain an internal antenna; however, many provide for an external antenna.

The Virtual carrier Sensing mentioned above is part of a mechanism called the Basic Service Set (BSS). Among other functions, the BSS allows wireless clients to roam between different access points without interruption to service. The feature can also be configured to limit access for certain clients to specific APs, i.e. the number of physical locations or the number of users on a given AP. This is implemented by permitting a unique ID to be programmed into each wireless NIC, similar to the ESN number used in your mobile phone. Some manufacturers provide access points that can be used with high-gain external antennas that claim useable distances of several miles.

Most currently available WLANs operate with a signal rate of approximately 11Mb/s. This shouldn't be confused with actual data throughput. Similar to that of wired Ethernet, the actual data throughput of these devices is an area of debate in many circles. Manufacturers claim data rates in excess of 6Mb/s; my experience is that the speed of wireless systems tend to operate slightly slower than a properly configured 10baseT network (1.5Mb/s). The reason that it operates slower is due to the additional payload added to the transmitted frames containing the CSMA/CA protocol data, and the delay of the signal due to free-space RF characteristics and multipath. Keep in mind that performance will decrease as the number of users and amount of traffic increases.

One of the problems with comparing the speed of an Ethernet network to that of a dedicated bandwidth transmission method, such as a T1, is that the Ethernet network can only be measured by an average over time, since the data passing through it is sent in bursts. Depending on the type of data passed, that average could vary greatly. Some manufacturers also use aggressive data compression techniques, which yield up to a 3-to-1 data transfer boost. The problem is that most data is already stored in a compressed format, thus nullifying any advantage of further compression.

Next month we'll look closer at the standards and some applications.

Kevin McNamara, BE Radio's consultant on computer technology, is president of Applied Wireless Inc., New Market, MD.

All of the Networks articles have been approved by the SBE Certification Committee as suitable study material that may assist your preparation for the SBE Certified Broadcast Networking Technologist exam. Contact the SBE at (317) 253-1640 or go to www.sbe.org for more information on SBE Certification.

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Frequently asked auction questions

By Harry Martin

The FCC has begun the process of awarding 359 FM radio station licenses at open auction. Here is a list of frequently-asked questions, and their answers, about the upcoming FM auction:

When and how long is the auction? The auction will begin on February 21, 2001. The length of the auction is dependent upon how much participants are willing to bid. The longest FCC auction lasted more than four months and comprised 276 rounds of bidding.

How is the auction conducted? Participants log into the FCC's dedicated electronic auction system to place bids, review opponents' bids and receive FCC notifications.

How do I become qualified to bid in an auction? To participate in the FM auction, an electronic short form application (Form 175) must be filed in January and a refundable upfront payment (earnest money) must be wired to the FCC.

What is in the application to participate? Form 175 requires general name and address information and detailed ownership and affiliate information. The application provides the opportunity for a bidder to designate what construction permits are targeted and provides the opportunity to request a new entrant bidding credit.

What is a new entrant credit? Bidders who have no attributable interests in mass communications will receive a 35% discount and entrants with no more than three mass media facilities, provided they are outside the area of the proposed station, will receive a 25% discount. The bidding credit is applied at the end of the auction. There are no special bidding credits for minorities.

Must a bidder have engineering completed? While the FCC requires a bidder to certify that it is technically qualified, no further engineering is requested in Form 175. However, the FCC will not refund a bidder's money if the bidder later discovers that zoning of FAA problems have a negative impact on the allocation won.

Once qualified, in what markets may I bid? Bidders will be permitted to bid based upon the amount of bidding eligibility they have purchased. The purchase of bidding eligibility is achieved through the upfront payment and is fully refundable if no penalties are assessed and no licenses are won. Each market will have a bidding unit value that will remain unchanged throughout the auction.

What is the correct amount of eligibility to purchase? The amount of upfront payment is a matter of discretion. For example, assume only three markets exist, Market A worth 3 bidding credits, Market B worth 2 credits and Market C worth 1 credit. To participate in all three markets, a bidder would (1) have to designate all three markets on the Form 175 application and (2) have to deposit an upfront payment of $6. However, if a bidder knew that it could only afford Market A alone or a Markets B/C combination, it could opt to deposit only $3 (A=3 or, alternatively, B+C = 3). Using the latter scenario ultimately denies the bidder the opportunity to bid on all three markets simultaneously.

How will the FCC auction all 359 licenses? The FCC is using a simultaneous multiple round format for the auction. As such, and to follow the example of the previous question, Round 1 would require bids on Markets A, B & C during the same designated time period. If a bidder had only purchased limited eligibility, it would be limited to markets for which it had adequate bidding credit. Again, in the example, with only a $3 credit, a bidder would be limited to bidding on A or a B/C combination. In a subsequent round, should a bidder be knocked out of A, it will still have the eligibility (3 units) to operate in the B/C market (2 + 1).

Will a bidder know who its competitors will be? After all bidders file Form 175, the FCC will release a list of all bidders and the markets they have designated.

May a bidder contact a competitor and settle? On the date of Form 175, anti-collusion rules apply. The anti-collusion rules prohibit competing bidders from contacting one another, and the FCC has been strict in enforcing this rule, issuing sizable penalties for violations. A winner found violating the rule will be disqualified from obtaining a construction permit and will lose at least the bid deposit.

How does a winning bidder obtain the license? At the close of the auction, a winning bidder will have to submit a full FCC Form 301. Once the application has been reviewed and deemed grantable, the remainder of the winning bid must be paid, at which point the construction permit will be issued.

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

Dateline

Unless the new EEO rules are invalidated by the D.C. Circuit Court of Appeals, stations in the following states will be required to place their Annual EEO Public File Reports in their public files and on their websites on or before February 1, 2000: Arkansas, Kansas, Louisiana, Mississippi, Nebraska, New Jersey, New York and Oklahoma. Biennial ownership reports will be due for the same states, also on February 1.

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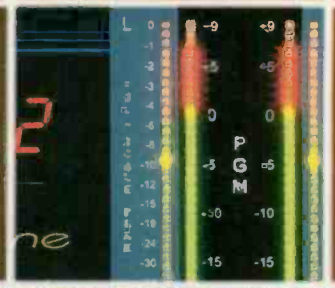
PLANNING THE

Studio photo by John Farrell,
courtesy of Meridian Design Associates.

The move to a digital facility involves a mix of traditional ideas and innovative methods.



DIGITAL FACILITY

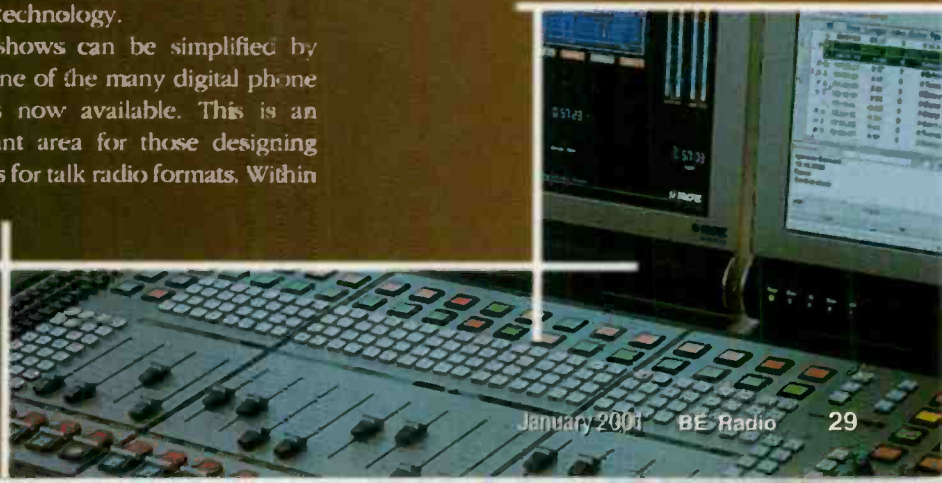
By Ron Bartlebaugh

Throw out the patch bays, and cut all the copper wire! Now may not be time for that—or is it? The days of planning a facility based around a lot of copper wire, punch blocks, patch bays, and intense labor may be over for many engineers. Planning a facility using the latest digital advances provides many advantages. The use of CAT5 or fiber cable with digital audio and control signals meets the requirements for flexibility and functionality in today's progressive broadcast facilities. The use of LAN and WAN network technologies are the logical choice for operators who need to share audio and data among multiple stations in various markets. Using digital technology within the facility environment can dramatically improve efficiency of production. Stations can now effectively and efficiently operate in a live, live-assist, or automated mode as well as integrate the tasks of scheduling, billing, news capture, and audio delivery using digital technology.

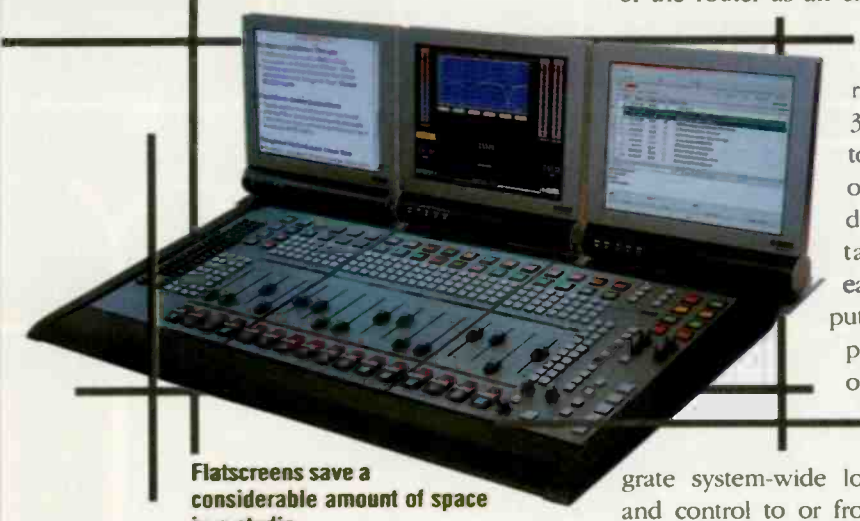
Talk shows can be simplified by using one of the many digital phone systems now available. This is an important area for those designing facilities for talk radio formats. Within some systems, 12 callers or more can be routed to two digital hybrids. High-quality audio can now be transmitted over a normal POTS line by using digital codecs.

The use of digital technology for voice tracking can save time and money. A typical four hour show can usually be voice tracked within 30 to 60 minutes. Digital technology can provide seamless integration with traffic and music systems as well as news capturing and text management for talent. Digital automation systems effectively and efficiently provide programming to many audiences throughout the country. WAN-casting enables you to transfer large amounts of digital data over a wide area. Digital systems can provide enhanced system security via the issuance of multi-level user passwords. User interfaces are becoming increasingly friendly.

Digital combines the best features



and technology into a facility. The digital technology has become a rapidly emerging science that is in the process of evolving broadcast industry requirements. With so many possibilities, new facility plans can begin in a very different way.



Flatscreens save a considerable amount of space in a studio.

A new approach

Every facility designer must seek an easy and orderly transition to digital with the goal of implementing proven solutions for audio and data delivery to satellite links, multiple transmitters, multiple stream webcasting, and other destinations. The selection of network architecture, hardware, and application software is critical to the success of any broadcast facility. Digital technology provides for a new perspective on networking audio for broadcast and a new design paradigm for the facilities planner.

A few popular digital audio mixing console (control surface) manufacturers, either on their own or in cooperation with a router manufacturer, offer facility-wide audio, logic, and associated programming routing functions via control integrated into the console or adjacent PC. It is now possible to connect any source, regardless of location and audio type, to any console input via router controls integrated into the console, thus eliminating the need for analog patchbays and digital audio distribution amplifiers.

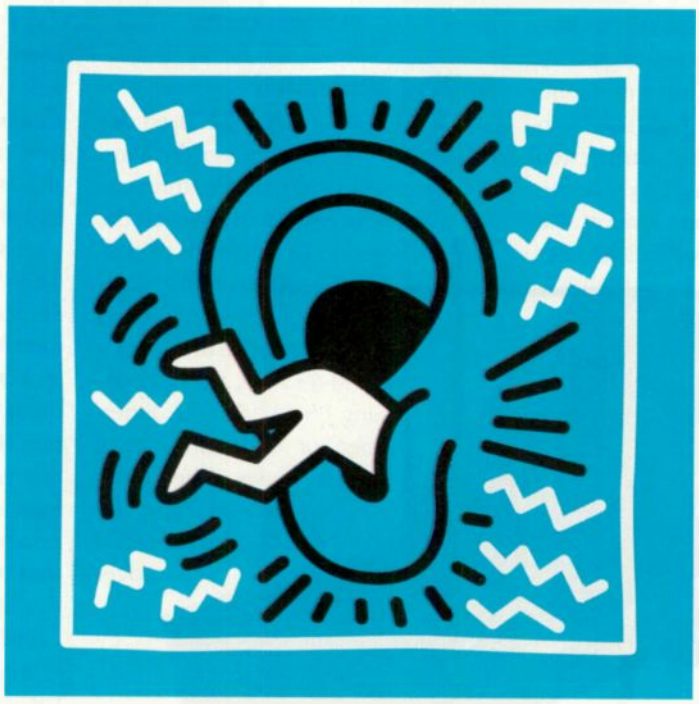
The router provides a central point for all input and output wiring. Think of the router as an electronic patch bay with capabilities ranging from 32in/32out up to 256in/256out or more. An LCD display contained within each console input module displays the source of choice. Some manufacturers integrate system-wide logic command and control to or from any device connected anywhere in the system in a logic follow source/destination configuration within their router control. GPI units, in some cases, can be located anywhere within the facility, and a common GPI unit can be shared by multiple channels. Individual channel settings for all audio settings and logic commands can be saved and recalled in an instant, including mix-minus set ups.

As an added bonus to our pending digital future, program-associated data, such as that which may be used in digital radio, as well as the program-associated data used for webcasting, can also follow the router assignments in some consoles. Routing functions may be automated via logic command salvos or time-of-day commands.

More and more console inputs are now capable of audio format conversion, both on the inputs and outputs, thus eliminating the expense of external format converters and the artifacts caused by oversampling of audio. Other console manufacturers use a daughter board on each console input to convert from analog to digital. Look for automatic sample rate sampling and conversion in the consoles as well, which eliminates the need for somewhat expensive sample-rate converters. Some digital signal processing (DSP) console input modules are capable of dynamics control such as equalization, gating, limiting, ducking, compression, and expansion, thus eliminating the requirement for external processing units. A large number of mix-minus sends are also available on a few digital consoles.

Traditional VU meters are not as effective as PPM and peak-reading meters for digital audio. Photos courtesy of Wheatstone and Soundcraft.

STUDER



Keith Haring

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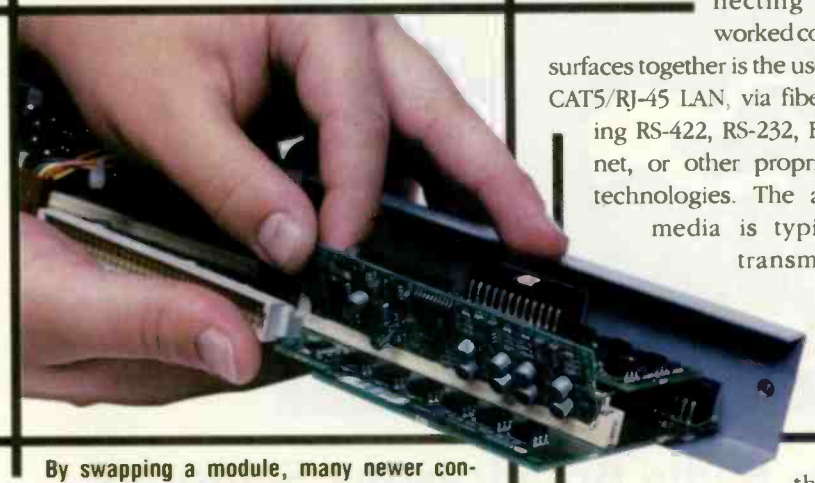
The use of flatscreen monitors is becoming more popular due to their smaller overall size. Some digital audio console manufacturers now offer flatscreen integration with their console designs. Fully redundant system power supplies, as well as a redundant digital audio sync source with selectable clock rates, should be considered standard equipment in an all-digital facility.



By swapping a module, many newer consoles can convert their input and output structures to support analog or digital signals. Photo courtesy of Harris.

Getting connected

ATM technology can be used for connectivity in some larger facilities, or between multiple facilities throughout the country. However, the most popular methods of connecting networked control surfaces together is the use of a CAT5/RJ-45 LAN, via fiber using RS-422, RS-232, Ethernet, or other proprietary technologies. The audio media is typically transmitted over the fiber channel while the control circuits are transmitted via the CAT5/RJ-45 LAN. The use of CAT5 and fiber cable eliminates the need for a lot of audio and control wire, which greatly minimizes documentation requirements. Shielding, line loss, and ground loop problems can also be eliminated when using digital technology.

Some fiber-based systems that use 62.5×125 standard fiber with ST connectors can be interconnected at distances of 10,000 feet or greater, making it an ideal transmission medium for group-owned multiple stations located within a common city. Fiber cable is also highly tolerant to heat and insensitive to electromagnetic and electrostatic fields. Further cost savings may be realized via the use of CAT5 or fiber cable because of their reduced conduit requirement, greatly reduced costs for analog termination hardware (such as audio connectors and punch blocks), and lower labor costs due to increased installation efficiency. Future rooms can easily be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added to a LAN-based system using CAT5 or fiber cable by simply installing the required number of cables from the existing system to the new room. Be sure to use AES-3 cable for all digital audio paths to and from digital sources and destinations. Be sure to test each cable, end to end, and keep the test data for future reference as needed.

A facility sync generator is a necessity for most installations unless the purchased system provides its own digital sync timing source, which some do. The proper use of the sync generator will eliminate audible pops and clicks from mixing unsynchronized digital sources. It will also eliminate timing errors from daisy chaining word clock signals through equipment, and it will lock multiple digital sources to one accurate and stable clock.

A facility sync generator is a necessity for most installations unless the purchased system provides its own digital sync timing source, which some do.

User-friendly software will ensure ease of operation in all types of broadcast environments. Back-up of all software is very important. Some digital audio equipment manufacturers now offer sophisticated software that continuously monitors their operating system and displays fault messages on the screen in the event of a malfunction. Remember, the easier the software is to use, the greater ease you will have in training station personnel on its use.

Handling digital

Digital audio meters and processors are also an area for consideration when designing an all-digital facility. The meters need to indicate digital domain metering via full-scale digital peak plus VU and/or PPM for overall best accuracy. Digital audio processors, such as those used for STL preprocessing, SCA processing, satellite uplink audio, and Internet feeds, need to have AES-3 input and outputs with, preferably, no internal conversions. An STL system with an AES input and output is also highly desirable, as is an FM exciter with an AES digital input.

Other considerations for a facility design include proper power management. UPS units of the proper size and type should be used, along with power line conditioning procedures that will assure a pure, clean, and balanced power source. Always be sure to plan for expansion of power distribution to facilitate future equipment installations. Proper ventilation and air filtration should also be a high priority in any facility, especially one with digital equipment. And, don't overlook those often forgotten areas of acoustics

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and ergonomics when designing your facility.

New design, installation, and troubleshooting paradigms are now necessary in most engineering departments for the support of high-speed networks such as those found in an all-digital facility. Redundancy, connectivity, and low-fault tolerances are all of importance within a well-designed facility. New methods of network termination and the proper use of the necessary tools need to be learned. Engi-

Manager's Perspective

TO BUILD OR NOT TO BUILD

By John Carraciolo

After the past two years of consolidation and mergers, it is time to get down to the business of running our radio stations. Let's face it, the only difference between a radio station and a sales company is that one has a room at the end of the hall that has music coming out of speakers. The radio station exists to make money.

A radio manager of the new millennium must take a hard look at the bottom line. After a banner sales year in 2000, there are extreme pressures to move forward and grow the business in the coming year. Every penny spent will be scrutinized. Every dollar earned will be used to service debt. So how can an engineer justify to a radio manager dollars to be spent on a facility build or a system upgrade?

As a former engineer now sitting on the other side of the desk, I know it is a smart business decision to upgrade broadcast equipment and stay on top with technology. However, I have a budget to make, bills to pay, and I need to pay 70 employees each week. How can I afford to spend money on this build out? The answer? I can spend the money on capital improvements, if I can find a way to make it back with savings or growth.

New digital technology gives operators the ability to automate or consolidate station-staffing requirements, helping the staff work smarter, not harder. An upgrade to digital now will save money later. When DAB rolls out, our stations will be halfway there. Improvements in older equipment bring less down time, require less spending on parts and maintenance, and reduce engineering maintenance time. All this means more time can be spent on growing the business.

Don't be penny wise and dollar foolish when it comes to new broadcast equipment, major station capital improvements or a facility move. As with any major change, you need to empower people to make decisions and evaluate the recommendations of the end users.

John Carraciolo is vice president and general manager of Jarad Broadcasting Company, Garden City, NY.

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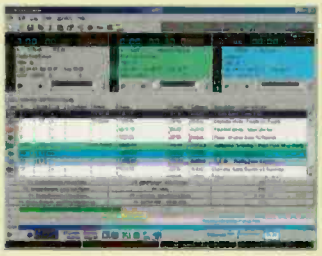

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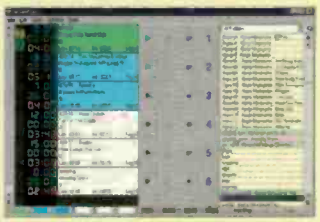

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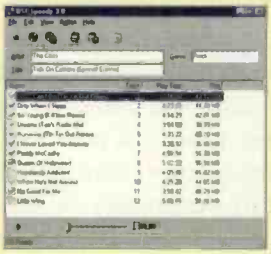

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neers need to take the time necessary to be properly trained in design, installation, and maintenance of networking technologies and equipment. Test equipment capable of high-speed measurements now has become more of a necessity rather than a luxury. Be sure to include funding for training and equipment within your project budget. A network systems integrator, in lieu of in-house support, may also become a portion of your project budget.

Digital is here to stay. Digital audio, when properly created and handled, provides a bright and resonant sound. With satellite radio and terrestrial digital radio very near, it is now time for facility designers to think outside of the box by designing a facility that will provide a digital audio media platform that includes facility-wide audio, logic, and program associated data management to and from multiple locations. The greatly increased efficiency of an all-digital networked facility will lead to savings in day-to-day operation. A quality, all-digital facility can be implemented at a cost similar to that of a high-end analog installation. For an easy-to-use and totally flexible facility capable of storing audio, integrating plant-wide control, and increasing operator productivity, digital is the answer.

Clean and reliable power should be a primary concern in any new facility. An effective UPS and power generator are just some considerations.

Ron Bartlebaugh is director of engineering for the WKSU stations, Kent, OH, and president of Audio and Broadcast Specialists, Akron, OH.

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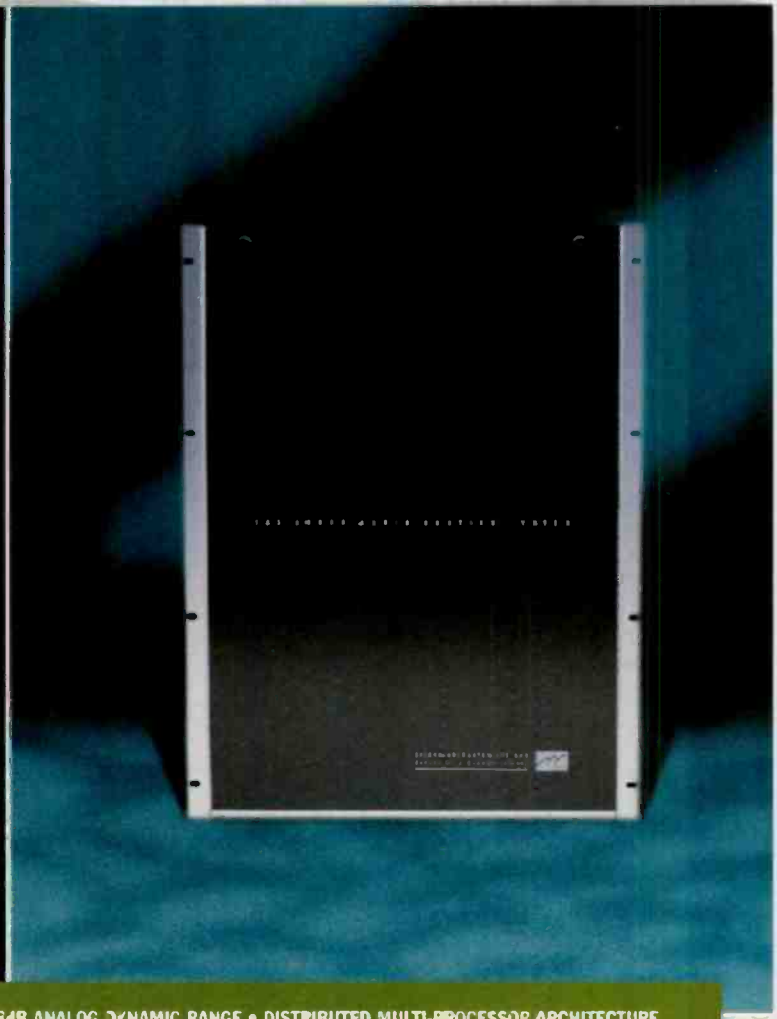

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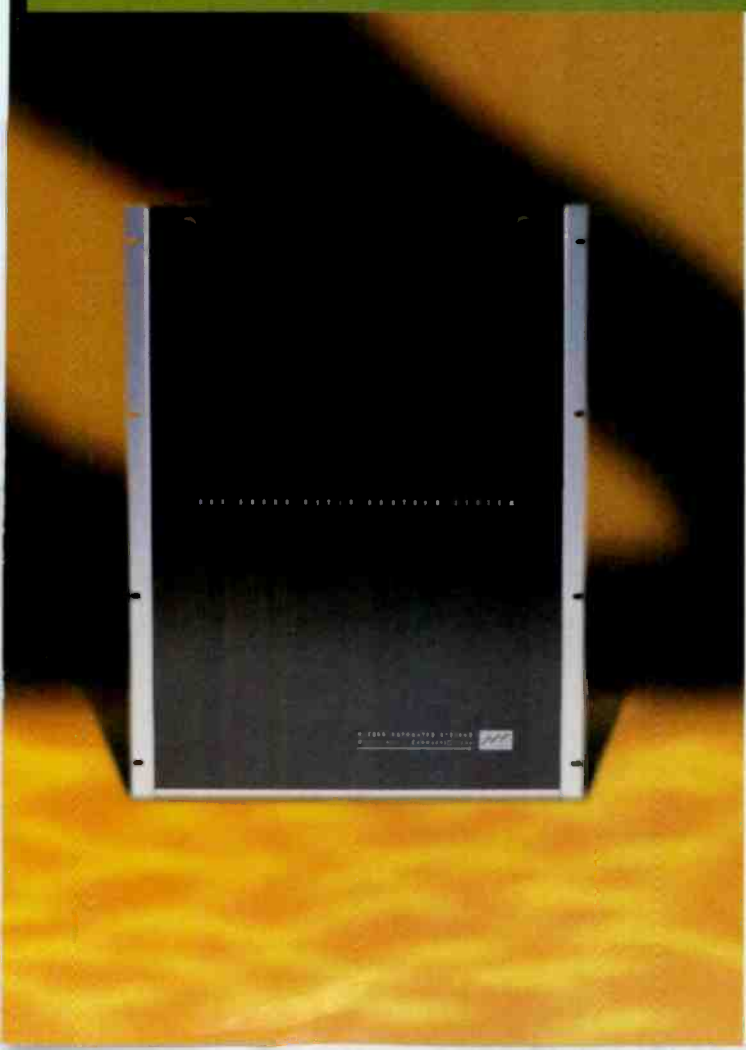

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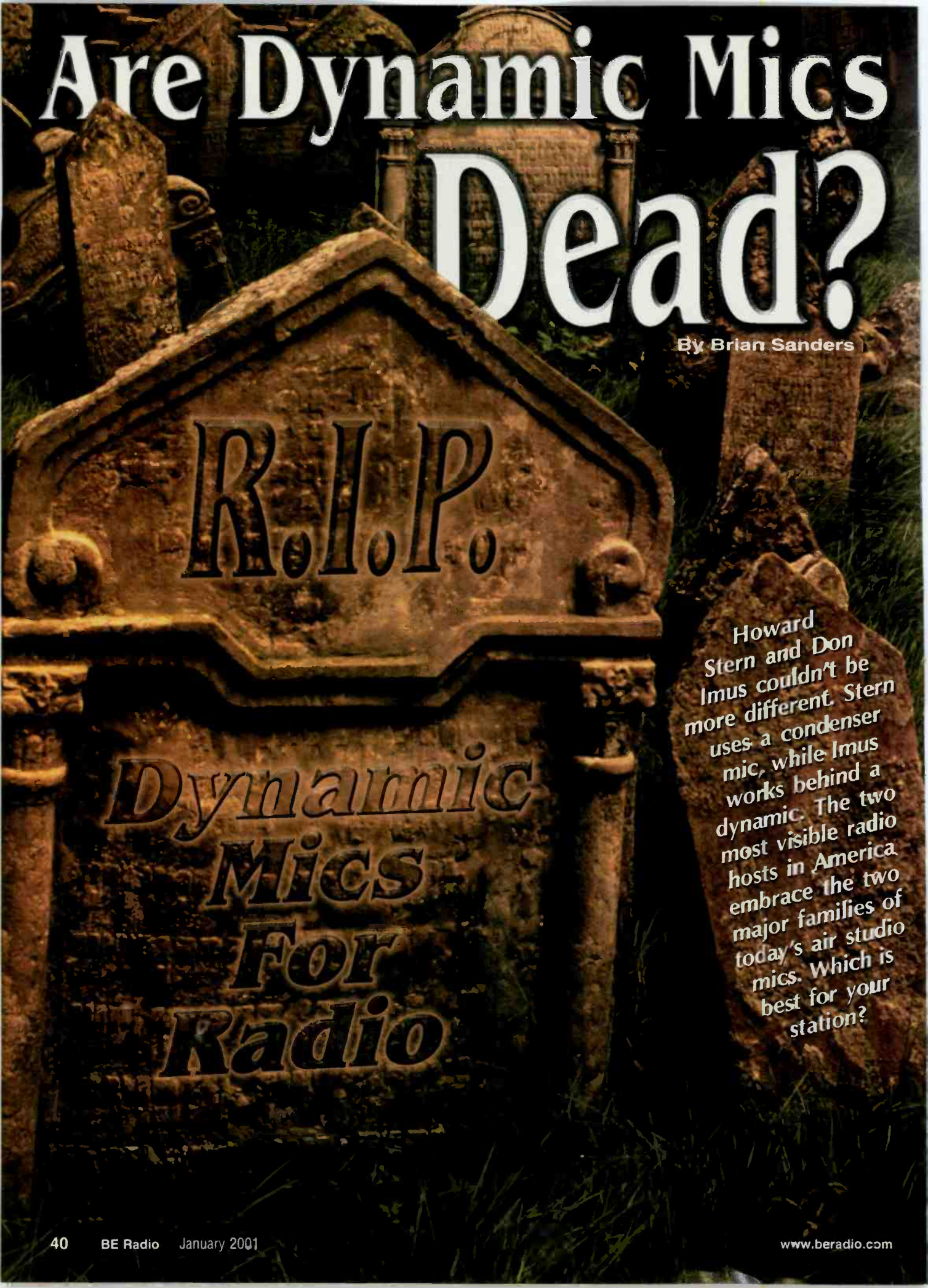
Are Dynamic Mics Dead?

By Brian Sanders



Howard Stern and Don Imus couldn't be more different. Stern uses a condenser mic, while Imus works behind a dynamic. The two most visible radio hosts in America embrace the two major families of today's air studio mics. Which is best for your station?

Condensers and dynamics weren't always the big two. Many broadcasters spoke to us over ribbon microphones, whose image has come to symbolize an era. Large, robust and flattering to voice, these mics were in wide use well into the 1960s. Condenser, moving-coil and carbon mics were also on the air to some degree, but wide-bodied ribbons such as RCA's 44, 74 and 77 were king.

Not that they were without a few problems. Although ribbons are usually described as *smooth* and *warm*, these mics typically had a rather low output level, were large, heavy and somewhat fragile, and required periodic ribbon replacement. (I should add that modern ribbons have solved these problems, although there seem to be very few ribbon mics in use on the air.)

The post-war generation of dynamic microphones also solved these problems. As a group they were less expensive, less fragile, usually more compact, and easier to make unidirectional.

Condenser microphones offered the most accurate response and widest frequency range, but they too came with unwanted baggage. They were expensive. They were fragile. Their sensitivity made them ill-suited for close-micing. They required a power source. And I will repeat: they were expensive.

It was natural that dynamics should dominate broadcasting as ribbon use faded. Dynamics gained in popularity with a surprising array of 1960s and 70s vintage types such as Shure's Unidyne (the Elvis mic), SM-5 (and later SM-7), SM-57 or EV's RE-16, many of which are still in use today.

A quick peek at studio web-cams reveals a scattering of Shure SM-7 and Sennheiser 421 types amid a forest of RE-20s and RE-27s. Today these two remain the most popular on-air mics. They're rugged, fairly inexpensive and sound great on voice. Can they remain dominant in the digital age?

Industry insiders observe that a new generation of condenser mics is poised to make a run on this industry standard. Why? Because many of the problems inherent in condensers have been solved.

Price has come down considerably. Classic models still carry a hefty price tag but many quality cost-efficent products are on the market now as well. One factor hastening the new models is improved design and manufacturing techniques available in the industry. Another is the fact that competition over market share is extreme, pitting well-known major manufacturers against young upstart companies and even companies from former Soviet-bloc nations. But the most significant reason these mics are less expensive is that they are much simpler than their older siblings. Most of the new mics, it seems, are single-pattern cardioids.

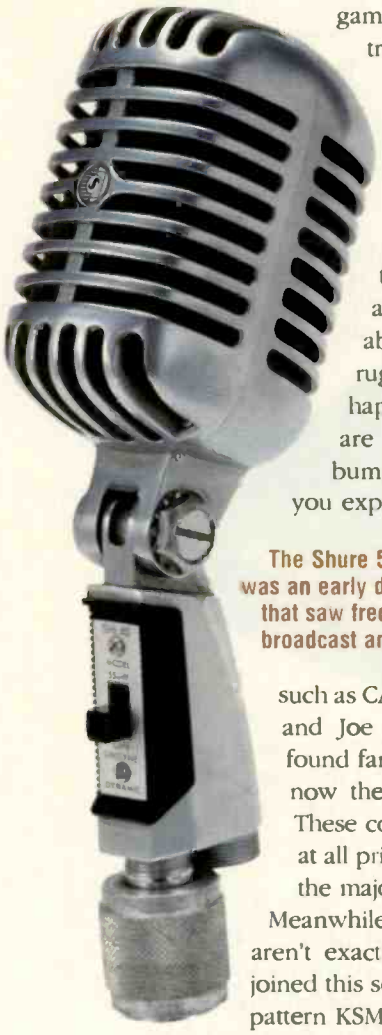
Classic ribbon mics like the RCA 74 were very popular in radio's early days. They can still be found in special uses, and many people prefer their unique sound.

Classic designs, such as the Neumann U87 and AKG C414, offer a variety of pickup patterns by employing a second diaphragm. Sound energy collected from front and back diaphragms are added or subtracted in order to achieve the desired polar pattern – omni, cardioid or figure-eight. The simple single-pattern design eliminates this second diaphragm. We're left

Are Dynamic Mics Dead?

with reduced cost at the expense of pattern flexibility. Because the vast majority of situations call for cardioids, this is typically an acceptable trade-off.

Years ago, the transistor also changed the game. In substituting solid-state electronics for vacuum tubes, these mics eliminate bulky external power supplies. The mic bodies can be made more compact too, a significant factor in a cramped control room – especially where the operator/announcer must be able to see copy, a computer monitor, an interview subject, or all of the above. Solid-state also means more rugged. In the real world, accidents happen. Some of today's microphones are designed to withstand quite a bump, although we don't recommend you explore this envelope at home.



The Shure 555 Unidyne was an early dynamic mic that saw frequent use in broadcast and on stage.

Another part of the changing face of microphones today is the emergence of smaller companies such as CAD, GT, Marshall, Rode, Soundelux and Joe Meek. Their products originally found fans in the home-studio market, and now the mics are edging into broadcast. These companies are introducing products at all price levels, going head-to-head with the major mic makers.

Meanwhile, the big names in condenser mics aren't exactly napping. Shure's KSM-32 was joined this season by the top of the line multipattern KSM 44. If there is a single condenser that has found widespread, long-term use in broadcast it is Neumann's U-87. Neumann's catalog offers some less-costly alternatives in the TLM-103 and TLM-193. (Though not large-diaphragm, Neumann's KM-180 series is also worth mentioning, as is the KMS105 – designed as handheld stage mic but with great potential for on-air.) AKG has an extensive array of voice-specific mics including the C 4500B-BC, and Audio-Technica's single-pattern AT4047/SV has attracted some interest, notably in the public broadcasting sector. Still, condensers have considerable ground to make up.

Dynamics have many advantages condensers can't touch. They're rugged; able to survive nearly anything an exuberant jock (or butter-fingered engineer) can dish up. They're simple, quiet, and don't require a power supply. And the most expensive dynamic doesn't come close to the cost of traditionally priced condensers.

The choice is yours

Picking a studio mic is often a balancing act. What do I want in the perfect mic? Sound quality is of foremost importance, but after that opinions vary. Of course, cost is right up there. If you're equipping several studios with two or three high-end mics, costs can mount fairly quickly. Opinions are more varied on the subject of uniformity. Do you insist on having identical mics at every chair? Or is this a place you can save a few dollars by having less costly mics at the secondary positions? Form follows function, and so does the bottom line. Some would point out that it is more important to have the right mic on each voice than it is to be uniform. Obviously, this is easier to achieve if your crew has sole access to a particular studio and can lock down its setup.

The uniformity issue also comes into play for guest mics. Certain microphones can be more difficult for non-professionals to address correctly; a more "forgiving" type – wider pattern or less susceptible to popping – may be called for. There may not be much to be gained by having identical mics all around the studio if guests sound poor.

In budgeting for your new mics, dynamic or condenser, don't fail to

The Neumann U87 and AKG C414B are typical mulipattern condenser mics.

and its mount. Pay close attention to its proper location. The boom should place the mic within comfortable reach of anybody: from young children to your ex-all-pro-linebacker sports guy. Proper placement should never compromise being able to see the equipment and vice versa.

Several newer companies, such as CAD, GT, Rode, Soundelux, and Marshall, make quality microphones that are finding a comfortable spot in many stations.

account for proper windscreens and shockmount suspensions. Many are type-specific to each mic and are often included in the package price. (Some also come with a nice very nice case which you'll never use for anything except maybe paper clips.) Other mics offer these accessories only as options. Be prepared to pay up to 20 percent more for such add-ons. Also, be advised that some of the suspension mounts are rather bulky. If sight-lines in your studio are already an issue, trying to work with of one of these elaborate "birdcage" shock mounts may force you to rethink your choices. Select a boom arm capable of supporting the full weight of the mic

Are Dynamic Mics Dead?

For some stations, the move to a studio condenser will be complicated by the need to deliver phantom power to the mic, as a surprising number of popular consoles are not so equipped. The simplest solution is an external phantom power supply such as those available from Radio Design Labs. A more sophisticated solution, which addresses both the phantom power problem and the sometimes dubious quality of console mic pre-amps, is to consider an all-in-one mic pre-amp. Some support two microphones and range in price from about $100 per channel to well

Established manufacturers have developed new designs that feature familiar styling with better audio specifications.

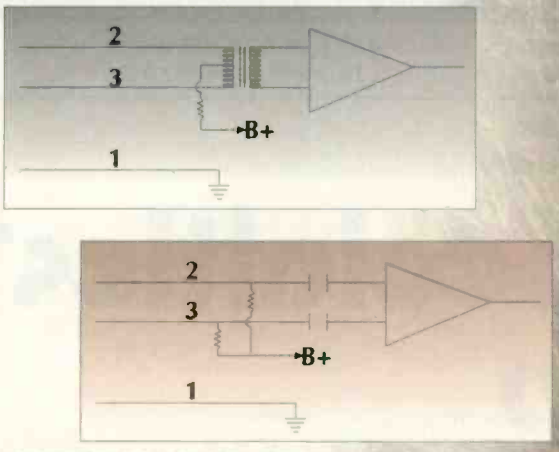
Phantom Powering

By Chriss Scherer, editor

Condenser microphones require a power source to operate. Sometimes, this power can be provided internally with a battery. More commonly, however, an external supply is used. Most consoles today have a phantom power source built in to the microphone input channel.

Phantom power, also called simplex power, is typically fed at 48VDC, but can actually range from 9V to 52V. Microphones requiring phantom power have an internal voltage regulator to accept the possible range of voltages. The name phantom power is just as it implies, being supplied apparently from nowhere. Phantom power uses the same conductors as the audio path, so no additional wiring is required.

Standard balanced low-impedance microphone wiring can support phantom power. The advantages of phantom powering are clear. Without the need for special wiring, the cost of installation or use is reduced. The power supply voltage already present within a console can be adapted for phantom use. While the phantom voltage is present, microphones that do not require it can also be used on the same inputs without any adverse effect.



Two methods of inserting phantom power onto a microphone channel input.

The figure above shows how phantom power is put onto the audio lines from the console input or mic pre-amp to feed the condensor mic. The main difference between the two methods shown is the use of a transformer input. If the console's input transformer does not have a center tap, a hybrid resistor design can be used to create one. The value of the dropping resistor will limit the current draw of the mic to 10mA or less. The power supply return is connected through the cable shield connection.

The simplicity of phantom powering is its greatest asset. The built-in foolproof design also allows non-phantom powered microphones, like dynamics and ribbons, to be used interchangeably. ■

Are Dynamic Mics Dead?

A mic pre-amp can provide phantom power to condenser mics, and can also provide dynamics control and equalization.

over $1,000 for a one-channel audiophile-quality tube rig. The most feature-rich family of external mic pre-amp designs incorporates multi-function processing (compression/expansion, de-essing, equalization, phase inverter, attenuation) with phantom power and a pre-amp for comprehensive mic control. At least one manufacturer offers a pre-amp with switchable digital AES/EBU or S/PDIF outputs.

Have condenser mics turned the broadcast market on its ear? Hardly. We're still using our old favorites because we like them and because our listeners like them. Do broadcasters have more options today than ever before? Absolutely. Are condensers coming? They're already here and their popularity will only grow.

Brian Sanders is a freelance audio consultant based in Mt. Baldy, CA.

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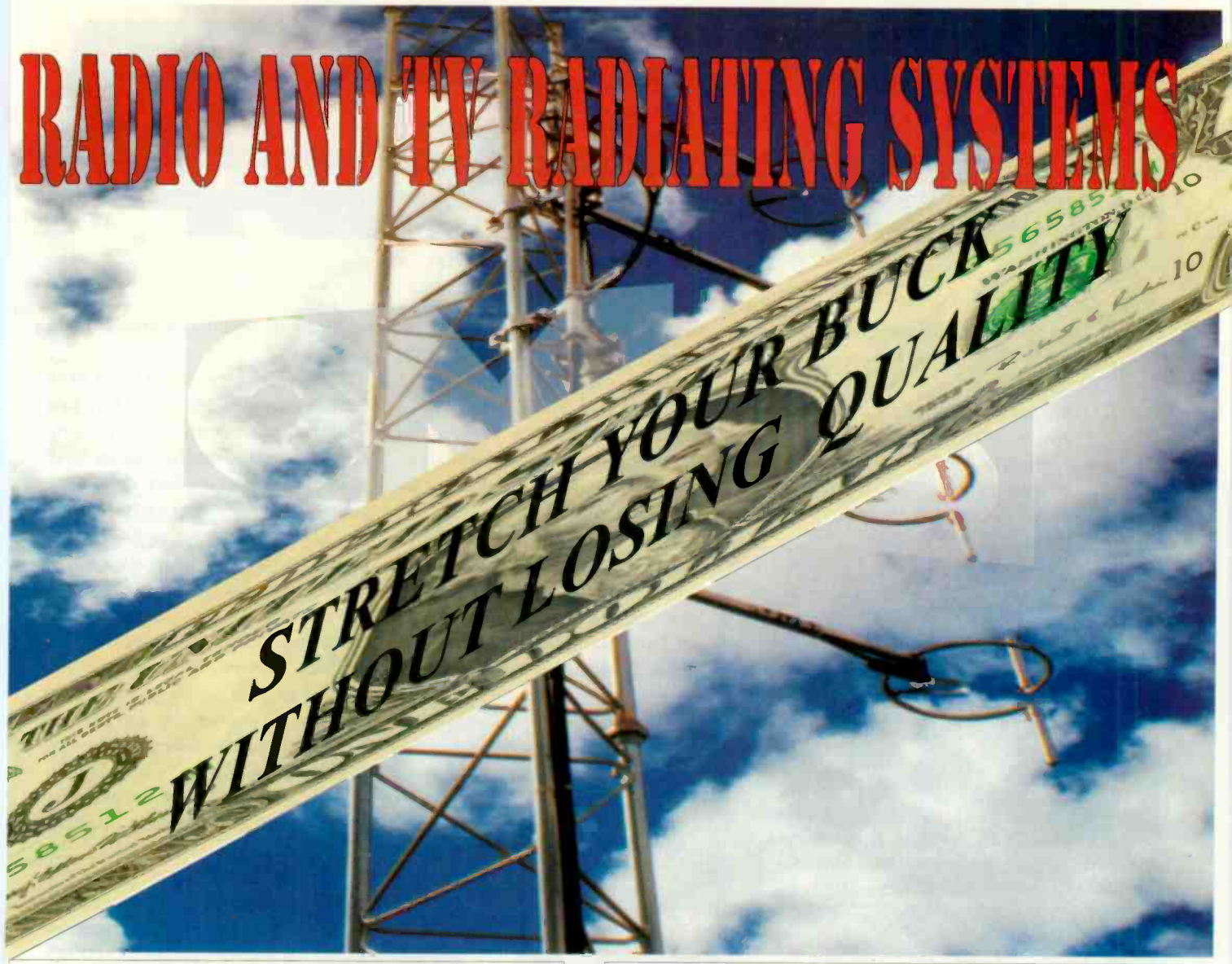

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WRAP UP

streaming media WEST 2000

DECEMBER 12-14 2000 - SAN JOSE CONVENTION CENTER, CA

By Chriss Scherer, editor

The new transmission medium for radio is the Internet. This is no surprise, as there are thousands of stations and Internet-only broadcasters online already. The Streaming Media West convention, held in San Jose last December, is a newer convention that caters specifically to the streaming media audience. While the NAB and AES conventions provide a substantial amount of Internet-related coverage from exhibitors and in the sessions, there are many other points of interest being addressed. This is not the case at Streaming Media.

Audio streaming was a major part of the Streaming Media West convention in San Jose.

The first day began with a keynote address by Steve Ballmer of Microsoft. Ballmer discussed the overall state of streaming today. The general view is that streaming is in its early stages and that subsequent advances will allow for audio (and video) delivery that rivals CD quality.

The conference included five keynote addresses and 200 speakers during the three-day event. One session on Wednesday was of particular interest to radio stations. It was titled *Internet Radio: Profitable Business Models for Online Radio.* The focus of the session was different business models to make Internet radio profitable, but it also included general ideas on how Internet radio can simply compete.

One point of discussion covered the mobility of terrestrial radio and the idea that for Internet radio to truly succeed, it will need to become wireless. While this is a valid argument, it was also noted that up to half of all radio listenership is in static environments such as homes and offices. The further development of wireless Internet accessibility and applications will aid Internet radio in its growth.

The panelists, representatives from Launch.com, eYada.com, Live365, Onlinemusic.com and TuneTo.com, also commented on the various business models for Internet radio. The commercial sales approach, like the one used for terrestrial radio, is commonly used. Other methods, such as alliances with merchandise providers, use e-commerce for CD, concert ticket and merchandise sales. Still another method is to have the content provider support the transmission mechanism by paying the streaming provider directly. This shifts the profit-generation responsibility back to the content provider.

On the floor

There were 275 companies exhibiting on the show floor with products and services covering every aspect of streaming from content creation and management to audience measurement. Attendance figures were posted at 15,000 attendees. This was the largest streaming show to date and shows that the interest level is very high. While streaming video is a hot topic, it appeared that there was an even distribution of audio and video streaming interests represented at the show.

One news item that sparked interest on the show floor was the formation of Internet Streaming Media Alliance (ISMA). This organization will serve to accelerate the market adoption of open standards for





streaming rich media over IP.

Some of the founding companies include Apple, Cisco Systems, Kasenna, Philips, Sun Microsystems, Analog Devices, Informix Media 360, iVAST, Minerva Networks, nCube, Network Appliance, Optibase, Packetvideo, Pix Stream, Sea Change International and SGI. Noticably missing from this list were companies such as RealNetworks, Microsoft, Akamai and iBeam.

While standards already exist for the fundamental pieces required to deploy streaming media over IP, the ISMA will adopt elements of these existing standards and contribute to those still in development in order to publish and promote a systemic, end-to-end specification, which enables cross-platform and multi-vendor interoperability. The first specification from the ISMA will define an implementation agreement for streaming MPEG-4 video and audio over IP networks.

Still room for radio

The show was not just dot-coms and computer hardware manufacturers. There were several exhibitors who are already familiar to radio broadcasters. Radio has an advantage over many of the new streaming media providers in that storage and management of audio data is not new to us. Radio has been creating continuous audio streams for more than 75 years. Radio's experience with audio processing, ad management and ad insertion are other areas that can draw on the extensive knowledge already in place.

A show that is dedicated to streaming technology may give you the idea that terrestrial radio is on the verge of being supplanted by Internet radio, but that is not the case. As advanced as streaming technology is, there are many areas that have considerable hurdles to clear.

Visit the ISMA site at www.ISM-Alliance.org.

BUILDING TODAY FOR DIGITAL TOMORROW

By Chriss Scherer, editor

Efficiency in facility consolidation

Any facility construction project requires time and personnel to do the job right. In many instances, stations try to plan and build new facilities and still maintain the existing facilities without any additional manpower. Typically, when this is done, something suffers. Either the new facilities fall behind schedule or the present facilities fall apart. Hiring additional help during a major project is a wise investment.

When Entercom Buffalo decided to consolidate its six stations into one facility, the decision to hire a system integrator was made early. Over the course of the project, the decision proved to be perfect. When plans for the move began, the stations were owned by Sinclair. A change of ownership during a project can bring its own concerns, but the Buffalo project continued forward. Even with two format and call-letter

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115	132	149	166	183	200	217	234	251	268	285	302	319	336	353	370	387	404	421	438	455	472	489	506	523	540	557	574
116	133	150	167	184	201	218	235	252	269	286	303	320	337	354	371	388	405	422	439	456	473	490	507	524	541	558	575
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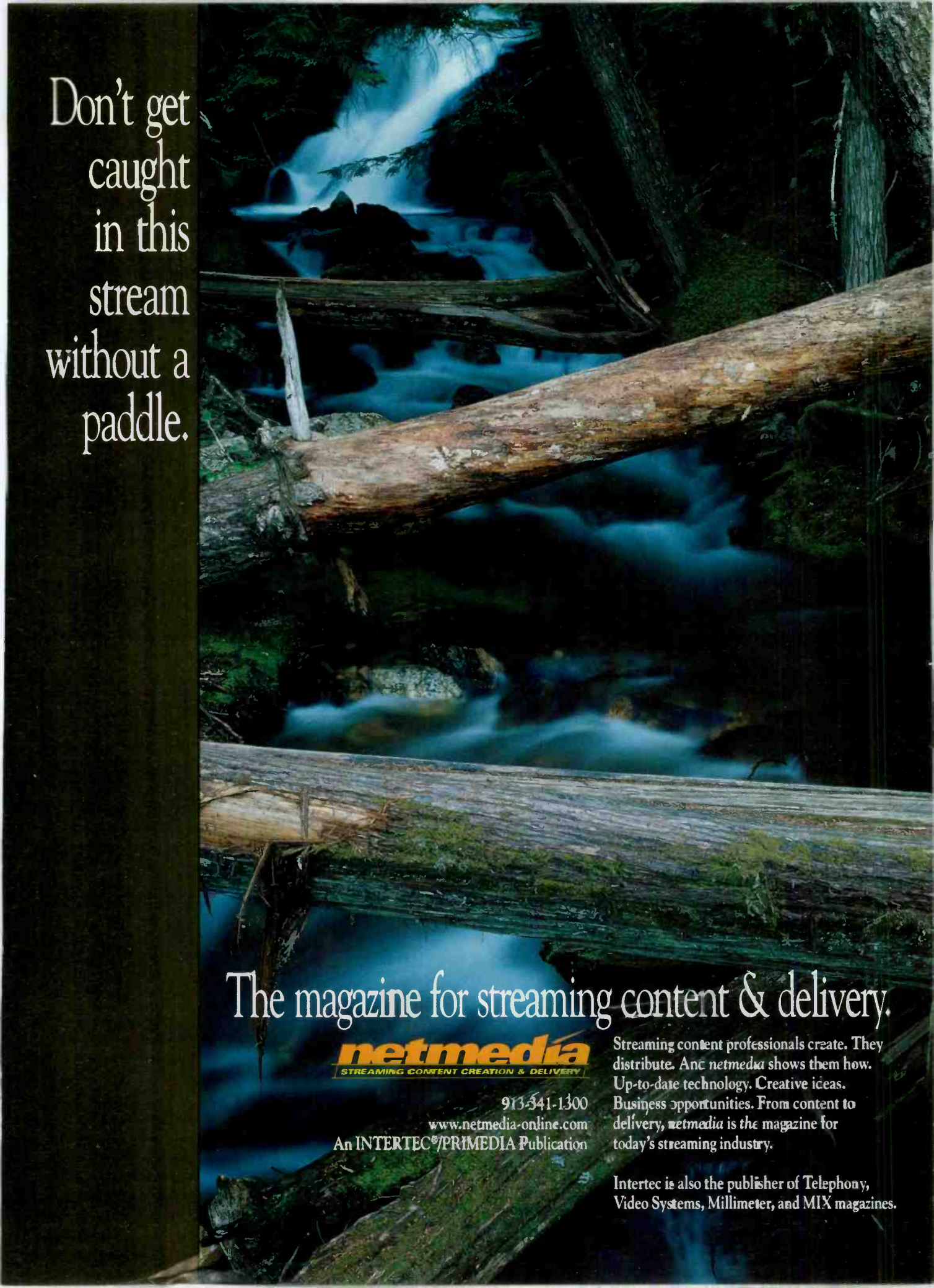
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changes, the project stayed on course.

The biggest advantage to hiring a system integrator is that a considerable amount of work can be done off site even before the studio building is ready. In this case, the work on the studios in Buffalo began in Cincinnati at Harris Broadcast. This type of off-site work is common for most system integrators. It allows an installation to be almost completely turnkey by having a nearly completed studio delivered to the new facility. During the studio construction, Harris personnel completed the new installation work while the Entercom staff maintained the existing facilities.

The WBEN-AM control room looks into its accompanying talk studio.

All the control rooms have a similar layout but are tailored for each station's needs. Subtle differences between two control rooms can be seen here and above

Getting started

The six Buffalo stations – WKSE-FM, WTSS-FM, WGR-AM, WBEN-AM, WWKB-AM and WWWS-AM – occupied four locations around Buffalo before the move. Like most consolidations, the expense of operating multiple locations was not cost effective. Also, some of the studio facilities were far from modern in appearance and function. The initial plans to move began in 1995. A suitable facility was not found until July 1999.

While the location search progressed, the equipment choices were made being made. The stations knew they wanted digital consoles and an on-air audio delivery system that would be fully integrated into their new operations. Not every new facility is designed to be completely digital from end to end. Each project will have unique requirements, and the appropriate solution may be provided by analog or digital equipment. The final choices for the heart of the operation were made with Auditronics NuStar consoles, SAS routing switchers and a Dalet audio delivery system.

The entire facility occupies 35,000 square feet, which is most of one floor in the two-story building. An additional 2,500 square feet is being used by another building tenant. The building has only two stories, so the STL antennas are mounted on a neighboring office building. Copper wir-

Auditronics NuStar consoles are the center of each on-air control room.

Building from a scale model

The inter- and intra-studio wiring was begun in Harris' Cincinnati facility. When wire and cable is being run, there is no room for error. Making cables that are too short can cause significant delays later on. To avoid this problem, the studio plans were laid out in life-size proportions first.

Masking tape was placed around the floor of the high-bay room to indicate walls. The studio furniture and racks were brought in and put in place. Then, the wire and cable assemblies were measured, run and terminated on one end. By creating the exact facility dimensions off site, and without the limitations or real walls and ceilings, the wire and cable assemblies were constructed in less time, and each was made exactly to the proper length.

ing and fiber optic cable have been run between the studio and nearby rooftop through a 2,000-foot trench. The STL transmitters have a touch-tone remote control.

At the center of the operation is Tech Core. The room houses 22 racks and is also the central distribution point for the facility. Each studio is connected to this center with 12-pair Gepco AES-3 audio cable and Belden DataTwist CAT5 cable. The CAT5 cable is used for all the logic wiring and for handling Ethernet signals. While not every audio source in the facility is digital, the AES-3 cable is excellent analog audio cable. AES-3 cable also provides a constant electrical characteristic; something that is not always the case with analog wiring. Each studio also has six coaxial cables run to it for future use.

All the wiring is terminated on ADC Icon (I-24 and I-96) blocks with IWS frames. The inter-room wiring was completed off-site and delivered in Buffalo ready for installation. Once delivered, the cables were run in cable trays, and the studio terminations were completed. In all, the entire facility has more than 7.5 miles of wire and cable.

The on-air delivery system was chosen in 1995. At that time, the choices for a system that integrated newsroom and on-air functions were lim-

ited, and Dalet made the final cut. The stations wanted an integrated system to avoid file conversions and distribution between different systems. It is based on a WindowsNT network and has 31 workstations, including those in news. It is capable of up to 450 hours of storage using LayerII compression in a RAID5 array. The playback-only PCs use Digigram PCX-80 cards, and the recording PCs use Digigram PCX-11+ cards.

Audio routing and intercom functions are handled by an SAS 64000 and 32000, respectively. D/A conversions are made by the SAS 256 × 256 router as needed. The 32000 serves as a facility intercom, but it also provides IFB feeds for remotes.

Each talk studio can easily accomodate up to four guests. The center turret provides the host with easy access to all the controls he may need. Each mic position has a comfortable view into the associated control room.

There are five control rooms in all. The sixth station is automated, so it does not require a dedicated control room. The air studios are similar in design but are tailored for the use of each individual station. There are six production rooms that are all identical. This allows producers to move easily

between studios without having to adapt to a different setting each time a new studio is used.

There are four talk studios. Three of them are dedicated to single control rooms for WGR, WBEN and WWKB. The fourth is available for overflow needs and is used for public affairs program preparation. To complete the studio compliment, there are two small booths used for voice-overs and news announce booths. These can be routed to any control room or production room and are used regularly for daily newscasts. News is prepared in the 10-workstation newsroom.

The sports/news announce booths have more functionality than just a voice-over booth. Each has a console and can preform some limited production

While the Entercom Buffalo facility is not completely digital, it is ready for a smooth transition when that day comes. Selecting equipment that can serve a facility's analog needs today and its digital needs tomorrow is a valuable step in preparing a station for continued success.

Thanks to Paul Barzizza, manager, systems engineering, Joe Perez, systems engineer, and Ken Dillard, systems engineer, of Harris, and Tom Atkins, director of engineering, Entercom Buffalo, for their assistance in preparing this feature. Photos by Tom Atkins.

Project timeline

- ***1995***
  Decision made to consolidate al facilities
- ***July 1999***
  papers signed for new location
- ***August 1999***
  general contractor work began
- ***December 1999***
  stations' ownership transferred from Sinclair to Entercom
- ***January 9, 2000***
  Harris arrives onsite and begins 90-day install period
- ***January 10, 2000***
  general administration offices move from two buildings into one.
- ***February 2000***
  WTSS moved into new facility
- ***March 2000***
  WBEN and WWWS move
- ***April 2000***
  WKSE, WGR, WWKB move

For more photos and a facility equipment list, go to *www.beradio.com* and click on *Spotlight*.

New Products

Active monitoring system
Genelec Oy

▼ **S30D:** A nearfield monitor for digital workstations and recording studios, the S30D is available in vertical and horizontal versions. Features include an input word length of 16 to 24 bits; input formats AES/EBU (S/P-DIF with an impedance adapter); de-emphasis 50/15us, automatic with 44.1 kHz sampling rate; input sampling rate 29 kHz to 100 kHz; DAC dynamic range 120 dBA (triangular PDF dither, 24bit data); digital audio thru connector; frequency response: 35 Hz to 50 kHz (-3dB); 112 dB SPL (peak) per pair at 1m with music material; 210 mm (8 inch) woofer; 80 mm(3 inch) midrange cone driver; ribbon tweeter; tri-amplified: 120 W, 120 W, 120W; electronic crossover and protection circuitry; and built-in bass, mid and treble level controls, bass roll-off and bass tilt controls.

+35 8771 3311; fax +35 8178 12267; www.genelec.com; genelec.usa@genelec.com
Circle (254) on Free Info Card or go to www.beradio.com

Digital audio logger
Computer Concepts

ReeLogger v2.0: A digital audio logger capable of storing one, two or three months of a station's audio on hard disk without user intervention. Because it rolls over automatically, there are no tapes to change. ReeLogger v2.0 features skimming and scheduled recordings. Using the supplied schedule editor, simply schedule an air check on the day or days of your choice, and ReeLogger handles the rest. Digital air checks, automatically scoped in industry-standard RealAudio files, can be accessed from the PD's desk or e-mailed to your consultant for instant feedback.

800-255-6350; fax 913-541-0169
www.ccc-dcs.com; support@ccc-dcs.com
Circle (257) on Free Info Card
or go to www.beradio.com

Internet-based audio logging
Arbor Audio Communications

▼ **LogDepot:** A software package derived from the NewsDepot. Because of the support and usage of advanced compression algorithm technology, it is possible to use a hard disk as the storage medium instead of changing tapes or other media. The usage of standard PC makes it possible to achieve any form of redundancy and reliability. LogDepot is developed according to the Client-Server model. One or more server PCs are constantly registering the broadcast signals, while multiple clients can access the previously recorded material. The LogDepot is web-based, which means that clients can use a web-browser, such as Microsoft Internet Explorer, to play back registered programs or download them and copy the recordings onto a CD.

+31 314 399 055; fax +31 314 366 402
www.arbor-audio.com
info@arbor-audio.com
Circle (258) on Free Info Card
or go to www.beradio.com

Mechanical housing
RDL (Radio Design Labs)

▶ **Flat-Pak series:** Seven models and two accessories comprise RDL's Flat-Pak series of products. The Flat-Pak is a flexible mechanical housing for various product functions including a 12V to 24V DC converter, 1×4 A/V distributor, NTSC Video and S Video distribution amplifiers, two and six channel unbalanced to balanced audio converters, and an SPDIF to AES/EBU digital audio converter. The Flat-Pak housing features all metal construction; cabinet, shelf or rack mounting; top mounted connectors; and DC jack input and DC power bus output. The FP-RRA and FP-RRAH accessories provide a method of rack mounting the modules.

800-281-2683; fax 805-684-9316; www.rdlnet.com
Circle (265) on Free Info Card or go to www.beradio.com

Digital STL
Moseley Associates

◀ **Starlink SL9003Q:** Using Quadrature Amplitude Modulation technology, the SL9003Q delivers four 16-bit linear audio channels and two data channels over narrow-bandwidth 950 MHz STL channels. AES/EBU I/Os, combined with a built-in variable rate converter, provide connection to the all-digital air chain without compression. Plug-in MPEG audio modules and a digital multiplex allow for additional program, voice, FSK, async and sync data channels. The efficiency of the SL9003Q is achieved by user-selectable 16, 32 or 64 QAM. Reed-Solomon error correction, coupled with a 20 tap adaptive equalizer, provides signal robustness in hostile RF environs. An ultra-linear 4 Watt average transmit power is achieved with redundant RF modules.

805-968-9621; fax 805-685-9638; www.moseleysb.com; info@moseleysb.com
Circle (252) on Free Info Card or go to www.beradio.com

Compressor
TC Electronic

▶ **Triple C:** Features three compression techniques: The multi-band compression mode allows you to spectrally compress your source material in three bands independently. In envelope compression mode, users can alter the dynamic envelope of the incoming source by changing attack and release gain. Full-band compression mode simulates conventional analog compressors. With the Triple C, users press a single button to choose between the sound of full-band compression, envelope or the multi-band compression technique. An external sidechain allows you to control the Triple C via an external source, and the sidechain I/Os allow insertion of various processing devices.

805-373-1828
fax 805-379-2648
www.tcelectronic.com
info@tcelectronic.com
Circle (263) on Free Info Card
or go to www.beradio.com

Effects processor
Alesis

▲ **AirFX:** A musical device that processes incoming audio or generates sound effects in reaction to movement, airFX features 50 preset programs that modify any audio signal from CDs and vinyl to live performance in real time. AirFX is the first product from Alesis to incorporate Axyz (pronounced ax-is) technology. Axyz technology consists of an infrared beam that can be manipulated in three dimensions, along the X, Y and Z axis. Using triangulation, up to five different parameters can be controlled in each preset program. The 50 preset programs include effects like panning, flanging, pitch shifting, and resonance filtering.

800-5-ALESIS; fax 310-255-3401
www.alesis.com
Circle (260) on Free Info Card
or go to www.beradio.com

New Products

Flash memory/PC card recorder
Superscope/Marantz

▶ **PMD680:** This device records 16-bit digital audio using PC Card media. Audio files recorded on the PMD680 can be transferred to a computer for editing, archiving, or uploading to the Internet. Simply eject a recorded PC card from the recorder and place it in the computer's PC Card slot. This direct method of importing sound into a computer requires no cables and avoids file transfer delays. The PMD680's Type III PC Card slot accepts compact flash cards (with adaptor) and ATA-sized PC Cards. The PMD680 records audio in MP2 format. A variety of compression settings are available to extend recording times on smaller-capacity PC Cards. It can also record uncompressed PCM digital audio as Wave (.wav) or Broadcast Wave (.bwf) files. A built-in non-destructive EDL system enables the user to place reference marks and create custom playback sequences.

630-820-4800; fax 630-820-8103; www.marantz.com/product/professional
Circle (266) on Free Info Card or go to www.beradio.com

Studio mixer
SeaSound

◀ **Solo Ex:** This audio recording interface is the easiest way to record and monitor directly to and from your computer, which offers virtually unlimited tracks. The Solo EX offers: analog microphone pre-amps with 48V phantom power, instrument pre-amps for guitar & bass, inserts, line inputs, two headphone amps, MIDI I/O and a zero latency monitor mixer.A Solo EX is a completely integrated environment replacing: direct boxes, mic pre-amps, headphone amps, a sound card, a mixer and a standard MIDI interface. The Solo EX includes an expansion port for the Solo Expander, for a total of eight discrete inputs and outputs. SeaSound also offers the Soloist, a scaled down version of the Solo EX.

415-485-3900; fax 415-485-3901; www.seasound.com; winfo@seasound.com
Circle (261) on Free Info Card or go to www.beradio.com

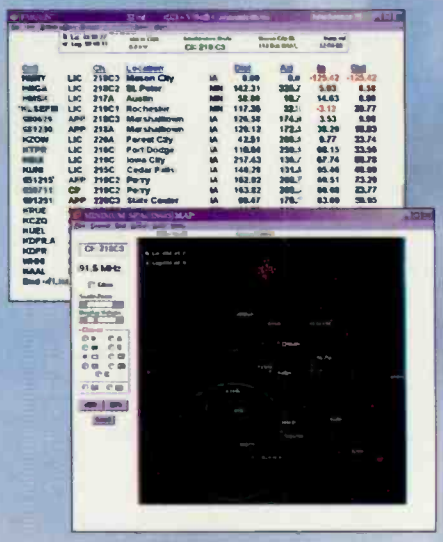
Microphones
beyerdynamic

Opus: A series of microphones optimized for music performance, the Opus series combines beyerdynamic's classic acoustic design experience with new materials and contemporary designs, to capture the dynamism of music performance, new music styles and spontaneous creativity, whether it is on stage or in the studio. The Opus series includes a full range of popular microphone types and is designed to provide an integrated family of microphone products.

800-293-4463; fax 631-293-3288
www.beyerdynamic.com
Circle (262) on Free Info Card or go to www.beradio.com

Interactive FM channel studies
V-Soft

▼ **SearchFM:** This full-featured Windows program offers the ability to display graphics and tabular representations of any channel. SearchFM produces colorful U.S. maps on which the FCC's minimum separations are plotted. It takes just a glance at the computer screen to determine if a drop-in



exists. Page from one channel to the next instantly, across the entire FM band if you wish. Zoom in on a possible transmitter site or use the automatic search feature. The latest FCC database comes packaged with every SearchFM program as well as an FCC database editor and query window.

800-743-3684; fax 319-266-9212
www.v-soft.com; kmichler@v-soft.com
Circle (255) on Free Info Card or go to www.beradio.com

New Products

Multichannel mic/instrument preamp
PreSonus Audio Electronics

▼ **DigiMax:** Designed as a front end for any digital audio workstation, each channel features dual-servo microphone preamplifiers, 48V phantom power, -20dB pad, EQ enhance and dual domain limiter. The dual domain limiter processes the audio signal using both RMS and peak detection. A full offering of digital and analog outputs include:

48K/24Bit ADAT lightpipe digital output, 48K/24Bit S/PDIF digital outputs and balanced TRS analog outputs. AES/EBU outputs will be offered as an option via DB9 connector. The first two channels offer polarity reversal and high impedance instrument inputs on the front panel for easy access. All outputs are available simultaneously.

800-750-0323; fax 225-926-8347; www.presonus.com; presonus@presonus.com

Circle (251) on Free Info Card or go to www.beradio.com

Turnkey ad guide
WebPresence

WebNTR.com: These applications allow stations to begin producing revenue through seamless integration with their existing websites, allowing control of Web content for a single station, a market cluster, a geographical area, an entire nationwide broadcast group or a number of other designated groups. WebNTR.com Radio Advertiser Guide gives stations a turnkey option for generating new revenue. Now advertisers can give audiences something they can see. In addition, stations can offer each advertiser printable coupons, searchable text for detailed information, and interactive maps with turn-by-turn directions.

978-448-8882; fax 978-448-8883

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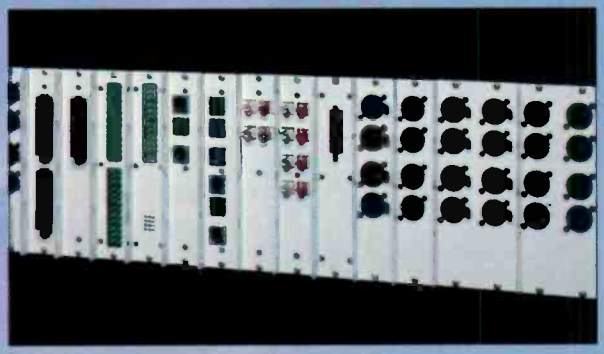
Sudio interface strips
Wheatstone



▶ **Wiremax strips:** These studio interface strips allow users to connect studio equipment to a console without the need for soldering. Wiremax strips are designed to be mounted in the wiring bay and to do away with the need for 66-type punchblocks and the massive documentation needed to complete wiring of the studio that punchblocks entail. The two-sided Wiremax strips are the same dimensions as console modules and have steel faceplates, connectors, labeling and a tie strap. Wheatstone supplies the strip panels, console-to-strip wiring and hardware.

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

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Hardware and software product line
Waves

Maxx Stream v3.0: A hardware and software suite optimized to stream live audio signals over the Internet. Integrates audio capture, processing, and encoding into a single workstation. Features and capabilities introduced in version 3.0 include: open support for any streaming audio encoder or format, the ability to process audio from an external audio or software source, and full support for Waves version 3.0 processors, which offer a new graphical interface. Further improvements include: C4, 4-band compressor controls the dynamics of multiple bands simultaneously; hardware settings and parameters can be changed from within the MaxxStream application itself; and professional and consumer standard audio connections, making it compatible with all product types.

865-546-6115; fax 865-546-8445
www.waves.com

Circle (256) on Free Info Card or go to www.beradio.com

Curved LED meters
Logitek

▶ **TVU4 meters:** These meters, available in analog and digital input formats, are based on the curved LED meters found in Logitek digital consoles. This styling retains some of the feel of analog VU meters while providing the immediate response of electronic meters. The Tru-VU meters are DSP based for precise level indication. The Tru-VU represents the true 300ms VU ballistic standard along with a peak display. Each meter display has 25 bar-type LEDs with colors ranging from green (-35dB through -1dB) to yellow (0dB) to orange (+1dB through +3dB) to red (+6 dB through +18dB). Inputs can be analog or digital.

877-231-5870; fax 713-664-4479; www.logitekaudio.com; info@logitekaudio.com

Circle (253) on Free Info Card or go to www.beradio.com

Reader Feedback

From the clear blue sky

The article in the November 2000 issue on Satellite Services contains some misleading information on the StarGuide II Receivers. You state that with the new GE-8 satellite, the StarGuide II receiver will be obsolete. This is not true for the Westwood One/CBS StarGuide feeds.

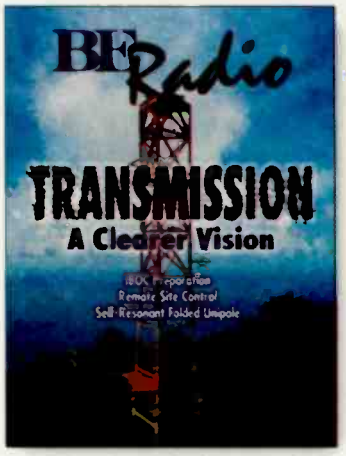
The only difference between the two receivers is bandwidth, and this will not affect Westwood One/CBS stations.

In regards to interference to C5 from GE-7, the C1 replacement satellite, the inference level has dropped. The GE-7 side lobe signals are greatly reduced because the satellite is not saturated. While Westwood recommends using a 3.8 meter dish for C5, a 2.8 meter antenna will still work with the Westwood One 27dBw signal. When GE-8 is active, the Westwood One power level will jump to 29dBw.

Keith Angstadt
manager, StarGuide operations
Westwood One Radio Networks
Arlington, Virginia

IBOC preparation

In regards to the very informative October article by Doug Irwin [*Implementing IBOC*], you asked how readers are preparing for IBOC. We aren't in the process of preparing for IBOC, nor do we really care about it. We are concerned that the implementation of IBOC may put our rural, low-power non-comm off the air if it is made mandatory. The financial investment alone would kill us. IBOC has no benefit to us, as we could jeopardize our non-profit status if we make too much money from digital channel leases—even if we could sell them here. The listeners that we have talked to about DAB couldn't care less about an almost inaudible difference between analog FM and digital FM. The cost vs. return is just not justifiable.



You can have IBOC, but give us a choice as to whether or not we want it.

Donn Willey
general manager, chief engineer
KGNR-FM
John Day, OR

A bridge overseas

I work for the Air Force Broadcasting Service, a directorate of Air Force News Agency, as a maintenance support manager. I read with interest the November RF Engineering column on using the operating impedance bridge. AFNEWS operates 11 overseas detachments providing AFRTS programming to US military personnel. We have several of the Delta OIB-3s in the field, but with little training information on proper use. I have referred our maintenance personnel to your story on the *BE Radio* website to help them better use the device.

MSgt Steven A. Yuoconis, USAF
maintenance support manager
AFNEWS/BGLM
San Antonio

Remote access

Just wanted to send a friendly wave to Bill Fawcett for his excellent article on unattended facility operation *BE Radio* October 2000. If I could only get one magazine, *BE Radio* would be the one. There's always something genuinely useful there.

Steve Graham
acting chief engineer
WUOM-FM
Ann Arbor, MI

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Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2215. Phone: 913-341-1300; Edit. Fax: 913-967-1905. Adv. Fax: 913-967-1904.

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Sales Offices

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Steven Bell
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Telephone: (913) 967-1848
Fax: (913) 967-7249
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REGIONAL MARKETING MANAGER

Anna Bannister
9800 Metcalf
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Telephone: (913) 967-1947
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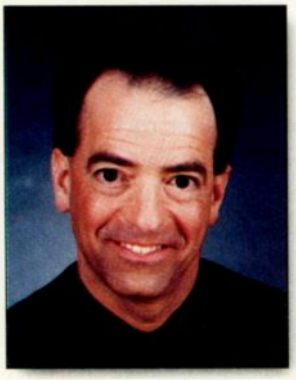
Reality check

By Skip Pizzi, contributing editor

Any demarcation point in time makes us think about taking inventory, so what better occasion than a millennial break to evaluate the hot topics in radio? They are listed below, in no particular order, along with some projections on what's likely to happen for each in 2001 and beyond:

A baker's dozen

S-DARS: Sirius Satellite Radio will inaugurate its service, and XM Satellite Radio will launch its birds. The DBS radio era finally begins.



IBOC: Uncertainty will continue, with some on-air testing likely, but not much other progress.

International DAB: Eureka 147 receivers will finally hit the store shelves, but their high prices will keep most of them there.

LPFM: Splash this one. By this time next year, we'll have trouble remembering what it stood for.

Streaming media: Growth of broadband access will stimulate on-line media providers to begin offering higher bit-rate services. The use of edge-servers for distribution of this content will grow to meet the new demand. Meanwhile, more on-line audio appliances with funny names will debut. Their use of broadband access will make their on-line reception nearly indistinguishable from (if not better than) their off-air performance. On the PC side, new codec upgrades for streaming media players will improve audio quality at lower bit-rates.

Wireless: Auctions for 3G service will open the U.S. broadband wireless age in earnest. By year's end, the first handheld streaming media devices may be appearing on holiday wish-lists.

FCC: The new administration will impose substantial change on the Commission, so Congress doesn't keep having to.

Advertising revenues: Profits from traditional on-air terrestrial radio service may hit their historical peak this year, as advertising opportunities in new media begin to siphon funds at noticeable levels. Growth in the overall advertising market may also suffer as the U.S. economy plateaus.

Consolidation: Activity here has already peaked. A few more station groups may merge, and several more stations may be acquired or traded, but the consolidation feeding frenzy is largely over. There may be some surprise shifts of control/ownership among the largest groups, however, as major media companies adjust their portfolios.

On the PC side, new codec upgrades for streaming media players will improve audio quality at lower bit-rates.

Copyright issues: The recent move by the U.S. Copyright Office to levy performance royalty fees on radio broadcasters' on-line services will kick off a series of legal maneuvers that ultimately causes dramatic change in the traditionally placid world of radio content acquisition and compensation.

LEOsats: Notwithstanding the Iridium debacle, speculative development of Low Earth Orbit (LEO) satellite systems will continue, but now aimed at providing *broadband* service. This could extend the impact of broadband streaming media to rural areas of the U.S., and to international markets, within the next two to three years—significantly faster than terrestrial broadband might be deployed to these areas.

Music downloads and Software radio: Younger listeners will move away from traditional radio in increasing numbers, drawn by the personalization capabilities of music download sites and customizable streaming audio services.

Automation: PC-based systems in radio will continue to grow in sophistication, as their usage grows in both the content creation and technical distribution sides of the business. It's more of the same good luck/bad luck with this 13th issue: Operations staff will suffer, while computer-savvy tech support will benefit.

Cosmic significance

Arthur C. Clarke fans in our industry will find mild irony in the fact that geostationary satellites (which Clarke first proposed) will become cosmically significant for radio in the year 2001 (the title and period of Clarke's best known sci-fi work).

That development, along with the others noted here (and, no doubt, a few that aren't), will shape a pivotal year for the radio industry – and for the media world in general. But that's the way any decent new millennium should start, not with a whimper but a bang. Best of luck, and buckle up.

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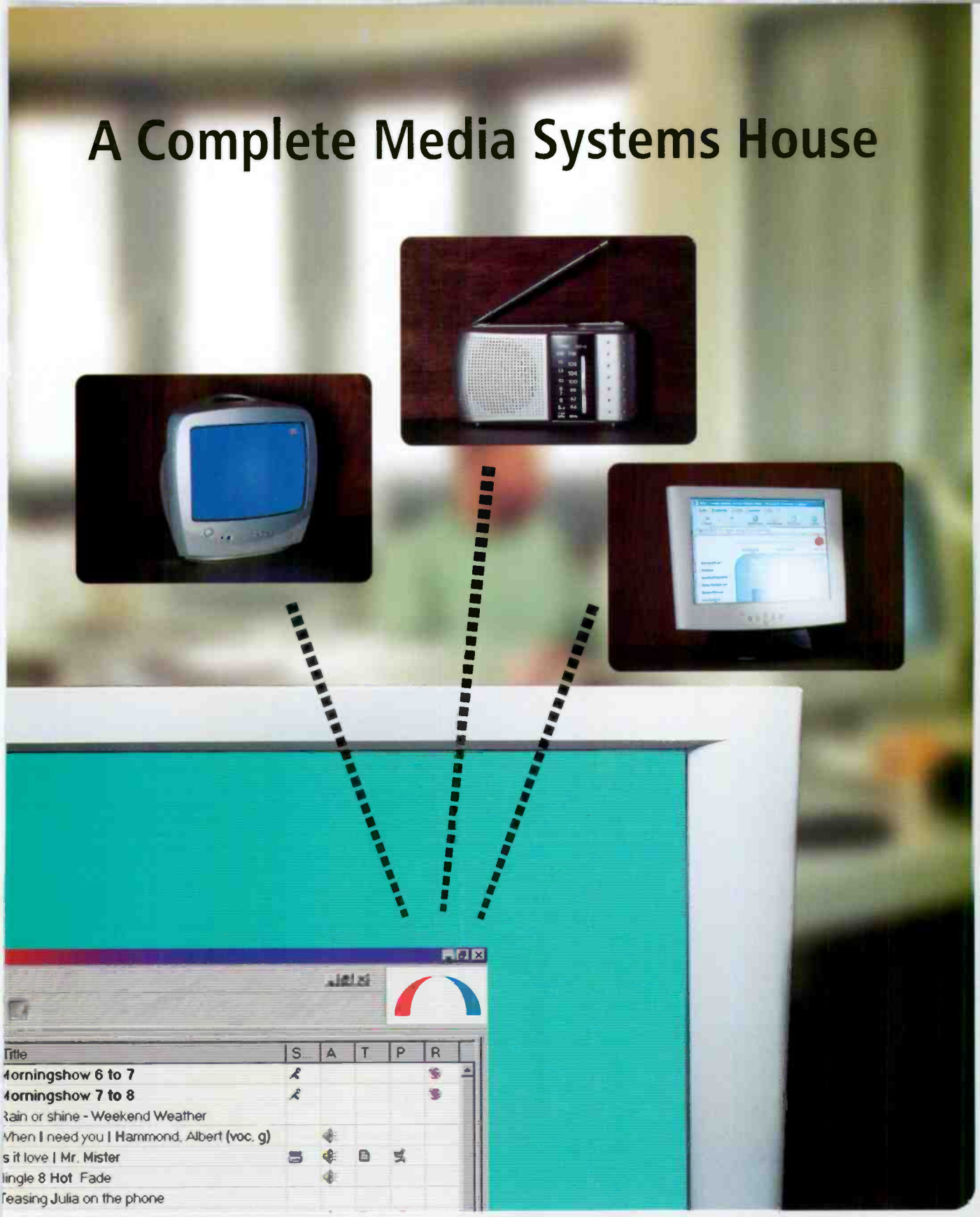

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