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December 2001
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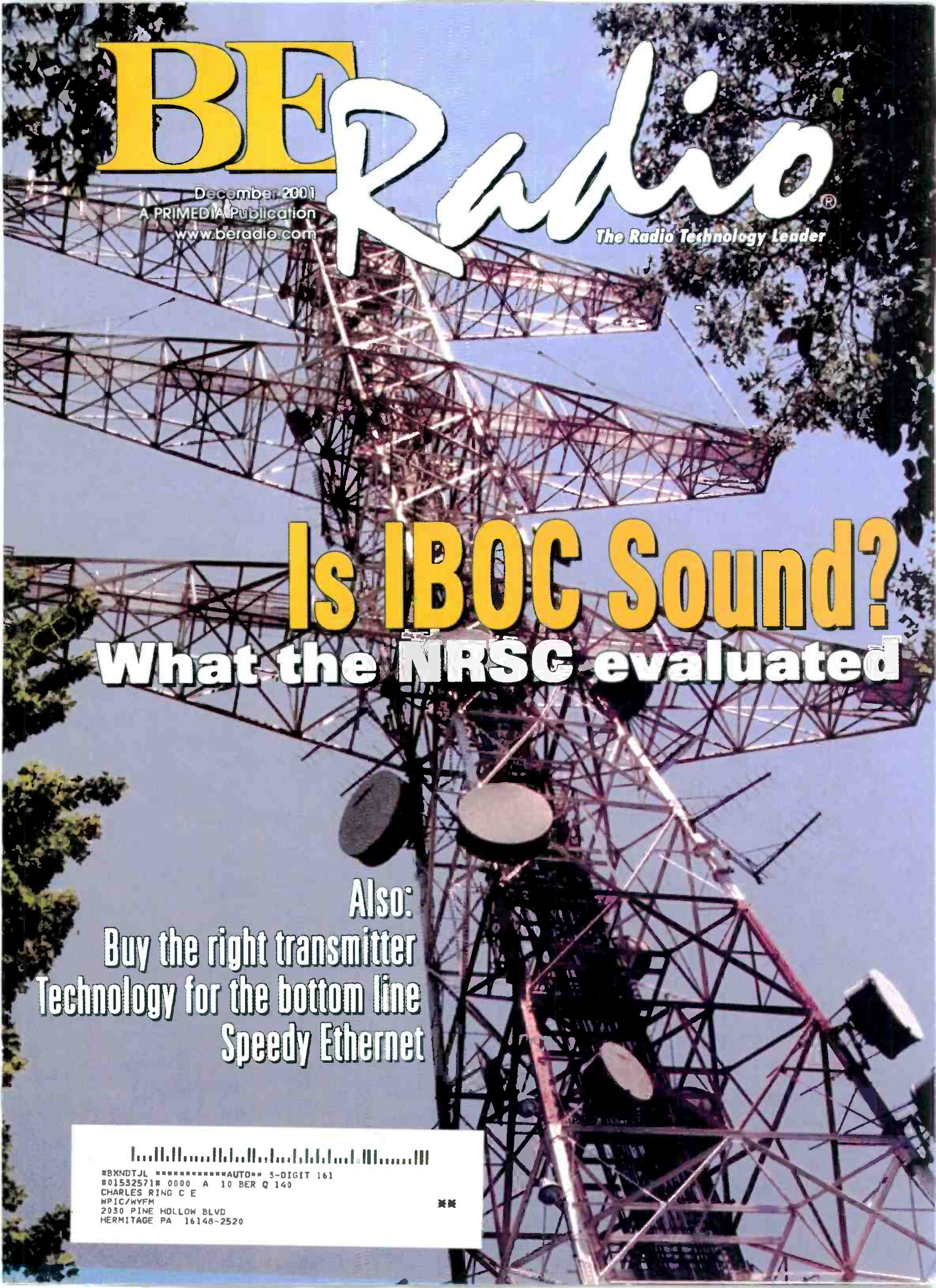

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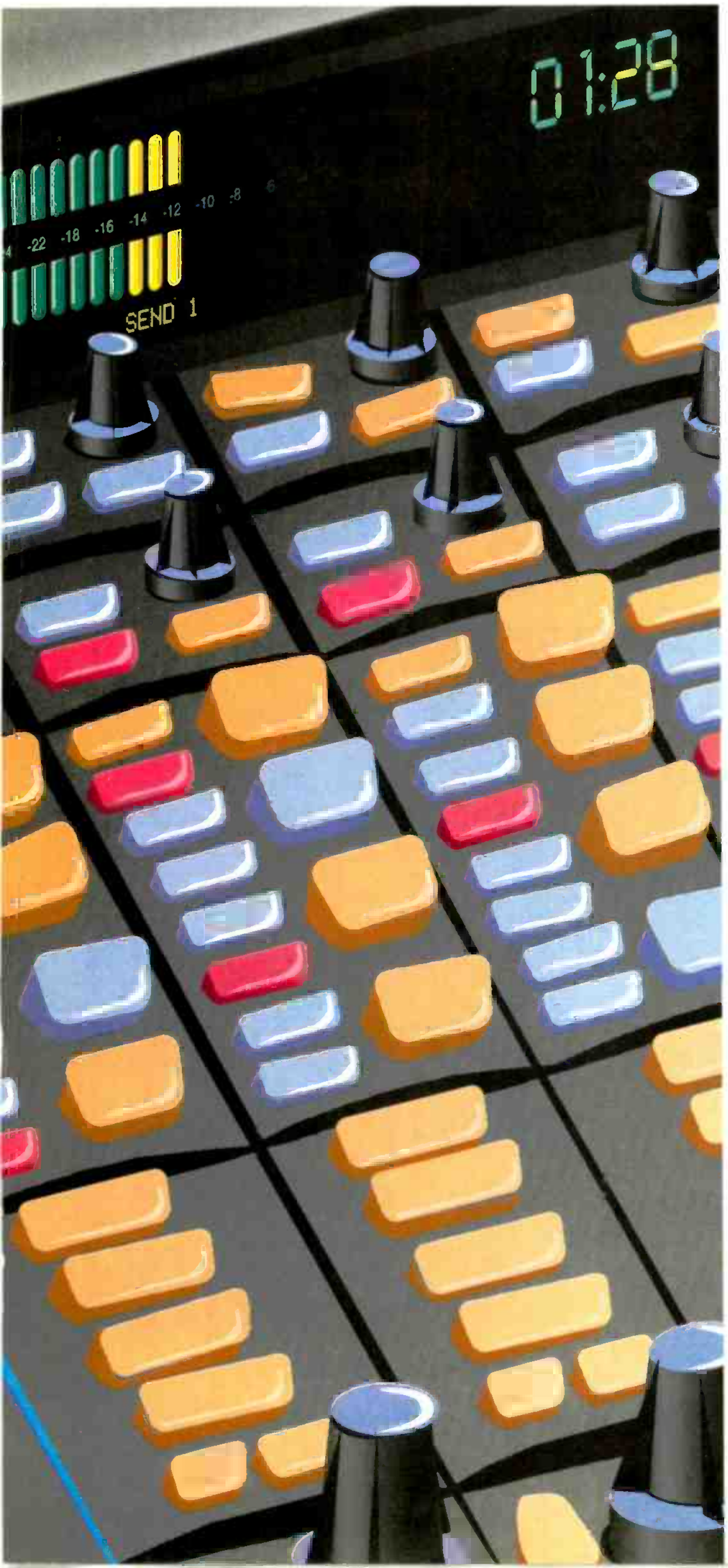

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ON THE COVER: The process to establishing an IBOC standard for the United States contines with the NRSC evaluation. Photo by Jim Hawkins. Cover design by Michael J. Knust.

Something to celebrate

At this time of year it is customary to look back at the events of the past and look ahead to the possible future. Like most industries, radio has had its share of setbacks and successes, from a near stifling of Internet radio (thanks to the DMCA and the RIAA and AFTRA actions) to the inspiration of renewed spirit with IBOC and satellite radio. As we look to what is ahead, we need to stop and look at where this all started.

Radio today is a result of the early wireless tests of the late 19th Century. Originally intended solely as a messaging system, radio quickly gained acceptance as a means to broadcast information and entertainment to a wide audience. The development and eventual invention of radio is the result of the work of many people, including Michael Faraday for his work in magnetism, James Clerk Maxwell for his work in electromagnetic mathematics, and Heinrich Hertz for his application of Maxwell's theories to create *Hertzian* vibrations. But when we think of one person to bestow with the title of the Father of Radio, that person is Guglielmo Marconi. This month marks a special anniversary for radio and the work of Marconi.

Marconi first began experimenting with radio wave transmissions in 1894 in Bologna, Italy. His early tests were over a range of about two miles and consisted of transmitting the Morse Code for the letter "S." In 1896 Marconi moved to London, where he filed a patent for his work. In July1897, the Wireless Telegraph Trading Signal Company was formed, with its first factory started in 1898.

By the end of 1901, Marconi erected a transmitting station at Poldhu in Cornwall, on a peninsula in the Atlantic Ocean. His first North American receiving station was built in Cape Cod. This receiving station was damaged during a storm, and a newer station was built at Signal Hill in St. John's, Newfoundland. This is when Marconi began testing reception of signals across the Atlantic Ocean by experimenting with various antennas, all of which were suspended from kites.

The daily transmission tests were conducted from 1:00am to 3:00am and from noon to 1:00pm. Again, the Morse Code letter "S" was used for the test. The transmitter operator was John Ambrose Fleming, who, in 1904, would invent the thermionic diode tube.

A triumph came on December 12, 1901, just after 12:00pm, when the signal was received across the distance of more than 2,000 miles. Marconi showed that radio waves could be used to cover great distances by receiving a signal transmitted across the Atlantic Ocean. Previously, most transmissions were made over short ranges of a few miles at most. This test set the path for radio to be accepted as a viable means of communication over great distances, and the event spurred a great interest in the further development of radio's capabilities.

These early radio efforts led to significant advances, including the work of such pioneers as Deforest, Sarnoff, Armstrong and others. Radio continues to grow and develop today, and while some changes are more dramatic than others, the work of radio's modern pioneers continues the spirit of innovation and ingenuity that was seen 100 years ago in radio's infancy.

Take a moment and consider how far radio has advanced from the spark-gap transmitters to the enhanced version of terrestrial, Internet and satellite radio we have today. When you celebrate the New Year, toast the innovators, like Marconi, who made our industry possible. Since technology advances on a curved scale, who knows what radio will be like in the next 100 years. Undoubtedly, it will change and adapt to serve the needs of the listeners.

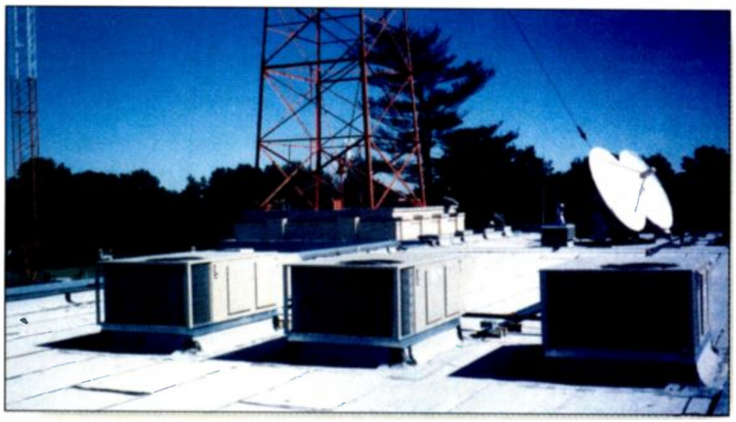
Chriss Scherer, editor
cscherer@primediabusiness.com

Open for business

By John Caracciolo

Since the Telecommunications act of 1996, groups all over the country started staking out dominant market shares. Multiples of 20 times cash flow was typical when pricing a station for a potential buyer. In 2000, when the buying leveled off and owners started operating their new facilities, times were good. The NASDAQ was over 4,000, consumer confidence was high and radio groups were experiencing a strong advertising market. Owners and managers were making money and servicing their debt load in a strong economy. What a difference in a year.

We don't need any more evidence that the economy is in a slowdown. The consumer price index fell 0.3% in the month of October. That is the largest one-month decline for the consumer price index in more than 15 years. Radio groups around the country are cutting paychecks across the board to eliminate layoffs in the continuing soft ad market. A recent survey of top companies found that a quarter of the employers surveyed had either denied or delayed salary increases, but a few had actually cut salaries or were considering such a move.



Vertical real estate, particularly on the studio rooftop, can be a source of new-found revenue.

By many accounts, radio groups that will remain successful during these times will be judged by how well they adapt to the economy. A new style of thinking must be incorporated into the broadcast environment. The new way of thinking says every department must produce. Every employee must contribute to the bottom line success of the company. Typically sales, promotions, and marketing were the moneymakers, and programming and engineering were the liabilities. As a chief engineer turned GM, it is my first priority to turn the old image of the chief engineer that always spent money, into the profit center engineering department that found untraditional revenue under every stone. There are many opportunities for the Engineering Department to make money for the company.

Every employee must work as a team to produce a large bottom line for the company. The first priority for an increased bottom-line profit, is to get every employee on the same page. Have one objective, one goal and one mission. Include every department in the planning at strategizing. Let's look at some immediate revenue the engineering department can bring to the table.

SCA rentals

The best place to solicit potential SCA customers is in the world of brokered time and foreign language radio. Start by contacting local hosts and shows that buy multiple hours on local stations. At WLIR, we took it to a different level this year. We re-invested in our own medium. We advertised the availability of our SCA on a local AM brokered time radio station. The response was overwhelming.

Other great sources for SCA rental are local high schools and colleges that do not have an FM frequency. Most schools that offer communication courses in highly populated areas are shut out when it comes to educational or commercial FM frequencies. An SCA is a wonderful opportunity for schools to have an over-the-air FM signal capable of being received on and off campus without the RF equipment costs that are associated with start up FMs.

Both of these plans can be lucrative for your station. Our SCA income will be more than $60,000 for 2001.

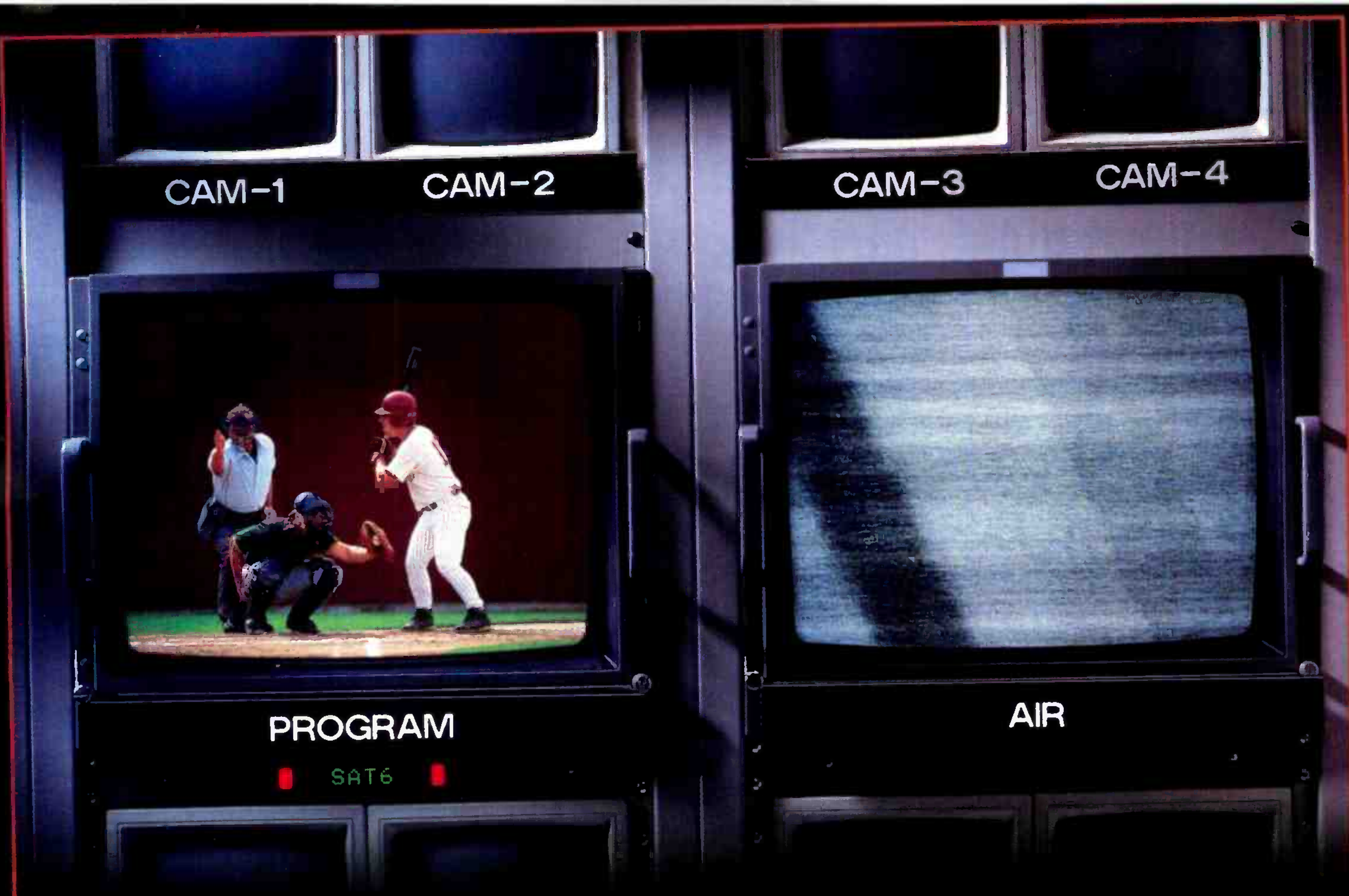
Rent the roof

Tower space is at a premium. The rental income from a broadcast tower should be lucrative, but if the radio station does not own a tower, there is still a way to make money.

Our station owns the small office building in which we are based. Most new PCS, Nextel, and cell services look to install on RF friendly sites with an average AGL of 100 feet to 150 feet. Use strategically placed advertising to sell your facility to them. We placed advertising in two national trade magazines and got great results. The ads were simple classified listings, but spoke the engineers' language.

Today's broadcasting environment is full of innovation and constant change. Every department in the radio station must keep an eye on raising revenue and lowering costs. A chief engineer in today's station must have the business skill, the technical experience and the in-depth knowledge of how to win and succeed for the team.

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



Strike one, you're out.

A single bolt of lightning can throw you off the air for hours — even days.

Even if your grounding exceeds minimum requirements, you could be in for some major league problems. One New England TV station lost $140,000 in equipment costs, plus untold amounts in revenue, from lightning damage. A midwestern FM station was tossed off the air for several weeks, costing them thousands of dollars. And lightning doesn't affect just commercial stations. Virtually every transmission tower — whether for police and fire stations, 911 call centers or telecommunications — is at risk.

The only way to play it safe is to upgrade your grounding system to 1-5 ohm resistance, as recommended by IEEE. At a fraction of what it would cost to repair and replace damaged equipment, you can get a correctly sized, properly installed copper-based grounding system. It's what these two stations did. And lightning hasn't been a problem since.

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Top loading, part 2

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

Part One described the events leading to the development of top loading of broadcast AM antennas. This part continues with details of the types of top loading and discusses the use of the FCC's Rules in planning a top-loaded antenna system.

Figure 1 shows one method of driving a top-hatted quarter-wave AM antenna. The top hat is insulated from the top of the tower and connected via a small network designed to provide the proper impedance match to the end of the coaxial cable, which is insulated from the tower. The current distribution for this construction is also shown dotted in Figure 1.

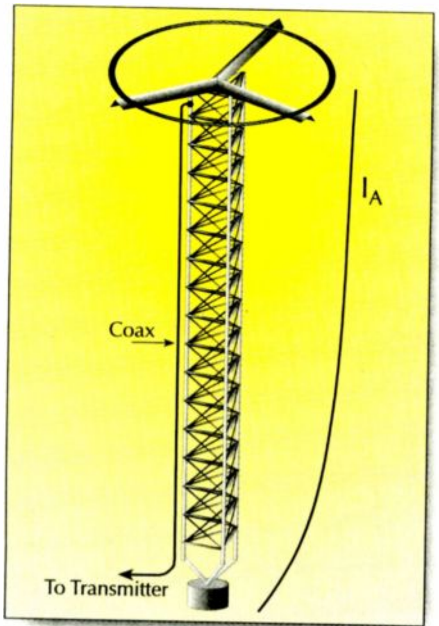

Figure 1. An inverted feed for top-hat loading. The current in the top does not contribute much to vertical radiation.

The top hat is not designed to raise the impedance but to raise the horizontal field intensity and reduce the high angle radiation that comes with a shorter tower.

The top hat performs as an elevated ground system, or as a counterpoise. Maximum current occurs at *the top of the tower* not at the overall height point. Current in the top hat flows radially and does not contribute to the total radiation from the antenna. The additional height of the top hat does not act as part of the radiator.

At the bottom of the tower, across the base insulator, there will be an infinite impedance because the tower and the outer coaxial conductor form a quarter-wave stub with a short circuit at its upper end. The transmission line is insulated from the tower and connected to it where the top hat is mounted. No current flows on the outer coaxial conductor.

I have rarely heard of this type of antenna system being used commercially. The high voltage at the base is probably a deterrent for broadcasters. Consulting engineer Tim Cutforth, P.E., has done much work on elevated ground systems and other exotic antennas. This inverted antenna was included to illustrate the many uses of a quarter-wave stub in antenna work and as another method of top loading.

Loading inductances placed in the vertical radiator are a natural consideration. There are three possible locations for such additional lumped inductance: at the base, in the center and at the top. Most readers have either experimented as hams, or seen such devices on a ham's automobiles. While these loading coils work well for the amateur, they do not fit easily into a large broadcast tower.

A base lumped inductance requires special mounting methods, either across the base insulator or inserted into the tower. The center coil requires an insulated break in the center. The top mount is easiest but still requires some engineering to do it satisfactorily. In all cases, the coil must be large and is subject to possible weather damage.

Only the top-mounted coil would give much improvement. Effective radiation requires high current through as much of the radiator as possible. In this case, the current would pass through all of the tower below the coil. Center loading provides the highest current in the lower portion of the tower, which would result in the least effective radiation.

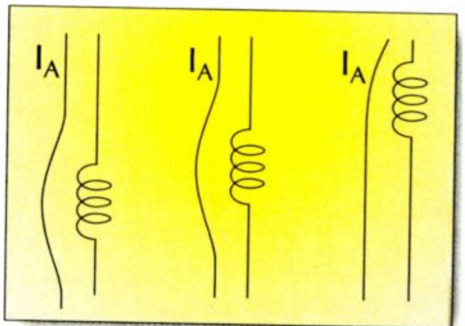

Figure 2. Various inductive loading positions. The location of the loading inductance controls the antenna current position.

Make a difference

For effective straight top loading use the top portions of the guy wires as the loading device. It is simple, inexpensive and usually very successful. If necessary, a folded unipole can be used in addition.

Figure 2 shows a typical top-loaded tower. Adding the length needed to make the overall length a quarter-wave seems to work well. The temptation to make the guy radiators too long can be strong. If the loading wires go down too far, they will shield the vertical radiator and reduce efficiency. A ring wire should go around the lower ends of the loading guys, joining them together. It is essential to ensure that all guy top ends are cleanly and securely connected to the top of the tower and that the ring wire is similarly well connected to the lower ends. Figure 3 shows a variation on top loading.

It has been my experience that the Commission will accept an application specifying a top-guy loaded antenna with dimensions that are reasonable and specifying a radiation figure that meets the applicable Rule.

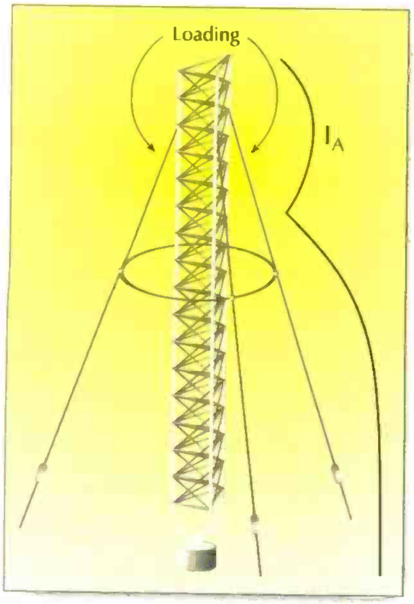

Figure 3. Top loading can also be accomplished by using the upper portion of the guy wires. Notice the effect on the antenna current.

The objective of top loading is to increase the antenna's electrical length to as close as possible a minimum of 90°. How it is done depends on the engineer and the desired effect. A combination of top-guy loading and use of a folded unipole antenna may present the best choice. This combination should give greater ease of adjustment, a desirable base operating resistance, lower Q, a grounded tower and a broader bandwidth. Many stations prefer using folded unipole antennas to using only top-guy loading.

I feel that the folded unipole is a form of top loading because it produces the similar effect of increased operating resistance and usually improves bandwidth.

For many years, the FCC's Rules had no formal provision in Form 301 for the use of top loading, and applications were accepted based on consulting engineer experience and engineering showing. Today's Form 301 provides spaces for loading and sectional antenna data and simplifies the application.

Frequently, when issued, the CP contained provisions for proof of performance measurements to be conducted on non-directional stations after construction to show that the required efficiency was obtained. This requirement was not confined to rooftop stations, but also applied to stations built on *terra firma* whose antenna systems might not meet the Commission's efficiency figures.

The Commission's Rules in Section 73.160 provide a guide to calculations for the vertical radiation characteristics involving the use of top-loaded and sectionalized towers. However, these calculations are not necessary if the station is non-directional and a daytimer. This value is referred to as $f(\theta)$ where θ is the vertical angle of radiation. In a daytimer, unless it has to observe critical hour protection, only ground level radiation (horizontal) is used in the application.

Non-DA and daytime stations are not concerned with vertical plane radiation and use only the horizontal radiation at ground level $f(0)$. However, $f(\theta)$ enters into most directional antenna studies. Section (b)(2) of 73.160 provides the equation for calculating $f(\theta)$ if any reader needs it.

When filing an application specifying any type of antenna, other than a standard vertical of sufficient height to meet the radiation Rules, the Commission will require sufficient engineering data to convince them that the proposed antenna will meet their standards.

E-mail John at batcom@bright.net.

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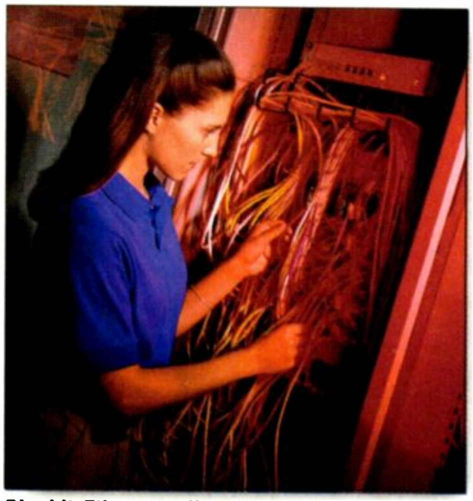
Gigabit Ethernet

By Kevin McNamara, CNE

In 1998, the IEEE adopted the standard defining one Gigabit (1Gb) Ethernet over fiber optic cabling. In June of 1999, the standard defining 1 Gigabit Ethernet, or 1000BaseT, over copper pairs was ratified.

The Gigabit Ethernet standard for operation over CAT-5 cabling, also known as IEEE 802.3ab, provides a seamless upgrade path from earlier versions of copper-based Ethernet. It supports such features as full and half duplex operations, the 802.3 Ethernet frame format and the CSMA/CD access method. The specification adopted for Gigabit Ethernet over fiber cabling is called 802.3z or 1000BaseX.

How is it possible to get the Gigabit rate over CAT-5 cabling? You may recall that 100BaseT Ethernet achieved higher throughput by using three-level binary encoded symbols sent at a rate of 125Mbaud across the cable. In addition, signals used separate pairs for transmit and receive, permitting full-duplex transmission capabilities. Gigabit Ethernet was developed as an extension to 100BaseT and uses the same 125Mbaud symbol rate; however, it uses five-level binary symbols operating over all four pairs of cabling. Each pair is also capable of transmitting and receiving simultaneously.



Gigabit Ethernet offers a bigger pipe for data distribution.

Network equipment supporting 1 Gigabit Ethernet, copper and fiber, is becoming available off the shelf. Fortunately, the network equipment designed to handle Gigabit Ethernet will also support earlier standards, such as 100BaseT and 10BaseT, so for a few extra dollars it is a wise investment to begin purchasing network hardware that will support the new standard, even if there are no current plans to upgrade the network infrastructure. Such an upgrade may make sense for several additional reasons.

- Higher-speed/more efficient networks can be built using existing cabling.
- There is no need for additional training of technical staff.
- Minimal disruption to the existing network is required.
- Copper cabling is the lowest cost method to deliver Gigabit Ethernet.

Why upgrade?

The answer to this question depends on the needs and objectives of the organization. The underlying theory is that the primary backbone provides a large pipeline to which data flows to/from one location to another. The size of this pipeline must be large enough to allow the unrestricted flow of data from the maximum amount of simultaneous users. In the classic client-server computing model, the network provided an efficient means to transfer files, share resources and access the Internet, but the actual processing of information took place on the desktop. Trends such as real-time multimedia content, storage area networking and remote application servers are placing demands on networks. In that same client-server model, workstations are connected to hubs, which are, in turn, connected to other hubs (or switches), etc. At some point, all of the data from these points will appear on the network backbone. Maintaining the proper bandwidth of this backbone and other portions of the network infrastructure is necessary for efficient operation. Gigabit Ethernet provides a means to increase the overall data throughput capabilities of a network at minimal cost.

Whether you plan to upgrade to Gigabit Ethernet now or in the future, there are some issues of which to be aware.

Cabling

One of the best features of the Gigabit Ethernet standard is that it will operate over existing CAT-5 cabling, assuming that the cabling and installation practices meet or exceed the standard defined in TIA/EIA-568A. In practice, this shouldn't be a problem if the cabling was installed within the past six years and tested in accordance with 568A, adopted in 1995. Most cabling systems, currently operating properly at the 100BaseT rate should pass Gigabit Ethernet; however, the higher demands placed on the cabling operating at the gigabit rate may show problems that were passable at 100BaseT. Each existing cable span should be tested using a cable analyzer suitable to certify operation for the new Gigabit standard. In particular, each cable span should be tested for return loss and *Equal Level Far End Crosstalk* (ELFEXT) (see September 2001 Networks) based on the 1000BastT specification. Most current cable analysis tools can be upgraded to conform to the latest specifications through a software download or by purchasing a hardware module.

If plans call for the installation of new cabling, consider using the new generation of cable that conforms to the new CAT-5e specification. The specification for CAT-5e

cabling is similar to that of CAT-5, except that it is required to meet more stringent performance requirements for return loss and ELFEXT. Several manufacturers also offer cabling meeting the more enhanced CAT-6 and -7 pre-standard cabling products, which permit transmission of data at speeds in excess of 600MHz.

In all cases, maximum length of cabling per segment is at 100 meters, as specified in the TIA/EIA-568-A standard.

Since Gigabit Ethernet will pass slower signals, it is best to install the fastest hardware you can to be future ready.

Upgrade paths

Network upgrades should be performed at the top-most levels of the infrastructure, typically the level that handles the largest amount of aggregated data traffic, such as switch-to-switch or switch-to-router. Some possible scenarios follow.

Switch-to-switch. Upgrading from 100BaseT to Gigabit Ethernet switches would permit more switched and shared segments. This is beneficial for networks that carry large amounts of multimedia or streaming content.

Switch-to-server. Facilities that maintain high performance and multiple servers that provide multimedia content, high availability to users, and complex database, graphical and scientific function, would benefit from an upgrade to Gigabit Ethernet from the servers to the network switch.

Switch-to-hubs/routers. In a switched network environment, upgrading hubs (or workgroup switches) and routers to Gigabit Ethernet would increase the overall bandwidth, number of available segments and the total amount of nodes per segment.

User-to-hub (switch). An upgrade would permit increased speed between high-performance workstations and Gigabit network infrastructure.

Backbone. Buildings and campuses are typically interconnected via high-speed backbone using fiber (or wireless) media. Backbones using fiber, or FDDI, can be upgraded either through replacement of existing FDDI hubs to Gigabit Ethernet switches or through the addition of an FDDI switch that can be interfaced directly into Gigabit Ethernet infrastructures.

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) 846-9000 or go to www.sbe.org for more information on SBE Certification.

Class C-0 FM implementation

By Harry Martin

In November 2000 the Commission created a new FM channel classification to join Classes A, B, B1, C, C1,C2 and C3. Use of the new class—Class C-0 (C-Zero)—permits upgrades of existing stations and new allocations based on the reduced spacing protections, which will apply when Class C stations are converted to Class C-0.

FM Class C is designed for regional use by stations operating with 100kW at up to 600 meters (about 2,000 feet) antenna height above average terrain. Since all FM channels are, for allocation purposes, protected to the maximum potential facilities for their class, full Class C channels are treated for interference-protection purposes as if they are being used (or, in the case of vacant channels, will be used) at 100kW/600m.

However, few Class C stations operate with such maximum facilities. Thus, Class C stations have been able to operate at as little as 300 meters and still lay claim to full Class C protection. The Commission decided to recover the resulting unused FM spectrum by creating the intermediate Class C-0.

The creation of the new class has multiple potential effects on existing licensees. Stations operating on full Class C channels with antenna heights of 450 meters or less are subject to downgrading if another station files a channel allotment proposal that would necessitate the downgrading of the existing full Class C station to C-0 status.

Such downgrading is not automatic. The proponent of the downgrading must certify that no alternate channel is available to permit the service it is proposing. The Commission then issues a *show cause* order directed to the affected Class C licensee, giving it 30 days in which to express, in writing, its intention to seek an upgrade of its facilities to preserve its Class C status. The affected licensee then has 180 days to file an application to increase its height above 450 meters. After approval, the licensee has three years in which to construct its full Class C facilities. The affected licensee could also argue that the initial downgrading proposal does not conform to the rules, or that another channel could be used to achieve the desired result.

The new class may be useful to licensees who see the possibility of improving their facilities or adding a new channel into a desired community. However, a recalcitrant full Class C licensee would likely be able to stall such an effort for several years by availing itself of the procedural rights described above.

Two notes: First, vacant Class C allotments are preserved against reclassification, but pending applications for full Class C allotments that propose antenna heights of 450 meters or less, are being downgraded to Class C-0 status; second, while new rulemaking proposals may invoke Class C-0, counter-proposals filed in response to notices of proposed rulemaking may not rely on Class C-0 possibilities.

NCE commercialization issues

In a September decision by the Enforcement Bureau, the FCC admonished a noncommercial FM station in Alabama for broadcasting commercial matter in violation of Section 399B of the Communications Act, which prohibits the use of underwriting announcements to promote the contributor's products, services or business. Acknowledgments may only include identifying information about the contributor.

The Commission found that language that stated that the sponsor's dealers "usually deal only with America's largest importers" constituted a promotion because it distinguished the underwriter from competitors. Similarly, references to an underwriter's inventory of "name-brand" musical instruments were deemed promotional because the reference casts the product in a favorable light.

Also found to be prohibitively promotional were a reference to an underwriter's having "kept up with changing technology" and a description of a service as "convenient."

The Commission also noted that the longer it takes in the underwriter announcement to identify the underwriters, the more likely it is that the announcement will be found to be a promotional message.

EEO update

The FCC will not seek review by the U.S. Supreme Court to reinstate the EEO rules that were declared unconstitutional by the U.S. Court of Appeals in the District of Columbia in January. The Commission's position is that it will try to revise its earlier rules to meet the concerns of the Court. That proceeding, however, has not yet begun. While two public interests have filed appeals on their own, the chances that the Supreme Court will take the case without the FCC's participation are very slim.

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

Dateline

February 1, 2002 is the deadline for biennial ownership reports for broadcast stations in Arkansas, Kansas, Louisiana, Mississippi, Nebraska, New Jersey, New York and Oklahoma

By
Doug Irwin

Testing IBOC

As broadcasting enters a new era, the industry must determine the viability and benefits of the IBOC system.

Those who follow the trades and attend trade shows know by now that iBiquity has completed tests for its FM IBOC system, and tests for the AM version are currently underway. The tests and their procedures were specified by the NRSC. What interests most broadcasters is understanding the test objectives. At this critical point in the acceptance of IBOC, stations should be aware of the efforts being made to develop a workable and realistic system.

NRSC inquiry and objectives

In August 2000, the NRSC released a Request for Proposals offering all parties with functional IBOC DAB systems an opportunity to participate in the NRSC's standards development process. IBiquity was the only organization that responded to this request. At one time, there were three IBOC proponents: USA Digital Radio (USADR), Lucent Digital Radio (LDR) and Digital Radio Express (DRE). Digital Radio Express was acquired by USA Digital Radio in 1999. IBiquity was then formed after the merger of USA Digital Radio and Lucent Digital Radio in August 2000. At the end of 2000, the NRSC had developed comprehensive FM IBOC laboratory test procedures in addition to field test procedures that focused on two areas. The first area of focus was the performance of the system under adverse ("real world") conditions. The second was the effect that the IBOC transmissions had upon current analog FM transmissions (compatibility). IBiquity carried out the tests using the IBOC systems that had been developed by its predecessors, USADR and LDR.

Simply stated, the tests that the NRSC developed were designed to demonstrate conclusively that an IBOC system would provide a significant improvement over the current analog technology. Tests were developed that were both of an objective nature (laboratory) and of a subjective nature (field tests).

The laboratory tests were carried out by the Advanced Television Technology Center in Alexandria, VA. The NRSC and its observers were allowed access to all ATTC testing, and an NRSC representative took part in the lab's work. The ATTC recorded the data from the tests. In addition to the objective measurements, ATTC recorded audio samples for subsequent subjective tests carried out by Dynastat in Austin, TX. Details of these tests will be discussed later.

Testing IBOC

The field tests

For the field tests, the NRSC specified many aspects, including the receivers that were to be used. These receivers were chosen on the basis of market information, as well as their performance abilities in their respective market segments. All four receivers were used for performance tests (in direct comparison to the digital receiver) and compatibility tests.

The NRSC defined the adverse conditions under which the IBOC system was to be tested in the field. These conditions were: a clean channel environment; physical impairments such as distance and terrain shielding; co-channel and adjacent channel interference; and multipath interference. The compatibility study looked at the effects of the IBOC transmission on co-channel, first adjacent, and second adjacent stations.

The NRSC also identified particular stations (and the driving routes) to be used in the field tests.

Members of the iBiquity staff made the field measurements. In most cases, an auditor from the ATTC was present. Additionally, an NRSC observer witnessed all of the tests.

The measurements were both complex and thorough. From the whip antenna on the roof of the test vehicle, the RF was divided four ways. The first two outputs went to the two mobile receivers as shown in Figure 1. The third output went to the IBOC receiver itself. The fourth went to the spectrum analyzer on-board the truck.

Type	Manufacturer	Model #
Original equipment Auto	Delphi	PN 09394139
Aftermarket Auto	Pioneer	KEH-1900
Home Hi-fi	Technics	SA-EX140
Portable	Sony	CFD-S22

Figure 1. The various receivers used during the NRSC tests.

Three sets of audio outputs from the respective receivers were recorded on a Tascam DA-98 digital recorder. This audio was used for subjective tests that were carried out later. An on-board computer was used to record data such as signal strengths (derived from the spectrum analyzer) and GPS information. In addition, the computer was used to store images from video cameras facing fore and aft of the vehicle. This visual information allowed the iBiquity testers to correlate reception anomalies heard in the recorded audio that were the result of environmental changes, such as overpasses and large trucks, that were encountered along the way during driving tests.

The field test stations incorporated in the NRSC test procedures were selected to assess system performance in common FM environments. Figure 2 shows the stations that were tested, and Figure 3 shows which environmental characteristic were scrutinized.

As each of these particular cases was evaluated, the data was recorded in the mobile test vehicle, and the audio recordings made were used for later subjective evaluations.

The stations and the results

The various stations were chosen because of certain unique characteristics that were useful in evaluating various test parameters.

Overall coverage. WETA has an extensive coverage area without any strong first- or second-adjacent interfering signals. The coverage of the digital signal was consistent out to the 35dBu level of the analog transmitter.

First-adjacent analog interference. Both WPOC and WNEW have first-adjacent channel interference, which does not have an effect on the digital coverage. Even in the presence of this interference, the digital coverage for each station went out to the 35dBu to 38dBu level of the analog transmitter.

Second-adjacent analog interference. Tests conducted on WNEW in the presence of strong second-adjacent channel interference from WBAB in Babylon, NY, attest to the robustness of the digital system. The digital coverage in this case extended to the 100dBu contour of WBAB. At that point the desired to undesired ratio (D/UD) was approximately -47dB. Similar results were obtained from the KLLC testing in the San Francisco market. KLLC has a strong second adjacency (KFFG) on 97.7 in the southern half of the Bay Area. The digital coverage of KLLC extended to within the 80dBu contour of KFFG.

Second-adjacent digital interference. WD2XAB was used to demonstrate the IBOC system's ability to maintain digital coverage with a second-adjacent channel digital interference source. WD2XAB operated at 93.5 in hybrid mode (analog and digital signals broadcast simultaneously) while WPOC operated at 93.1, also in hybrid mode. While running 8W of digital power, WD2XAB still offered digital service up to the point where the desired to undesired ratio (with respect to WPOC) was -15dB.

Dual second adjacency interferers. WHFS has strong levels of second-adjacent interference from stations operating in the same market. WHFS transmits on 99.1, while WIHT transmits on 99.5 and WMZQ transmits on 98.7. The IBOC system broadcast on WHFS still gave partial digital coverage at the 120dBu contour of WMZQ.

Testing IBOC

Station	Location	Frequency	Class	Power	HAAT	Digital Power
WETA	Washington, DC	90.9	B	75kW	185m	750W
WHFS	Annapolis, MD	99.1	B	50kW	142m	500W
WPOC	Baltimore, MD	93.1	B	16kW	269m	60W
WNEW	New York, NY	102.7	B	6kW	413m	60W
WWIN	Baltimore, MD	95.9	A	3kW	95m	30W
KWNR	Las Vegas, NV	95.5	C	92kW	351m	920W
KLLC	San Francisco, CA	97.3	B	82kW	315m	820W
WD2XA3	Columbia, MD	93.5	n/a	800W	15m	8W

Figure 2. The stations used for the iBiquity and subsequent NRSC tests.

Coverage with multipath. Tests taken with KWNR in Las Vegas show that the system is robust, even while experiencing high levels of multipath. This was confirmed on tests done with WNEW, transmitting from the Empire State Building. Driving the streets of Manhattan, the user of an analog radio will encounter extreme multipath distortion. Yet, the IBOC system performed extremely well, rarely blending to analog from digital. Further tests on KLLC in San Francisco provided similar results.

Class A facility. Class A tests were performed on WWIN in Baltimore. WWIN has strong second-adjacent interfering stations (WHUR and WPGC from Washington) and a strong first-adjacent interfering signal (WSOX from Red Lion, PA). Yet, the digital coverage was basically the same as the protected contour of the station.

Terrain Obstructions. Even with terrain obstructions, the digital system is able to provide coverage that is comparable to the analog coverage. San Francisco and Las Vegas provided the greatest challenges related to terrain among the stations that were tested. In the case of the KLLC coverage of the Bay Area (with which I am very familiar), digital service was provided throughout the greater Bay Area, with the exception of the areas east of San Francisco that are severely shadowed by the East Bay hills.

Nearly all of the San Francisco stations have fairly large, on-channel boosters to provide coverage in these areas.

Subjective testing and results

It is widely accepted in both the telecommunications and audio industries that subjective testing is the gold standard for audio system evaluations. IBiquity believes that subjective evaluation using participants from the general population provides the best means to assess the true significance of the system's performance. The NRSC believes that the use of the general population gives better insight into the

potential acceptance of the system in the marketplace. About 480 people, from diverse demographic backgrounds, took part in the subjective testing. The subjective evaluation lab screened these participants for their ability to distinguish small impairments and/or differences in audio quality. Only participants who were trained and passed the screening test were used in the tests that generated data subsequently presented to the NRSC.

The audio samples that were used in the evaluations were derived from recordings made in the iBiquity mobile test vehicle, under the various conditions discussed above. The evaluators were given analog and digital samples that were recorded simultaneously from the same point of a particular test radial.

Using a test methodology known as *Absolute Category Mean Opinion Score*, the participants were asked to rate the quality of the audio samples as excellent, good, fair, poor, and bad. These answers were then translated in to numerical values (five through one), which were then used to draw conclusions.

The performance tests, taken in their entirety (counting the first- and second-adjacent channel interference, and the various other impairment tests such as noise and multipath), show conclusively the superiority of the audio of the digital system over the analog FM. Perhaps just as important as the baseline quality of the audio is the tremendous durability of the system, its proven ability to continue to operate in the presence of real world impairments. Finally, test results show that the introduction of IBOC will have no meaningful effect on existing analog stations and their listeners.

The success of iBiquity's efforts to enhance the listening experience and

Station	Characteristic Assessed
WETA	Overall coverage in an area characterized by low interference
WPOC, WNEW	1st adjacent channel interference
WNEW, KLLC	2nd adjacent analog interference
WD2XAB	2nd adjacent digital interference
WHFS	Dual second adjacent channel analog interference
WNEW, KLLC, KWNR, WHFS	Multipath
WWIN	Class A facility
WNEW	Centrally Located urban antenna
KLLC, KWNR	Terrain obstructions
WWIN	Low Level power combining

Figure 3. Test stations were chosen because of certain characteristics that could be evaluated during the IBOC tests.

to improve audio quality is borne out by the subjective evaluation results.

SCA testing

IBiquity carried out a series of measurements designed to test the compatibility of SCA transmission with that of IBOC. This was not part of the NRSC test, and was not as extensive as the NRSC tests, at least in the number of stations and real-world situations that were examined.

Most of the tests were objective, i.e., done in the laboratory. Using standard broadcast transmission equipment and commercially available SCA receivers, 67kHz and 92kHz SCA transmission were examined. The conclusion is that while a performance degradation can be measured, it is so small as to not effect the SCA system performance. A subjective measurement was done on WETA-FM using receivers and listeners located at the offices of National Public Radio. No one in attendance was able to hear any impairment of the 67kHz SCA in the presence of the IBOC carriers on WETA.

A typical digital SCA (centered at 66.5kHz) was tested in the lab and in the field (on WD2XAB). In the presence of the IBOC carriers, a slightly higher bit-error rate was measured, but the difference was negligible. Performance of an SCA system such as this will not be significantly altered by the presence of IBOC carriers.

On-channel boosters

Field measurements taken on KLLC in the San Francisco Bay Area (as part of the NRSC tests) show that IBOC will not obviate the need for analog booster transmitters that provide fill coverage in areas suffering from severe terrain impairments. Indeed, the iBiquity report states that the same areas that are now covered by analog boosters will be able to get digital coverage by small IBOC boosters.

While one always expects any organization's report on itself to be painted in the most favorable terms, it is hard to do anything but draw the same conclusions iBiquity has after looking at the test results presented in its report to the NRSC. It is obvious from even the most meager knowledge of communications that our environment is permeated with digital radio transmissions. That technology is not new but is evolving in many favorable ways. The fact that the consumer wants digital audio is a given, as is the fact that analog FM has its drawbacks. The recent launch of XM Satellite Radio, with its great early success, and the imminent service launch of its competitor Sirius Satellite radio on February 14, 2002, compels the traditional broadcast world to embrace the IBOC technology, for its own good and long-term viability.

Doug Irwin is director of engineering for Clear Channel San Francisco.

Selecting a new transmitter

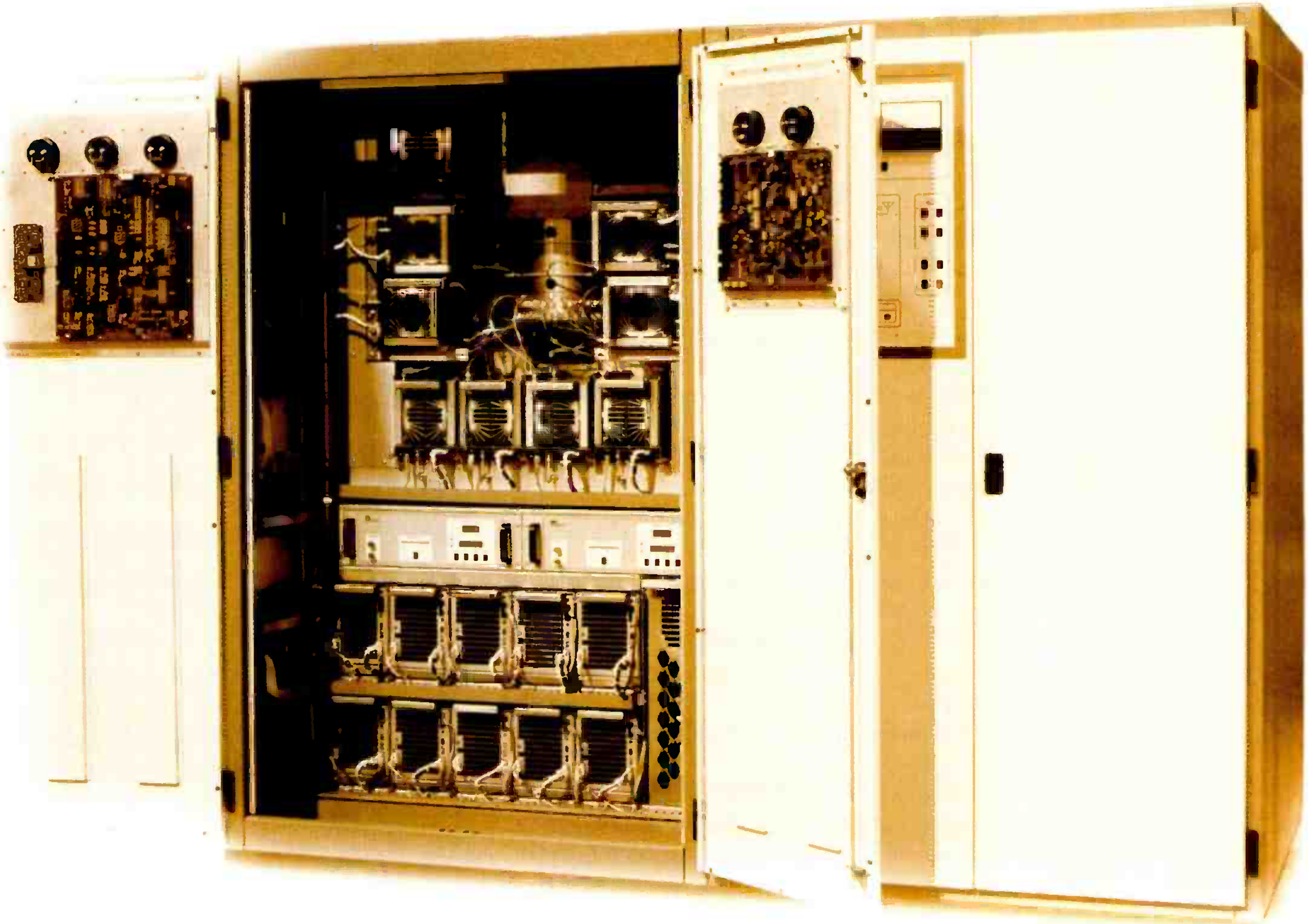
By Hal Kneller, CPBE CBNT

Solid-state technology has taken over the major AM broadcast transmitter manufacturers, and up to 40kW of solid-state power is available in FM. When making the decision to buy a new transmitter, there are several factors to consider. We will look at some of these choices and offer suggestions on how to weigh each of them in your decision.

Redundancy and soft failure modes are the solid-state rule. Remaining on the air despite module failures is the benefit when common points of failure are eliminated. Individual redundancies and features vary by company, so buyer diligence is required.

When shopping for an AM transmitter at any power level, the only choices from the major U.S. manufacturers are solid-state amplifiers. Choosing between solid-state versus tube for FM based on price hovers around the 3kW to 5kW level. For a 10kW solid-state FM transmitter, the added premium over the cost of a tube transmitter is small enough to justify the purchase unless the transmitter is destined for secondary or back-up use. Some manufacturers are making attempts to produce a solid-state line at tube prices, and some have dropped tube transmitters below 10kW. Those building a 20kW solid-state FM transmitter, such as Nautel's Q-20, have a price advantage over others who combine two 10kW cabinets. Pricing at 10kW and below appears reasonably competitive between manufacturers. Still, single-tube transmitters at higher power levels of 20kW and up offer a significantly lower acquisition price.

When contemplating a new transmitter purchase, one must examine time, expense, ease of maintenance, overall reliability and possibly IBOC-conversion compatibility. The cost of ownership should be considered in the purchase decision, since a transmitter's life expectancy is typically 10 to15 years. There are direct savings in a reduced electrical bill (particularly in AM) and the cost savings in tubes, in addition to the claims of reduced maintenance. For AM transmitters, an immediate breakeven occurs, since there is no real purchase price difference, and electrical savings over older transmitters can be substantial at higher power stations. FM power savings range from negative to marginal, so all cost recovery depends on elimination of tubes and reduced maintenance. The real payback depends on the value of lost airtime and reduced maintenance costs. Remote or difficult-to-access transmitter locations, and major-market installations will benefit from the redundancy and reliability of the newer solid-state units. In smaller markets, some stations may be comfortable not having a backup if a modern, solid-state transmitter is in use. New features available in current solid-state transmitters include automatic switching of dual IPAs and dual exciters, switchless automatic combiners, cooling fans on each module or redundant fans, multiple power supplies and dual controllers. All these factors contribute to significant reductions in lost air time from a transmitter failure.



Selecting a new transmitter

Better specs

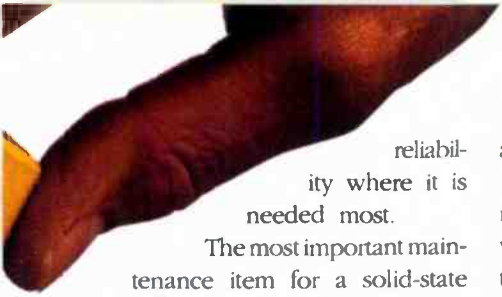
Overall, solid-state performance has allowed AM and FM analog transmission systems to reach the operating capability limits of the medium. How much better do newer FM solid-state transmitters perform? Several manufacturers report exciter specifications that are essentially passed through the solid-state power amplifier, whereas some degradation of performance is noted when using tube final amplifiers, particularly in AM and FM noise performance. In solid-state use, the FM exciter is the key to high system performance. In current-generation AM transmitters, receivers do not measure up to the quality that can be transmitted (±0.5dB 50Hz-10kHz, <1% THD and IMD with -60dB noise).

Large clusters of commonly owned stations have appeared in markets with fewer engineers to maintain them, making transmitter maintenance key. Historically, tube transmitters suffered from poor designs such as low-headroom tube-driver sections, self-oscillating tetrodes, and tube failures. Modern single-tube transmitter designs incorporating solid-state drivers have eliminated 99% of these problems. In general, repairs and troubleshooting are easier with a solid-state unit. Manufacturers have greatly simplified identifying and replacing a failed subassembly. While modern tube transmitters outperform their predecessors, a failure still typically results in lost air time. However, a solid-state transmitter will stay on the air at some power level, even if devices fail.

Solid-state FM power levels of up to 40kW are now available.

Newer feature sets

During a visit to the Harris facility in Quincy, IL, I noticed a Z10CD transmitter on final test. It had a custom panel that permitted any one of five or six frequencies to be selected. A group operator had purchased this unit (to be connected to a wideband antenna) to function as a multistation backup for a market. This would not have been possible with tubes and tuned circuits. This approach enhances



reliability where it is needed most.

The most important maintenance item for a solid-state transmitter is to keep it clean. New transmitters should be installed in clean room environments as well. Maintenance-cost savings are quickly realized compared to a tube transmitter, which, in addition to more frequent cleaning because of the high voltages, includes such work as filament adjustment and tuning touch-ups to get the most life from the tube. Tube replacement is another cost issue, along with tube sockets and associated components.

By adding the number of solid-state (both AM and FM) transmitters in the field, we may be approaching 10,000 units worldwide, indicating that the tube transmitter's days are numbered, certainly at the 10kW and below power level for FM. As manufacturing costs continue to decrease and new, higher power devices are brought to market, the premium to manufacture solid-state transmitters will continue to be mitigated or even eliminated.

A look at the past

Successful solid-state AM broadcast transmitters were introduced in 1975 when Harris installed an MW-1 (1kW series-modulated using bipolar devices) at KXEO in Mexico, MO. In 1982 Nautel introduced the pulse-modulated AMFET series with up to 10kW of solid-state power, offering the first higher power AM units (using MOSFETS). Harris followed that with the SX series in 1983 with a polyphase PDM design offering 1kW to 5kW. Today's Gates third-generation series is similar. Even first-generation AM solid-state transmitters claimed an operational power cost advantage, eliminated tube cost and had excellent audio performance. Harris and Nautel introduced 50kW solid-state AM transmitters by the mid 1980s. By then, Broadcast Electronics, Continental and several others were selling solid-state AM transmitters (10kW and below) for the U.S. market. Continental has dropped its AM and FM solid-state product line for 10kW and higher single-tube FM transmitters.

Higher power solid-state FM transmitters (above a few hundred watts) were much slower to appear due to the lack of suitable devices for VHF frequencies. It was in 1991 or 1992 that Nautel introduced the FM7 (using MOSFETs), which eventually migrated to the 10kW power level at which FM solid-state transmitters gained significant market acceptance. QEI also sold Quantum solid-state transmitters during the mid 90's. Harris introduced the Platinum line soon after and unveiled the Z line in 1996.

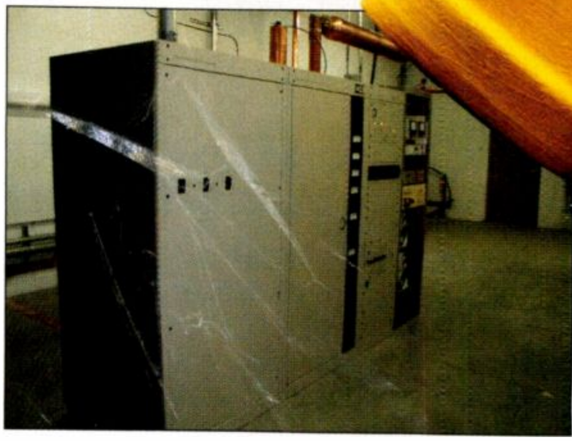
Digital FM exciters have also taken firm hold; several thousand digital exciters have been shipped from various manufacturers. The digital exciters feature composite analog or AES-3 digital inputs, along with an analog SCA input.

Selecting a new transmitter

Here to stay

Solid-state AM and FM radio broadcast transmitter technology is relatively mature, yet some engineers are still concerned about lightning damage to solid-state devices. Anyone who thinks solid-state is more vulnerable to lightning has not been paying attention. Many communication industry installations use only solid-state transmitters and base stations with big antennas.

Because the minute thermal mass of a transistor junction is less forgiving than a large tube filament, a greater adherence to good engineering practice and planned dissipation paths is required. All transmitters, AM or FM, tube or solid-state, should be installed using good engineering practices. This is especially true in the areas of grounding and AC line protection. If properly installed, solid-state transmitters can survive lightning as well as a tube rig.



The costs for tube vs. solid-state for higher-power FM transmitters are competitive. A station's individual application will determine which is better.

Manufacturers can do a better job communicating proper grounding and installation techniques and surge suppression in their instruction manuals. Nautel provides an excellent *Site Preparation Guide* that explains and demonstrates proper methods for installing any transmitter.

Another issue we hear less about today is the sensitivity of modern AM transmitters to improper loads. Some transmitters no longer even have front-panel tuning or loading controls.

Most current solid-state FM products can be linearized from the factory or in the field for IBOC FM common amplification mode. AM solid-state pulse modulated products should be easily modified, if not already suitable. Several AM transmitter manufacturers are now shipping "IBOC-ready" units.

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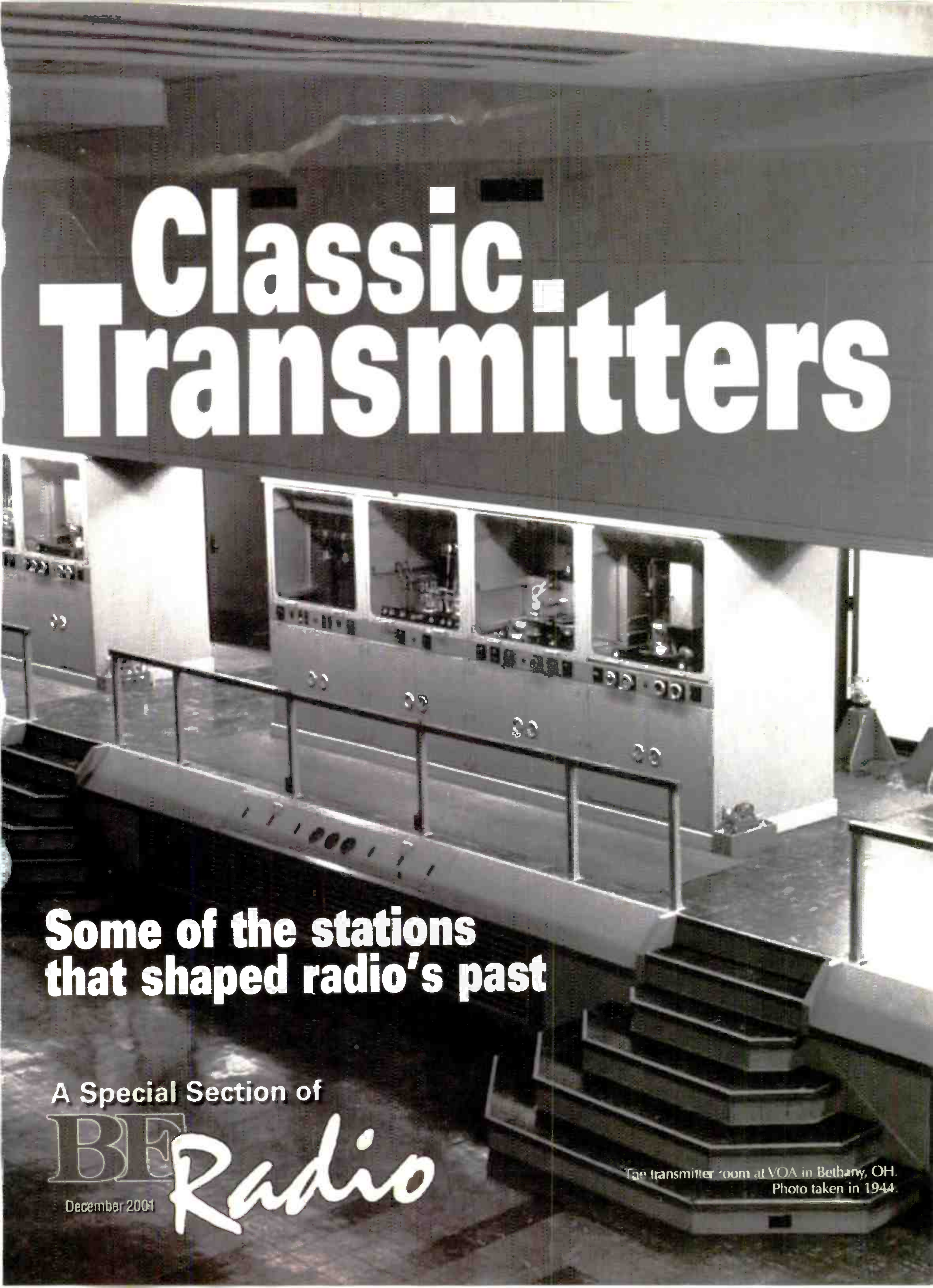


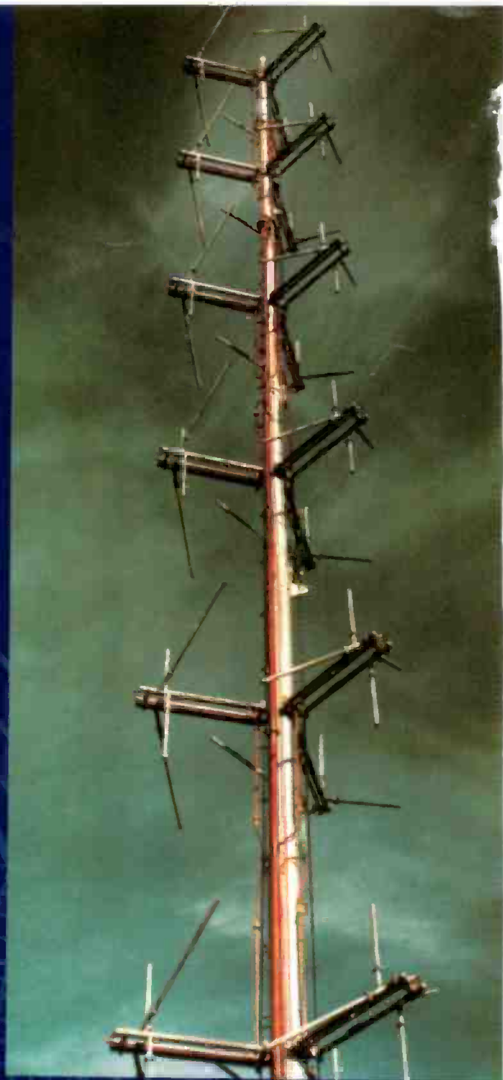
Classic Transmitters

Some of the stations that shaped radio's past

A Special Section of BE Radio

December 2001

The transmitter room at VOA in Bethany, OH. Photo taken in 1944.



Classic Transmitters

Some of the stations that shaped radio's past

By Steve Walker

Radio broadcasting in the U.S. has a rich history, and great stories have been told and written about call letter origins, news coverage, format development, programming and promotion snafus, and all the famous TV celebrities that got their starts in radio.

All of those stories enjoy varying degrees of interest from radio broadcasters and their listeners, but there are also hundreds of great stories that are of interest primarily to engineers.

If you've ever gotten together with other engineers at an SBE function, at the NAB or just an impromptu lunch with fellow transmitter hacks, the conversation has probably turned to stories about weird, funny or unfortunate happenings at some transmitter site or other. Nearly all broadcast engineers have at least one story to tell.

There are stories about haunted transmitter sites, transmitters with minds of their own, plate transformers falling through the floor, guy wires being cut, fried mice, freaky phone lines...the list goes on and on.

Some of the best stories come from some of the oldest transmitter sites. Sites you might term classic. We have gathered a few of these stories together to entertain and inform.

Walker is a freelance writer and station engineer for KBFB and KTXQ in Dallas. Contact Walker at beradio@primediabusiness.com.

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A singing washing machine?

S12 ... The Worlds Largest Battery
KLIF, Dallas
The world's largest battery was created by a young broadcast engineer in Dallas.

If you have stories you would like to share or information about radio from days gone by, send them to us at BE Radio magazine, 9800 Metcalf, Overland Park, KS 66212 or e-mail beradio@primediabusiness.com. Please include your contact information.

Let's Automate!

For nearly 60 years, the Voice of America (VOA) has been the USA's primary means of disseminating news and information throughout the world. Today, a network of 22 stations broadcasts material from 40 radio and three fully equipped television stations in Washington, DC, to more than 1,000 stations worldwide. One particular VOA relay station has some interesting stories to tell. Here is one of them.

The Bethany, OH, station was originally built during World War II. It was built so far inland because there was concern that German submarine activity along the East Coast might result in a coastal station being damaged or destroyed, and Bethany would be its backup. In fact, several of the rhombic antenna arrays at Bethany were aimed toward Europe.

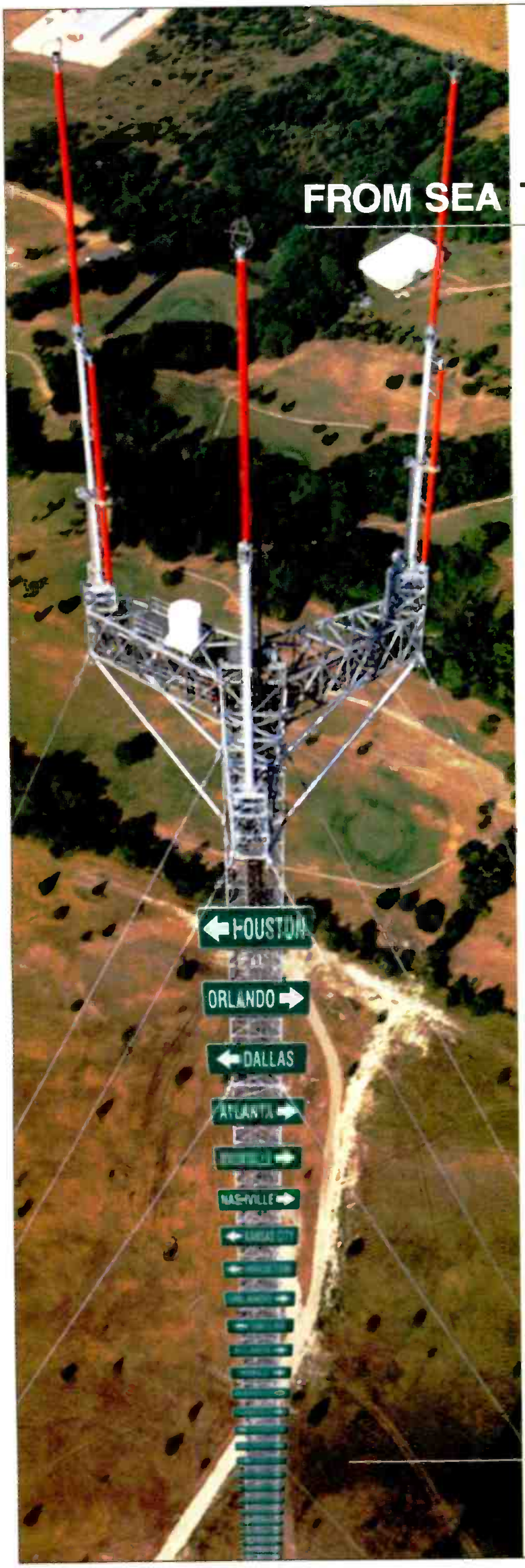
Other antennas at Bethany were used to broadcast directly to Central and South America and to relay Radio Marti to these countries, as they are directly south of the Bethany location.

The Bethany station was also used for Armed Forces Radio and Television Service (AFRTS) until the service discontinued the use of the HF band.

Operating at frequencies between 6MHz and 21MHz, time of day and atmospheric conditions required regular frequency changes at Bethany. In addition to changing loading caps and coils, each frequency change required antenna switching. The antenna system required manual switching.

John Vodenik, a VOA transmitter technician now stationed in California, was an operator at the Bethany relay station. "To switch antennas, a technician had to go outside into the switch matrix, sometimes in extremely cold or stormy weather conditions, and throw at least two of the antenna switches, often more," recalls Vodenik. "It took operating crews of three people as much as seven or eight minutes to change the frequencies. At one point, my crew had it down to a record of less than six minutes—but we had to hustle.

"In an attempt to get our speed up



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United We Stand

Let's Automate!

The antenna arrays at the Bethany, OH, site.

so we could continue to beat the other crews, we came up with the idea of automating the antenna switching." So one day, Vodenik stopped at the local hardware store and bought an automation system. It consisted of a 200-ft. roll of 1/8-inch nylon cord.

The crew wanted to make sure that they built the automation systematically, so they decided that as a test they would only automate one switch the first time. So before it was time to switch to 6.030MHz, Vodenik and another crewmember went outside and pre-set all but one switch. They connected one end of the nylon line to the last switch handle, ran the line down the pole and through a pulley at the bottom so that it came off at about 90 degrees. The line then went into the building where an operator could sit back and relax until it was time to switch. All the operator had to do was tug the line, and the experiment would undoubtedly be a success.

As the scheduled time for the frequency change approached, the crew was anxious to see the automation system in action. After all, this could potentially put an end to the treks into the frigid cold and rain.

When the time came, the transmitter was taken off the air and the work began. The coils in the RF driver stage were changed, and the 15MHz shorting bar was removed from the output tank circuit. Everyone was looking forward to being able to complete the job without setting foot out of the transmitter room.

When it was time to switch, the crew gathered around the free end of the nylon line, and one crewmember picked it up. Recalls Vodenik, "He pulled on the line—and pulled some more. He pulled and pulled, and still the antenna didn't switch."

No one remembered that nylon stretches, and it surely did that day.

"After we had been off the air about eight minutes, the switch finally dropped. But there wasn't enough force to cause it to close. So someone had to run outside after all and close the switch. We set another record that day—ten minutes for a frequency change."

Vodenik says the group decided that the system wasn't meant to be automated, and they never tried again. "We had to live down a lot of laughter, but we laughed too."

Years later, Jim Hawkins, who maintains the Jim Hawkins' Radio and Technology Page website visited the site. When he asked why the antenna switching wasn't more automated, he was told, "Because it works fine the way it is."

Photos by Jim Hawkins.

The transmitter control room.

The Bethany VOA site had three Collins 821A1 transmitters. There were 22 different antennas held up by 110 telephone poles, some of which were later replaced with self-supporting towers. The rhombic antennas were 1,000 feet long per leg.

The Bethany station was dismantled in September 1995 as a result of budget cuts and a diminishing need for HF relays. Most programs are now relayed by satellite.

Three Collins 821A1 transmitters were used at the VOA site.


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The Case of the Modulated Maytag

It had been two weeks, and Mrs. Nelson still didn't know what the noise was or where it came from; the thump...chink...thump...chink... that seemed to come from nowhere. At first she was certain it was in the kitchen. Then she was sure it was the guest bedroom. Then it was the kitchen again. The noise seemed to move

WAPI is non-directional during the day and directional at night.

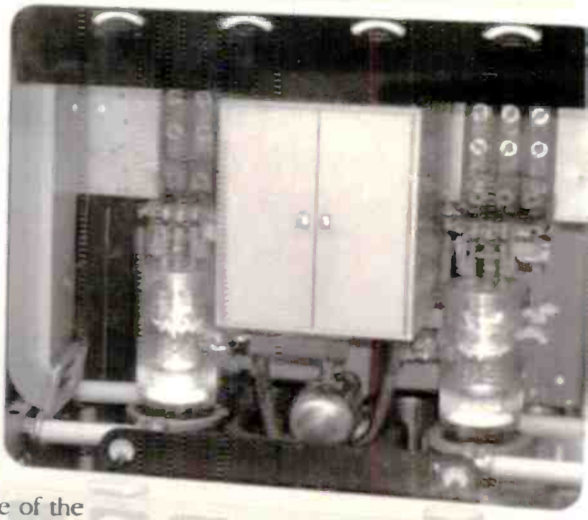
around, and it came and went at its own whimsy. Each morning she told Mr. Nelson about the noise, but the unmistakable rhythm was never beating in the early morning when he left for his job at the steel mill or in the evening when he returned.

Across town, in a nice two-story building near downtown Birmingham AL, WAPI-AM 1070 chief engineer Frank Giardina was showing a new staff engineer how to switch from the 50kW daytime power to the 5kW directional night parameters authorized by the FCC. Next to the remote control was a chart showing local sunrise and sunset times for the next few months.

Beautiful weather was in the forecast when Mrs. Nelson told her husband she wanted to stay home all weekend instead of making the usual trip to the lake. She had determined that the noise only came during the day when Mr. Nelson was at work. In fact, it seemed to come and go with the sun. This weekend, she wanted him home during the day. Maybe he would finally get to hear it. Reluctantly, Mr. Nelson agreed.

Sometime during the course of the weekend, and before the tree fell, the Nelsons determined that the noise was coming from the laundry room, which was just outside the kitchen.

On Monday morning, Giardina looked through the scrapbook someone had made for the station's sixtieth birthday, full of old newspaper clippings and photographs. Those people sure look funny, he thought.



But then, WAPI signed on in September of 1922, some 4-½ years before Congress created the Federal Radio Commission.

Giardina came across a 1952 picture of some of the early air talent heard

The neighbor's house where the singing washing machine lived is just beyond the transmitter site property line.

Modulated Maytag

The locks on the doghouses resonate during the day when WAPI is at high power.

on WAPI: Lum 'n' Abner, Burns and Allen, Amos 'n' Andy, and Baby Snooks. The headline began "Do you remember..." *Not really*, thought Giardina.

Finally he found what he was looking for: a special radio section of *The Birmingham News*, dedicated to WAPI at its first sign-on in its present location. This headline said "WAPI Operating Room Interesting." *Boy, can they write 'em*. The line Giardina was looking for came three-fourths of the way through the article: "Modulation is an important feature, and this has been taken care of by the latest equipment. Harmonics," the article continued, "are another feature that has been 'well taken care of.' " Giardina thought that this would be great material for the SBE chapter newsletter, but he was about to find something that would be even more newsworthy later that day.

It was just about then that Giardina's phone rang. It was Mrs. Nelson, muttering something about a tree and a fence. It seems that Mrs. Nelson lived just behind WAPI's 50kW AM transmitter site. One of the station's trees had fallen on her fence during the storm that had preempted the weekend's beautiful weather. She was calling to find out what Giardina was going to do about it.

When he arrived at the site, he found that a large pine tree had crumpled a portion of the fence. Pinecones and needles were everywhere, accompanied by the sweet scent of Southern pine in the air. Giardina went to the house to see Mrs. Nelson and found her talking on the telephone. When she finished, she mentioned that she could hear his radio station on the phone all day long.

They sat down to have a cup of coffee while Giardina related, in layman's terms, the story of how high concentrations of RF can do all sorts of strange things. He was telling her about the locks on his doghouse gates that play music during the day while the station runs at 50kW, when Mrs. Nelson had an idea. "Can it play music on washing machines?" she wondered.

When Giardina accompanied Mrs. Nelson to the laundry room, he heard the noise, the source of which had long eluded Mr. and Mrs. Nelson. She demonstrated how the noise would stop when the lid was touched and start again when it was let go. Likewise, the sound would stop when the lid was open and continue when the lid was closed. Always the same thump...chink... thump...chink. And always only during the day.

Detail of the top loading used on the towers.

Another mystery solved. Just a typical day in the life of a radio chief engineer. Apparently the oxidation present on the machine's lid had formed a diode detector—the Nelson's washer had become a crude crystal radio set.

WAPI took care of the fallen tree. The Nelsons got the firewood and a new fence. WAPI kept the pinecones. Mrs. Nelson and the washing machine are no longer there, but the doghouse locks still sing.

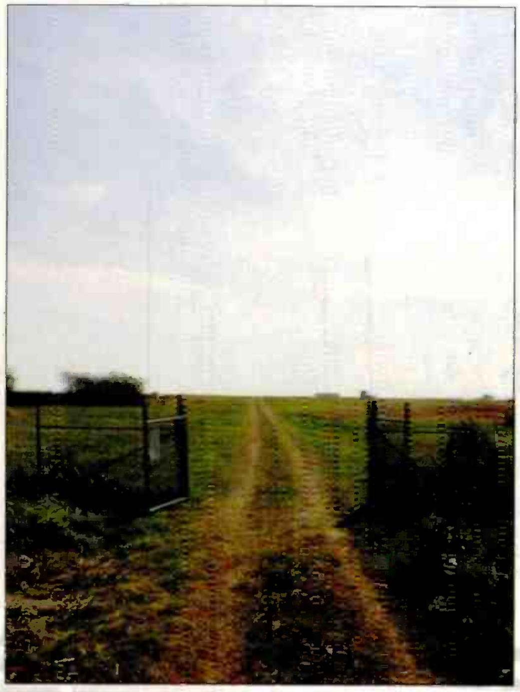
Today, WAPI uses a Harris MW-50 during the day (non-directional) and an MW-10 at running 5kW at night. The MW-10 is also used as a 10kW standby transmitter during the day when needed. The two windmill towers were built by the Battavia Wind Pump Company.

The World's Largest Battery

KLIF in Dallas is generally considered the birthplace of Top 40 radio, and Gordon McLendon is considered its daddy. On the air since November 1947, McLendon took a brave step in 1954 when he changed radio forever by instituting a 40-song play-

list and took the station from a 2% share to a 45% share almost overnight.

The station was 5kW non-directional during the day, but had a 1kW directional authority at night. The signal had long been unsatisfactory to McLendon. It was obvious to him that both Dallas and Fort Worth deserved to hear his station, even at night, so by 1969 he was determined to get a power increase from 1kW to 5kW at night, no matter what. The idea was to sacrifice nighttime coverage in less populated areas in favor of improved coverage of the entire metroplex.



The 12-tower array stretches for almost half a mile.

What he ended up with was a 12-tower array about 25 miles east of Dallas in Rockwall, TX, and a nighttime pattern that has been described as looking like a "Zeppelin with fish tails." Along with the 12 towers is a phaser that occupies five 42-inch wide cabinets. The man charged with installing this was Dave Hultsman, now domestic broadcast channel manager for Continental Electronics.

The 12 towers were arranged in two rows of six. The array was about a half mile long, and the rows of towers sat 200 feet apart.

With the towers up and the tower crew anxious to put in the ground system, Hultsman was under pressure to get the doghouse power, transmission lines and sampling lines buried. But not all of the sample line had arrived. The lines were 1,347 feet long and consisted of 3/8-inch unjacketed CATV cable, phase stabilized.

The transmission and sampling lines were specified to be the same length to simplify the phaser design and subsequent tuning. The towers nearer the transmitter building have a substantial amount of cable coiled and buried.

They had been ordered to be all the same length to make the already difficult task of phasing a 12-tower array as easy as possible. This meant that a lot of extra line for the towers nearest the transmitter building would have to be coiled underground.

Knowing that if he dug all the trenches and laid the power and transmission lines, the trenches would probably fill before the rest of the sample lines arrived, Hultsman was

World's Largest Battery

The stand-alone tower next to the transmitter building keeps the STL dish off the broadcast towers.

hoping to wait as long as possible to get started. But finally he gave in to the pressure and buried all he had, including three of the sampling lines. There were no doghouses yet, so the lines stuck out of the ground near each tower.

By the time the next shipment of sampling lines arrived, the trenches had caved in, so they had to be dug out by hand. As each trench was cleared, three sampling lines were buried. This continued until all the lines were buried.

Glenn Callison, McLendon's VP of engineering and Hultsman's boss, was in town to check the progress of the site. He grabbed an ohmmeter and put it on one of the sampling lines. It read a dead short. Callison was on a tight travel schedule and wasn't able to troubleshoot the line, so he gave Hultsman the responsibility of figuring out what was wrong.

"I had a lot on my plate and had hoped that Callison would deal with the sampling line issue, but the problem was given to me anyway." When Hultsman checked his first line, he didn't read a short. Instead, his meter slammed into the left peg. Knowing he had not discovered negative resistance, he measured for voltage and found a 0.3V potential between the center conductor and the outer shield.

Hultsman recalls, "I checked all the lines and found problems with most of them. I still held out some hope that Callison would deal with this as I was having problems with the power company. I finally got tired of being chewed out about not having it solved, so I got some rags and a tube cutter and headed out to tower 4. The soil was still a little loose so it wasn't too hard to dig up the line by hand. They were buried about 48 inches deep.

"When I got to the line, I could tell it didn't look right. So I kept digging until I had about a two-foot section completely exposed."

Hultsman then began trying to clean the muddy lines using the rags until finally he saw what had happened. "It looked like the entire line had been eaten up with some kind of acid. It turns out that the dissimilar metals of aluminum and copper, separated by the foam had undergone a chemical reaction with the wet soil, which is very acidic in North Texas, and created what one of my coworkers dubbed 'the world's most expensive battery'—12 cells and a grand total of about 3.6 volts if we could have hooked them all in series."

The base of tower eight and the original doghouse

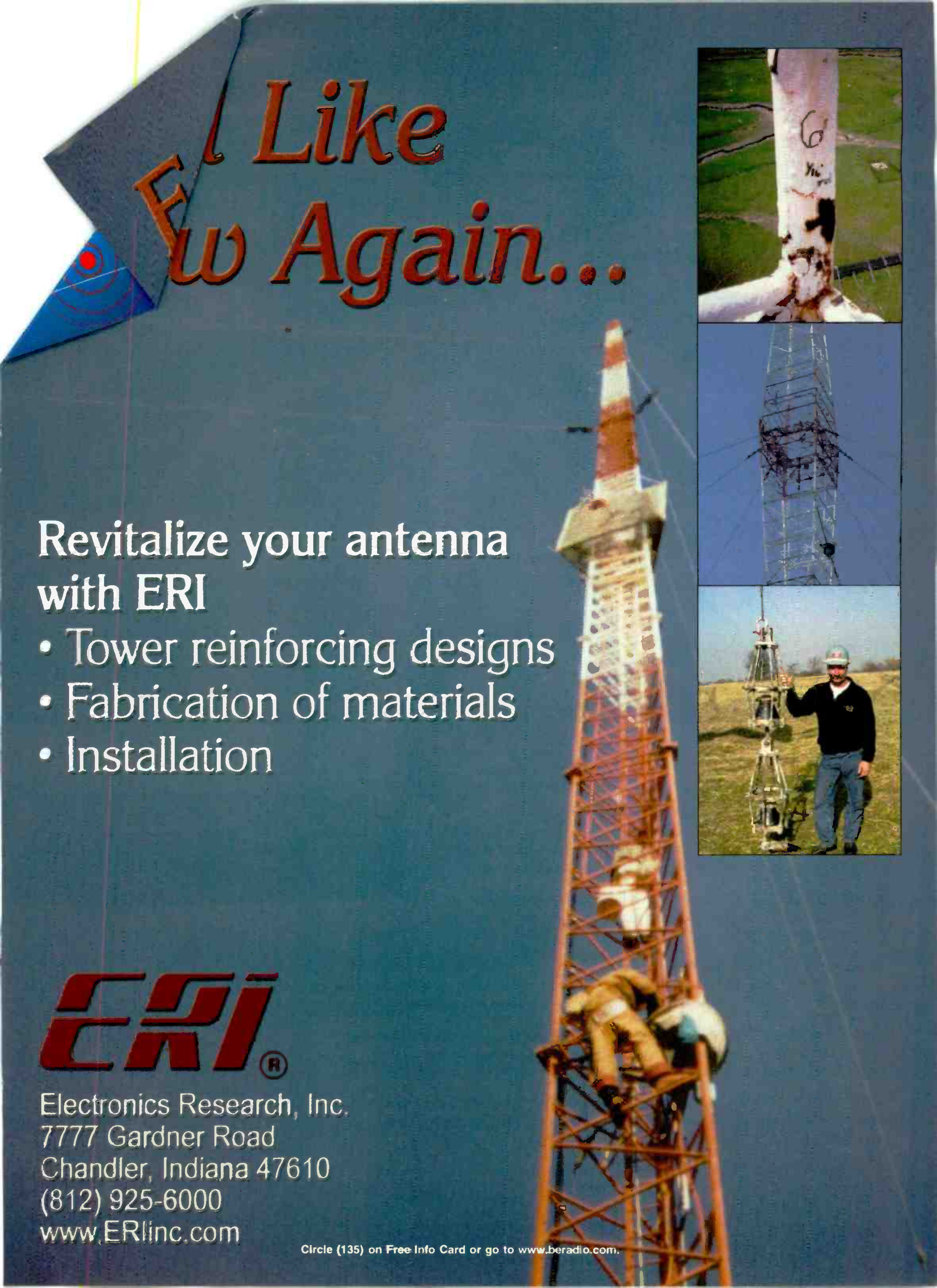
The Dallas station on 1190 is now KTRA, carrying Fox Sports programming. It has changed hands several times since the Gordon McLendon days, and it is now owned by Clear Channel.

During construction, the site was once mistaken for the Rockwall Airport runway and a disaster was narrowly averted when Hultsman, Rick Neace and several other engineers waved off a landing at the last minute.

The 164 acres used for the site are part of McLendon Ranch. It is a hilly site; some of the towers sit at ground level, some are in pits and others are on little hillocks. As you drive by the site at night on I-30, you can hear the station clearly all the way to Fort Worth. But if you travel very far to the north or south, it seems to go away as if turned off by a switch.

Hultsman is quick to point out that he didn't specify the unjacketed line that created the 164-acre battery. "There were four bidders and the one we went with was the only bidder that quoted unjacketed line. Callison and I both missed it.

"When I tell this story, I always write it off to being a young and inexperienced engineer," says Hultsman. He doesn't tell the story often.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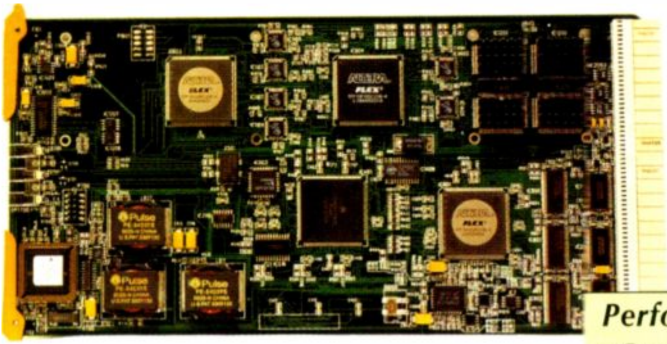
Computer Concepts Epicenter

By Steve Fluker

At a first glance, Epicenter might seem like just another audio routing switcher, but behind the front panel and flashing lights, there's a lot more going on. The Epicenter is designed to give operators the feel of a conventional control room, yet the look of something from the future by interfacing with several of the new digital control boards like the Logitek NuMix or ROC consoles. Epicenter's power comes from taking all of the electronics of a studio and combining them into a central audio control center.



What's inside

Epicenter is housed in a typical routing switcher type chassis, which holds up to 16 audio cards. These audio cards can be digital or analog, and each has 16 inputs or outputs. The Epicenter can tie up to four of these chassis (or bays) together using fiber optics for the interconnection, giving a total capacity of up to 1,008 inputs or outputs in any combination. Each of the Epicenter bays also has slots for additional cards. The bay is controlled by a System card, which contains a microprocessor to tell each of the audio cards what to do. This card is connected to a PC via an RS232 serial port to allow easy programming and setup. The PC is only needed to make changes in the routing, and thus a crash in this computer will not cause a problem with the Epicenter. Redundant system cards in each chassis allow backup should a card fail.

Interfacing to the studios is achieved through the use of a Multi-Protocol plug-in card. This card contains six RS-422 ports to connect to the audio control boards and two RS-232 ports, which can interface to a digital storage and automation computer system. Remote control start and stop logic for automation systems can be controlled via these ports. Logic to start other conventional devices can be accomplished through relays located inside the audio console. These relays are controlled by the Epicenter, not the control board, which opens up even more flexibility.

New thinking

In most on-air studios, the control board contains one or two line selector modules to expand the number of available inputs. With a routing switcher, these line selectors can be replaced with a module that can select any input into the switcher. With Epicenter, every pot on the control board becomes a remote line selector that can select any input into the router. The electronics also provide options for pan, stereo/mono/phase mode selections, gain trim, and a count-up timer. Future expansions will allow equalization and other processing controls through a DSP card.

The main difference between the Epicenter and a standard audio routing switcher is the power of the outputs. In a standard routing switcher, each output can be assigned to play the audio connected to any of the inputs. Epicenter allows each output to become a mixing bus. Through the use of a control board, or software on a computer, each output can mix up to 24 inputs. The gain of each input can be controlled separately using the pots on the board, or through programming of the computer. The audio electronics are housed within the routing switcher The control surface connects via a CAT5 cable through the RS-422 port. This allows the user to create mix-minus buses controlled by the console, or to be fixed through software.

Performance at a glance

- Combines all facility audio routing into one central location
- Routes audio and control logic
- Reduces wire and cable needs
- Interfaces with a variety of control boards and computers
- Flexible, powerful and economical

When wiring the Epicenter, all inputs and outputs are connected to the pack plane through WAGO connectors. Bringing out all of these inputs and outputs to a punch block is advisable and will make it easier to make future changes. Since no audio runs through the sudio console, all of the studio wiring is contained in a separate rack room.

It doesn't take long to get the hang of programming the Epicenter. Programming scripts tell Epicenter how to handle inputs and outputs. Start by setting up the control board with a pool of the sources you would like the console to access. Logic and audio features are assigned to the input source via the program. This allows all features to work the same, even on another console in another studio. A name is assigned to each source, which will appear in the display on the control surface over the selected pot.

All the eggs in one basket?

One concern about having a single system controlling audio and containing control board electronics is redundancy and backup. In the arrangement for Cox Radio's six Orlando stations, the Epicenter comprises four bays. Each bay is configured as one large router. A typical control room might have three CD players. Each player is connected to a different audio card in at least two bays. Should a card or bay fail, we don't lose all our players. Our automation system is configured the same way. For the air chain, the digital and analog inputs to the audio processor are fed simultaneously from different output cards and bays on the Epicenter. If the digital output card fails, the processor will switch to the analog input, and we are back on the air in under a second. Epicenter can reduce the number of back-up audio processors needed in a six station combo. The inputs and outputs of the back-up processor are routed through the Epicenter and can be routed to any of the six station's air chains.

The Epicenter is designed to operate with third-party controllers like the Logitek NuMix.

Soon, the system will be integrated into the news/talk station. Stored console configurations will accommodate local and network programs and allow the setup of the board to be changed through the touch of a button. Epicenter can control background network recordings automatically.

Steve Fluker is the director of engineering of Cox Radio, Orlando.

More online

See how Cox Orlando's Epicenter proved its value during the stations' coverage of the September 11 attacks. Go to . . .

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The Sound of Traffic

By Conrad Trautmann, CPBE

Westwood One, Washington DC

After nearly 20 years of working in radio, being involved in the design process of Westwood One's Washington, DC, studio facility was something of a departure from my experience. I learned that sound isolation, sound deadening and noise elimination are not necessarily a primary focus. In some cases, background noise can be a good thing.

Located at 8403 Colesville Road in Silver Spring, MD, are the offices and studios for Westwood One Shadow Traffic, Metro Traffic and SmartRoute Systems. On the 15th floor of a 17-story building that resembles a stealth fighter, the offices and studios occupy a combined space of 21,000 square feet, about 7,000 of which are dedicated to 23 sound studios, four television studios and an operations/traffic/news gathering area. The new facility was designed to consolidate Shadow and Metro Traffic operations, which were located in Chevy Chase, MD, SmartRoute Systems (also known in the Washington area as Smart Traveler), which was located in downtown Washington, and Westwood One's administrative offices, which had been located in Arlington, VA. The primary product delivered from the new facility is traffic information to affiliate radio stations. News and information are secondary. For simplicity, I'll refer to all the occupants jointly as Westwood One hereafter.

Early in the design phase, I questioned the fact that the studios were to have standard office walls, doors and windows, and that the HVAC had no special sound isolation. I was skeptical that this would work successfully, but was assured that many of the other traffic facilities we had around the country were built the same way and all of them worked very well.

Common practice in radio engineering is to strive for the best audio at all times. Despite these efforts, it is not uncommon for programming to complain that the audio is "too clean." Many engineers have used expensive noise-canceling headset mics, wide-band RPU/ICL systems and modified two-way radios, only to be forced to equalize the feed to make it sound like it's not in the studio. Another common scenario is to create a studio with nearly perfect sound-isolation specifications with superior microphones and processing, only to have the news department run an endless loop sound effects bed under the announcer to make it sound like it's coming from the newsroom.

Unlike a traditional radio studio, there are no monitor speakers in our facility. Sound isolation design in a radio station is to prevent sound from one studio from bleeding out of that studio or into another studio while a mic is open. We know that production talent like to listen to their final product through large monitors with 12-inch woofers driven by a 150W power amplifier. Add the common air-talent practice of cranking that new song in the air studio. This is not the case in a traffic or news studio. In such rooms, the traffic or news announcer is only listening for an IFB or cue from the affiliate station; this is done with headphones. Even with back-to-back studios, the announcer's voice from one room is not a distraction to an announcer in the next room. We take some measures to deaden the sound, such as sealing any penetrations between the rooms and lining the ceiling tiles and adjoining walls with bats of insulation, but the sound level created in the booths is nowhere near that of a typical radio station, and that eliminates the need for an isolated booth.

The Sound of Traffic

A typical TV booth with a MetroSource workstation.

Sound off now

As I mentioned above, noise can be a good thing, and to get the sound of a working newsroom or traffic center on the air, many of the Westwood One studios are designed to face the operations desk where information is gathered. Many announcers leave the studio doors open so that they can easily communicate with the producers who update them minute-by-minute of traffic conditions. All of these added audio sources also come through on the air.

All cabling is a home run from each studio to a central rack room. SAS 32000 routers route each studio to the affiliate station and handle IFB routing. An announcer can be in any booth in the facility and feed any affiliate station by selecting it on the program router. This offers complete redundancy in the event of an equipment failure in a booth. Stations that cannot be monitored off air or require a feed pre-delay IFB have dedicated lines that can be routed to the studios using the IFB panel. In the Washington market, we feed 37 stations with dedicated audio loops provided by Verizon, and a few have return loops for IFB. We also use ISDN and standard phone couplers for IFB returns.

The rack room relies on backup power from a 15kVA Best UPS, and the entire facility is connected to a 150kW generator. Since the building air conditioning only runs during business hours, a 35-ton supplemental air conditioning unit was installed to provide climate control. It uses an electronic variable air volume system to allow individual temperature control in the studios and operations center.

Each booth is equipped with a Dixon NM 250 mic mixer, which in addition to standard balanced-line outputs, has unbalanced inputs and outputs, eliminating the need for an impedance-matching box to connect our MetroSource computers and their standard PC audio card. The Dixon mixer also has remote switching capability for mic on/off control and control of external sources. It has three buses, one program, one monitor and a mix-minus for the phones.

The booth also has a Sennheiser 421 microphone, a program router control panel, an IFB control panel (with monitor speaker), a Telos hybrid, a VCR and television, a tuner, cassette deck, and a MetroSource computer.

There are several open traffic reporter booths in the traffic gathering area.

The MetroSource computer serves a few functions. First, it runs the MetroSource software, the newswire service that Westwood One originates from our Phoenix newscenter. The MetroSource computer takes the place of a reel-to-reel recorder to record and edit in each room. It also serves as the system to distribute traffic information data to each studio from the producer's area. Information is input into the producer's computer and is made available to all studios.

The operations desk is where all of the information is gathered. Two-way radios provide communication with the three aircraft we fly and the two mobile ground reporters during morning and afternoon drive. Scanners supply the ability to listen to police and other emergency services for tips on conditions. Video feeds come from the Virginia Department of Transportation, Maryland Department of Transportation and from WTTI's own five cameras placed around the Washington metro. The DOT cameras can be remotely switched, giving access to a total of 50 cameras. Co-locating Smart Traveler adds another six cameras.

TV-1 fiber lines provided by Verizon transmit many of these video feeds and provide connectivity to the local TV stations. A few of the feeds come in via microwave, and many of the images we access are used on the air of the television stations during the reports. Each TV studio has a local video switcher that allows the talent to switch between their own camera, the various traffic cameras and maps of the local area showing trouble spots. An in-house video modulator system provides feeds of all of the cameras to each studio through the in-house cable system. This allows the announcers to see what is actually happening.

Wise travels

Smart Traveler, which also has producers at the operations desk, translates the information it gathers into content used for the Internet and for on-demand dial-in telephone access. Information entered into the Smart Traveler system is translated from text to voice by an Interactive Voice Response (IVR) system. We also have the ability for announcers to record information in real time into the system, so callers will get a human voice instead of a computer-generated voice.

Pulling together a move of this magnitude was no small feat. We started by planning well. The key planners

The Sound of Traffic

were John Frawley, VP of operations for Metro/Shadow, Trevor Marriot, director of engineering and our architect, Marc Behrman of Interplan in Washington, DC and me. Next, we

More than 50 terrestrial video cameras can be controlled by an operator at the video wall.

selected a general contractor, Bob Ellingwood, owner of Patwood Construction, who was familiar with local codes and building practices. We depended on Orlando-based Balsys, a studio installation firm run by Tom Bohannon and Larry Lemoray, for the pre-wiring and installation of all radio equipment. Video installation was handled by DSI RF systems and included connection of all the cameras, studio switchers, TV stations, microwave paths and fiber-optic lines in and out of the facility. Our in-house manager of telecommunications, Dick Owen, ordered and supervised the cutover of all dedicated audio circuits, POTS lines, Centrex, ISDN and video fiber.

The Smart Traveler computer systems and studio equipment move was arranged by Peter Sturgis, director of operations and Wendy Richtor, system administrator. We combined all operations onto the mainframe relay line in the facility, which connects Smart Traveler to the Internet for Web content and Metrosource for our news feeds to our main office in Phoenix.

Equipment List:

- AMCO S30251 workstation furniture
- Dixon NM-250 mixer
- Sennheiser MD421 microphones
- Telos 9102 Zephyr ISDN codecs
- Telos 125 telephone hybrid
- Middle Atlantic racks and panels
- Dell GX-110 computers for Metrosource
- Sierra Automated Systems SAS32000 router
- Belar LP-1A AM loop antenna
- Belden wire and cable
- MetroSource recorders
- Telos phone hybrids

Westwood One knows what it takes to provide traffic and information to its affiliates and customers. When you hear a reporter on a radio station doing the traffic, there's a good chance it is originating from a facility similar to the one here in Washington.

Conrad Trautmann, CPBE, is vice president of engineering for Westwood One, New York.

New Products

By Cindy Holst, associate editor

Optical disc duplicator
Primera Technology

ComposerPro: Designed for high-volume, in-house disc duplication, ComposerPro uses dual CD-R or DVD-R recorders and a large media input bin to record and optionally print up to 100 discs per batch. Users can duplicate music or data disks. A precision pick-and-place robotic arm transports discs from the input bin to the dual integrated CD-R or DVD-R recorders. After recording, discs are transported to an optional Primera Technology ink-jet or thermal transfer optical disc printer where they are printed in color in up to 2400 dpi print resolution. ComposerPro comes equipped with professional mastering and duplication software for Windows 95/98/Me and NT/2000. The software allows the duplication of many CD formats, including CD-ROM, CD-RW, CD-DA and Video CD. Two models are available.

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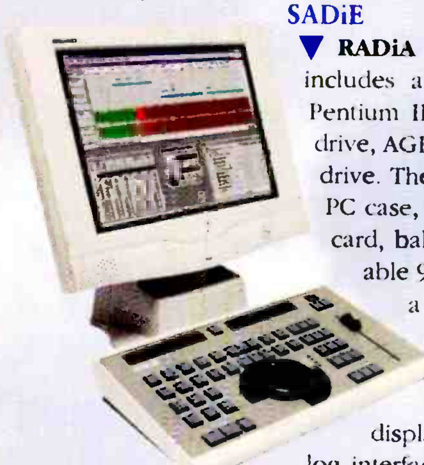
Digital audio workstation
SADiE



RADiA Platinum: This 4-in, 4-out turnkey system, includes a SADiE rack-mount PC featuring a 667MHz Pentium III processor, 128MB RAM, 10GB internal IDE drive, AGP video card with 8MB VRAM, and 48× CD-ROM drive. The system comes with the Studio Audio 19" rack PC case, external SCSI interface, RADiA PCI processing card, balanced breakout cable assembly and a removable 9GB SCSI audio drive. The system also includes a 15" LCD panel display and the RADiA Master Control Panel. The Master Control Panel has transport controls, scrub wheel, edit, locate and function keys, motorized faders, and time displays. The RADiA Platinum offers balanced analog interfacing, AES/EBU and S/PDIF digital I/O. It also interfaces with radio automation systems. The unit offers 24 replay tracks and 24-bit digital audio recording and editing at up to 48kHz.

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Broadband antennas
RFS Broadcast

828DA: This model is a circularly polarized Band II antenna with a nominal gain or -1.0dBd per plane of polarization. The antenna is fitted with a horizontal reflecting element to provide improvement in the directionality of horizontal radiation pattern. The thick walled stainless steel design ensures years of trouble-free performance in a hostile environment. For environments where antenna icing may be a problem, optional radomes are available. The 828DA can be used in applications from one up to 10 bays. The parallel feed system facilitates the customization of null fill and beam tilt to suit customer requirements. Three versions cover the FM band, with each version designed to operate over a 10MHz bandwidth. 828 antennas using ½ wavelength spacing and covering 87.5MHz to 108MHz are available on request.

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Transient voltage suppressors
dbm Systems

▼ **Audio Surge:** These suppressors are designed to protect high end, professional, and broadcast audio equipment from damaging transients. While nothing can

completely eliminate lightning and transient damage, transient voltage suppressors can make a substantial difference. The near instantaneous response time of 1 picosecond, provides immediate peak power dissipation of up to 1,500 watts. Audio Surge suppressors are available for most high-end digital audio cards. Audio Surge also manufactures custom suppressors for most audio and control applications.

800-795-7234; fax 601-853-9976
www.cartworks.com; sales@cartworks.com
Circle (254) on Free Info Card or go to www.beradio.com

Equipment rack
APW Enclosures

▶ **Steel Relay rack:** These racks are available in a variety of sizes in equal- and unequal-flanged format, with open or closed duct, and non-seismic and Zone 4 seismic ratings, to offer flexible universal spacing. The product family has an array of accessories including aluminium shelves and components to meet a variety of installation needs.

800-628-5858; fax 661-775-2657
www.apw-enclosureproducts.com
Circle (251) on Free Info Card
or go to www.beradio.com

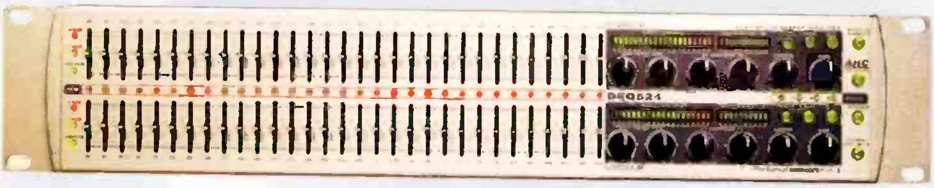
Monitor panel
Fostex America

▲ **RM1:** Designed for rack-mount monitoring of signals and suitable for use in rack rooms, editing and dubbing stations, news workstations and remote vehicles, the RM1 provides stereo onitoring in 1RU. The aluminum front panel has many user options so that the audio output can be configured for a variety of applications. Offering two 15W amplifiers, the specially designed transducers provide 80Hz to 15kHz frequency bandwidth. Features include two stereo balanced +4 inputs with 4 XLR/phono Neutrik combo connectors and electronic matrix switching for mode or channel selection, A/B select switch, signal presence indicator and a headphone jack and gain control.

800-7-FOSTEX; fax 562-802-1964; www.fostex.com
Circle (258) on Free Info Card or go to www.beradio.com

New Products

Stereo graphic EQ
PreSonus Audio Electronics



DEQ624: The two 31-band equalizers offer three switchable ranges of operation: ±6dB, ±12dB or +12/-24dB. A security feature locks out all front face-plate controls using a programmable password-style of access. Once engaged, the DEQ624 will retain all programmed settings. The user can recall up to four presets on the DEQ624. The DEQ624 features a brick wall limiter with variable threshold and a downward expander with variable ratio and threshold. The inputs and outputs of the DEQ624 include XLR balanced, ¼ unbalanced and barrier strips. The DEQ624's adaptive hum cancellation identifies 60Hz hum caused by ground loops and dimmers and uses phase cancellation to eliminate any problem without altering the audio. The DEQ624 also features high- and lo-pass filters (20Hz-20kHz), and Hi Q for selected frequencies.

800-750-0323; fax 225-926-8347
www.presonus.com
presonus@presonus.com
Circle (263) on Free Info Card
or go to www.beradio.com

Analyzer tools
NTI (Neutrik Test Instuments)

Rub and Buzz: This option is based on the patented transient analysis approach of Leonhard Research, which detects the slightest mechanical defects in acoustic transducers. With test times below 1 second, the Rapid Test equipped with the Rub and Buzz option is the ideal production line test product. The Rub and Buzz option detects every audible failure such as rubbing coils, connecting wires touching the cone, misplaced membrane, excess glue or air leaks. The typical test cycle time of below 1 second with a fast continuous sweep signal makes this option a perfect quality control tool for production lines or acoustic transducers. The Rub and Buzz analysis is combinable with frequency response, distortion and sound pressure level analysis (SPL). The Rub and Buzz option is available for all RT-2M and RT-2X voice band analyzers.

800-661-6388; fax 514-344-522
www.nt-instruments.com
info@nt-instruments.com
Circle (260) on Free Info Card
or go to www.beradio.com

Software Update
Telos Systems

▶ **Version 1.5.5 software:** This software can be downloaded and installed using an FTP connection with Zephyr Xstream's built-in update function. In addition to Zephyr Xstream's use of Fraunhofer's coding methods (MPEG-AAC and Low-Delay MPEG AAC-LD), the software adds a Layer-3 dual decoder mode and end-to-end ancillary data support. Eight bi-directional contact closures and serial data transmission are available in MPEG Layer-3 and MPEG-AAC/AAC-LD modes, as well as Layer-2 Mono and Half modes (64kb/s). Version 1.5.5 offers a local control option with a panic dial dial-on contact closure for all eight closures, choice of consumer or professional output line-levels in all models featuring built-in stereo mixers and MPEG Layer-2 support transmission of audio at 32kHz. The software is available free to Zephyr Xstream users.

216-241-7225; fax 216-241-4103
www.telos-systems.com; info@telos-systems.com
Circle (268) on Free Info Card or go to www.beradio.com

Condenser microphone
Audio-Technica

▼ **AT4033/SE:** The AT4033/SE includes a re-engineered shock mount, a dust cover, and a custom wooden microphone case. The AT4033/SE features a cardioid polar pattern and uses a vapor-deposited gold-plated aged-diaphragm capacitor element with an internal baffle plate to increase the signal-to-noise ratio of the microphone system. This 2-micron-thick gold-plated diaphragm provides accurate reproduction of even subtle sounds. The AT4033/SE has an extended flat frequency response of 30Hz to 20kHz, a wide dynamic range, and the ability to handle high SPLs (up to 145dB, 1kHz at 1% THD, 155dB with 10dB pad) without sacrificing high-frequency performance. The AT4033/SE features a floating-construction element to achieve peak performance and isolation from noise and vibration.

330-686-2600; fax 330-686-0719
www.audio-technica.com; pro@atus.com
Circle (252) on Free Info Card or go to www.beradio.com

Interface access

Extron

◀ **Hideaway HAS 400:** These mountable, mechanically operating architectural enclosures provide access to computer-video interfaces and A/V connectors and controls. There are four versions of the Hideaway HSA enclosure: the 400 series (HSA 400 and HSA 402) and the 800 series (HSA 800 and HSA 802). The 400 series pivots open, presenting the connectors at a 49° angle to the tabletop. The 800 series rises vertically from the installation surface, presenting the connectors at a 90° angle to the tabletop. All models in the Hideaway Series include room for four single-space Extron Architectural Adapter Plates (AAPs). These AAPs are available with hundreds of connector combinations, customizable for any application. The Hideaway enclosures can be optimized using the Extron RGB 580xi remote interface.

800-633-9876; fax 714-491-1517
www.extron.com;support@extron.com
Circle (257) on Free Info Card or go to www.beradio.com

Handheld microphones

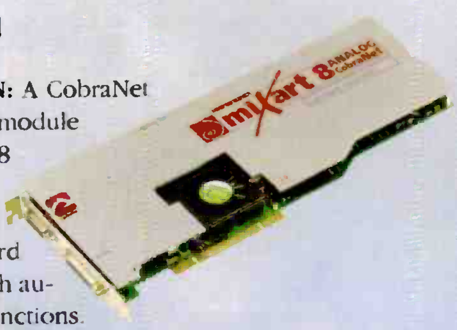
Electro-Voice

▼ **Cobalt series:** Available in four models, the Co4, Co5, Co7 and Co9, the Cobalt series of mics use Neodymium technology to provide quality sound for an inexpensive price. All the mics feature cardioid pickup patterns. The Co4 is designed micing of acoustic and electric instruments, and voice. The Co5, Co7 and Co9 are designed for vocal use. Each model offers unique features including controlled proximity effect, low handling noise and an on/off switch. Rugged construction makes them ideal for remote broadcast use. A wireless transmitter version is also available.

800-392-3497; fax 952-887-5588
www.electrovoice.com;pro.sound@telex.com
Circle (256) on Free Info Card or go to www.beradio.com

New Products

PC sound card
Digigram



▶ **MixArt8CN:** A CobraNet input/output module for the miXart8 sound card, miXart combines onboard processing with audio mixing functions. When connected to third-party CobraNet-compliant devices, miXart8CN is the foundation of audio systems distributed over large-area networks. The core of the system, the miXart8, has eight (or four stereo) analog input/output paths, including four studio-quality microphone preamps on its input bank. The CobraNet interface is managed via a daughterboard, yet only a single PCI slot is needed in the host computer. Eight channels of CobraNet input and eight channels of CobraNet output are provided, operating independently of the analog inputs/outputs. The network connection, using standard 100BaseTX Ethernet protocols, is available on two redundant RJ-45 jacks, which provide on-board backup.

703-875-9100; fax 703-875-9161
www.digigram.com; input@digigram.com
Circle (255) on Free Info Card or go to www.beradio.com

Forced air-cooled loads
Bird Electronic

▶ **Digital Air series:** 10kW and 25kW Digital Air VHF models join the line of 5kW, 10kW, 15kW, and 25kW Digital Air UHF models. Bird's Digital Air designs offer elimination of liquid coolants, which allows reliable, low maintenance operation without concerns over pump and plumbing systems at transmitter sites. These loads remain cool to the touch, and permit exhaust to be ducted to the outside. Advanced computer simulation (CAE) provides answers and rapid verification of specific user requirements such as altitude ducting. Extensive high-frequency electrical CAE modeling has also been used to optimize these products for digital broadcast. With electrical CAE, the VSWR of hundreds of configurations can be examined before a prototype is built.

440-248-1200; fax 440-248-5426
www.bird-electronic.com; sales@bird-electronic.com
Circle (253) on Free Info Card or go to www.beradio.com

New Products

Reference guide
PiROD

▼ **TIA/EIA Q&A:** As a prelude to the forthcoming revision of the TIA/EIA standard for communications towers, PiRod has published a Q&A offering insight on the changes most likely to occur. While shedding light on the imminent

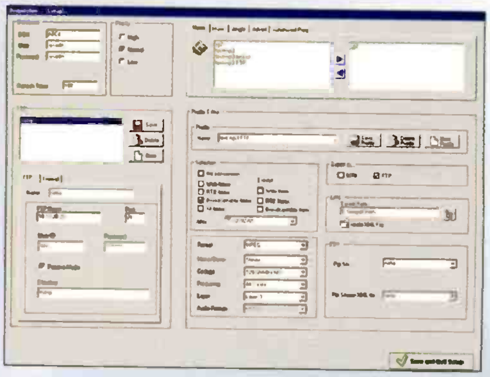
changes, the 12-page booklet also offers an explanation on how those changes will generally impact tower design. For a free copy of *Revision G: How It's Going to Impact Your Job*, contact PiRod at 1545 Pidco Drive, P.O. Box 128, Plymouth, IN 46563-0128, or call 219-936-4221. PiRod can also be reached via fax or online.

877-467-4763; fax 219-936-6796
www.pirod.com

Circle (262) on Free Info Card or go to www.beradio.com

File conversion tools
Netia Digital Audio

▶ **Dispatcher, Web Dispatcher, Autofill:** An automation tool that can convert and export sound files directly from the Netia Radio-Assist database to any target destination. Specific functions define different profiles. Each profile includes conversion format, sampling rate, coding and destination. Dispatcher converts and exports these files according to the predefined profile. Web Dispatcher is a direct application of this automation and adds a new Internet tool to the Radio-Assist range. Selected audio data is put online for a website. Internet sound files are lifted directly from the sound bank and converted to Real G2 format, then transferred to the Internet server via FTP. Associated XML and Media Object Server data are also distributed. Web Dispatcher generates the new Web pages and publishes the selected sound files. AutoFill is a multiple-format import automation tool.



973-364-7511; fax 973-364-7522; www.netia.fr

Circle (259) on Free Info Card or go to www.beradio.com

Multiplexer
AEQ

Ranger: An audio and data multiplexer for a full duplex channel E1/T1 of up to 2Mb, with capacity for 15 circuits of 15kHz, 31circuits of 7.5kHz or 61 circuits of 3.5kHz, or the corresponding data channels V-35 or X-21 interfaces at 64, 128 or 256kb. From a multipoint network, a suite of Ranger and other E@sy equipment can be controlled. The equipment is housed in a modular rack format, including two universal autorange power supply units. The rack handles up to eight audio and data cards. Ranger offers three audio quality compression modes: 3.5kHz (32kb), 7.5kHz (64kb) and 15 kHz (128kb), all of them with low encoding/decoding delay features.

954-424-0203; fax 954-424-0902
www.aeqbroadcast.com; aeqsales@aeq.es

Circle (250) on Free Info Card or go to www.beradio.com

Win a

Neumann KMS 105,

LPB Silent Mic Boom,

or ATI ML200!

Find the microphone icon on each BE Radio cover from 2001 and you could win.

Sweepstakes Rules

Introduction:

NO PURCHASE NECESSARY. A purchase does not improve your chances of winning. Void where prohibited by law.

Sponsors:

The Sponsors of this sweepstakes are Primedia Business Magazines & Media Inc. at 9800 Metcalf, Overland Park, KS 66212; Neumann USA at One Enterprise Drive, Old Lyme, CT 06371; Audio Technolgies Inc. at 328 W Maple Ave., Horsham, PA 19044; and LPB at 960 Brook Road, Unit 5, Conshohocken, PA 19428.

Timing:

Sweepstakes begins at 12:00:01 am EST on December 10, 2001 and ends at 12:00:01 pm EST on January 20, 2002.

Eligibility:

Sweepstakes open to all current subscribers of *BE Radio* in the United States as of December 10, 2001 and excludes the employees and immediate family (spouses and parents, siblings, children and each of their spouses) of Sponsors, the prize manufacturers, their parents, affiliates, subsidiaries, advertising agencies and any other company involved with the design, production or execution of the sweepstakes.

How to Enter:

Complete the online form located at http://www.beradio.com, or you may enter by carefully typing or hand writing the following information on your company letterhead or a standard 8½" by 11" sheet of paper: 1. Your name, job title, company name, address, telephone number, fax number and e-mail address; 2. A complete and accurate description of the location of the mic icon on each 2001 issue of *BE Radio* (Volume 7, dated January, February, March, April, May, June, July, August, August Product Source, September, October, November, December 2001). Please be as specific as possible in describing the location of the mic icon on each 2001 issue of *BE Radio*. Mail your entry to *BE Radio* Microphone Sweepstakes, P.O. Box 12901, Overland Park, KS 66282-2901 or fax it to (913) 967-1905. If you do not have all the necessary issues, you may obtain issue-cover copies by sending a self-addressed stamped envelope to *BE Radio* Cover Request, P.O. Box 12901, Overland Park, KS 66282-2901.

All entries (mail and online) must be received by January 19, 2002. Multiple entries are not permitted. One entry per person per mailing address and per e-mail address. Sponsors are not responsible for late, lost, damaged or misdirected mail, faxes or e-mail. Submitted entries will not be returned and become the property of Sponsors. Entries will be reviewed by the *BE Radio* Sweepstakes committee ("Judges") for completeness and accuracy. All decisions of the Judges are final and binding in all matters relating to the Sweepstakes.

Winner Selection and Notification:

Three (3) winners will be chosen at random from all correctly submitted entries (entries with 13 correct answers) on or around January 21, 2002. If there are no entries with all 13 correct answers, three (3) winners will then be chosen at random from all correctly submitted entries with 12 correct answers. Winners will be notified by phone or mail on or about January 21, 2002. Odds of winning depend on the number of correct, eligible and legible entries received.

Prizes:

The first winner chosen will receive a Neumann KMS 105 microphone (approximate retail value $595). The second winner chosen will receive an ATI ML200 mic preamp and power supply (approximate retail value $299). The third winner chosen will receive an LPB Silent Mic Boom (approximate retail value $179). **The total approximate retail value of all prizes is $1,077.** Cash will not be awarded in lieu of prizes. Prizes are not transferable or exchangeable. Substitution of prizes will not be permitted except by Sponsors, who reserve the right to substitute a prize of equal or greater value if indicated prizes are not available.

Miscellaneous:

Winners release the Sponsors, the prize manufacturers and each of their parents, affiliates, officers, agents and employees from any responsibility or liability in connection with any loss, accident, or death incurred in connection with the use of or the installation of the prizes won in the Sweepstakes. The winners hereby consent to the use of their names and/or likenesses by the Sponsors for advertising purposes without additional compensation unless prohibited by law. The verified winners will be required to sign an Affidavit of Eligibility and a Publicity/Liability Release. Any requested materials must be returned within ten (10) days of the date of notification. Failure to comply with any request in the allotted timeframe will result in disqualification and the selection of an alternate winner. Any tax liabilities are solely the responsibility of the winner. All federal, state, local, municipal and provincial laws and regulations apply.

By participating, entrants acknowledge and agree to be bound by these rules, and the decisions of the Judges, which are final. Sponsors do not make and are not responsible for any warranty (including fitness for particular purpose) or guarantee with regard to any prize or portion thereof.

To obtain the name of the prize winner, send a self-addressed, stamped envelope after January 25, 2002, to "Mic Sweepstakes Winner," *BE Radio* Microphone Sweepstakes, Primedia Business Magazines & Media Inc., P.O. Box 12901, Overland Park, KS 66282-2901, USA.

Other Terms and Conditions:

Sponsors assume no responsibility for any error, omission, interruption, deletion, defect, delay in operations or transmission, communications line failure, theft or destruction or unauthorized access to, or alteration of entries. The Sponsors are not responsible for any problems or technical malfunction of any telephone network or lines, computer online systems, servers or providers, computer equipment, software failure of any e-mail or entry to be received by Sponsors or congestion on the Internet or at any website, any combination thereof or otherwise, including any injury or damage to entrants or any other person's computer related to or resulting from participation or downloading any materials in the Sweepstakes.

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Active crosspoint switcher/router with 12 stereo inputs and 4 stereo outputs.

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Passive switcher/router with 10 stereo inputs and one stereo output or vice-versa.

3X2
Active crosspoint switcher with 3 stereo inputs and 2 stereo outputs.

SS 3.1
Passive switcher/router with 3 stereo inputs and one stereo output or vice-versa.

SS 8.2
Active crosspoint switcher with 8 stereo inputs, 2 stereo plus 2 mono outputs.

8x1 DAS
Routes any one of eight AES/EBU digital inputs to 3 common outputs.

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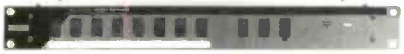
Passive switcher/router with 2 composite audio, video, or AES/EBU inputs to 2 composite audio, video, or AES/EBU outputs, or vice-versa.

ACS 4.1
Active crosspoint switcher with 4 balanced/unbalanced stereo inputs and one stereo output with Visual Audio Level Control.

6X1
Passive switcher/router with 6 stereo inputs and one stereo output, or vice-versa.

SS 2.1/TERM
Passive switcher/router with 2 stereo inputs to one stereo output or vice-versa.



8X2
Active crosspoint switcher with 8 stereo inputs, 2 stereo and 2 mono outputs

SM-6
Stereo mixer with 6 stereo inputs, a stereo output and front panel on/off switches.

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Full Name	Complete Mailing Address
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The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes:
☐ Has Not Changed During Preceding 12 Months
☐ Has Changed During the Preceding 12 Months (Publisher must submit explanation of change with this statement)

PS Form 3526 (Facsimile), October 1999

13. Publication Title: BE Radio
14. Issue Date for Circulation Data Below: August 2001

15. Extent and Nature of Circulation		Average No. Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
a. Total Number of Copies (Net press run)		16,320	17,140
b. Paid and/or Requested Circulation	(1) Paid/Requested Outside-County Mail Subscriptions Stated on Form 3541 (Include advertiser's proof and exchange copies)	14,268	14,760
	(2) Paid In-County Subscriptions Stated on Form 3541 (Include advertiser's proof and exchange copies)	0	0
	(3) Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Non-USPS Paid Distribution	312	295
	(4) Other Classes Mailed Through the USPS	0	0
c. Total Paid and/or Requested Circulation (Sum of 15b. (1), (2), (3), and (4))		14,580	15,055
d. Free Distribution by Mail (Samples, complimentary, and other free)	(1) Outside-County as Stated on Form 3541	690	617
	(2) In-County as Stated on Form 3541	0	0
	(3) Other Classes Mailed Through the USPS	0	0
e. Free Distribution Outside the Mail (Carriers or other means)		354	1,000
f. Total Free Distribution (Sum of 15d. And 15e.)		1,044	1,617
g. Total Distribution (Sum of 15c. And 15f.)		15,624	16,672
h. Copies not Distributed		1,739	2,085
i. Total (Sum of 15g. And 15h.)		17,364	18,757
j. Percent Paid and/or Requested Circulation (15c. Divided by 15g. times 100)		93.3%	90.3%

16. Publication of Statement of Ownership
■ Publication required. Will be printed in the **December** issue of this publication. ☐ Publication not required.

17. Signature and Title of Editor, Publisher, Business Manager, or Owner
Gayle Hutchens Grooms, Circulation Manager
Date: 9/27/01

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

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Taking stock

By Skip Pizzi, contributing editor

It's been a year to remember— or perhaps to forget. Wall Street witnessed figurative and real collapses, and radio has felt the ripples generated from that.

All this short-term noise makes it hard to discern the real trends in the industry. The best we can do is make a year-end inventory of the issues as the tumultuous first stanza of the new millennium comes to a close.

Hot buttons

Satellite radio finally got started in 2001. XM Satellite Radio came from behind and launched its service first (originally scheduled to debut on September 12, it was postponed to the 25th), while we're still waiting for Sirius Satellite Radio to get going. Early response has been positive, with XM receivers jumping off the shelves by some reports. The loudest complaints have been that each radio has to have its own subscription, with no discounts for multiple-receiver households.

What doesn't kill radio will make it stronger.

IBOC continues to develop but faces unresolved regulatory, broadcast deployment and consumer retail-channel obstacles. Its prospects remain uncertain, and compared with other here-and-now developments, IBOC appears speculative and distant, and its benefits (at least for FM) seem negligible.

Online radio services continue to proliferate. While most streams are still geared for the dial-up user, with audio data rates around 20kb/s, a growing number of services target the broadband listener with audio at 60kb/s to 100kb/s. When properly implemented, the latter rates are indistinguishable from CD or DAB services to most consumers.

The rights picture changed radically in 2001, with broadcasters who stream the air signals becoming liable for new music, sports and talent usage assessments. This caused many broadcasters to rethink their online business plans, and curtail their webcasting efforts. Thus, the primary focus of online radio is shifting from an alternate or extended method of delivery for local broadcast services to a new medium of its own, with Internet-only radio streams now beginning to dominate the environment. Given the concurrent cutbacks in peer-to-peer file-sharing services like Napster, many online music seekers have turned to streaming radio services for legal and easy access to free music online. Navigation improvements and program listing services on streaming media players and third-party websites have made surfing easier and more elegant.

Next up

It seems likely that satellite radio will become a force with which terrestrial broadcasters must reckon. Not all is rosy in S-DARS land, but the future seems promising for XM and Sirius, with ripening opportunity to gain a foothold in 2002 and beyond.

As broadband Internet deployment continues, and broadband wireless Internet emerges, online radio (dominated by Internet-only services) will also become a stronger competitor. Consider that today's broadband brings around 1Mb/s to the consumer's home, while next-generation systems will typically provide >20Mb/s, with such service likely to become available by 2004.

In other countries (notably Canada and the UK), Eureka 147 DAB services are slowly gaining momentum as affordable receivers begin to hit the market. The new year should see some progress there, though worldwide the largely replacement approach favored by Eureka DAB broadcasters has minimized the new services' attraction.

As mentioned here in the past, new broadcast channels that offer fresh and otherwise unavailable content appeal far more to listeners than those that simply improve the quality of existing services (particularly when new hardware purchases or subscriptions are involved). Thus, iBiquity's choice to make the IBOC format a qualitative-only enhancement (like most Eureka services) seals its fate as a less interesting development to consumers, who prefer the many new content offerings of other emerging platforms.

Perhaps the best outcome is that U.S. terrestrial radio may be gradually encouraged to increase or restore its localism, reduce its commercial loads, and increase its programming diversity and quality in order to compete with advancing new services. As elsewhere, what doesn't kill radio will make it stronger.

The ultimate asset in radio remains its human resources. Without them the medium is worthless. There are new opportunities emerging to lure them away, so broadcasters should do their best to keep these crown jewels intact.

A final watchword as we gather for this particularly poignant holiday season can be borrowed from Garrison Keillor: "Be well, do good work, and keep in touch."

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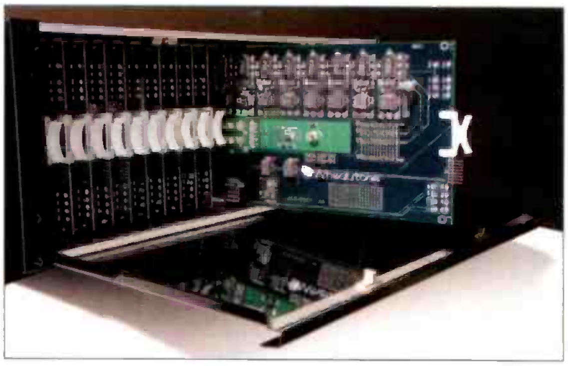

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