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THE RADIO TECHNOLOGY LEADER
Radio Magazine
www.beradio.com
July 2003 • Volume 9, Number 7

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Features

Columns

Departments

ON THE COVER:
Lightweight and portable with the highest-possible audio quality; this is the mission of today's portable audio recorders. Cover design by Michael J. Knust.

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Currents Online

Highlights of news items from the past month

SBE Certification Program Attains Recognition

The National Skills Standards Board (NSSB) has recognized 10 levels of SBE certification.

New Policy on NAB Radio Show Guest Passes

Plan ahead this year; there will not be unlimited passes for everyone.

New GIS Mapping and Error Check Available for FCC ULS

The new ULS GIS enables users to map all the licenses found in a ULS License search. The update also allows an error check before sending.

Arbitron Enhances PPM

The upgrade will allow the system to distinguish between at-home and away-from-home listening.

Cox Radio Atlanta Chooses Harris

EYE ON IBOC

WSB-FM, WALR-FM, WBTS-FM, WFOX-FM and WSB-AM will make the transition to IBOC with Harris transmitter and exciters.

Broadcast Electronics Scores Order from Clear Channel

Sixty-nine Broadcast Electronics transmitters and exciters will be delivered to Clear Channel during 2003.

Site Features

Engineer's Notebook

The details of DTMF, including .WAV files that you can use for testing. Select *Electronics/General* from the index tab.

Eye on IBOC

Track the trend as stations transition.

July Issue Online

Read the entire issue online, plus find additional articles and information.

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A close call

Just as we finish one convention season, another one begins. It's a never-ending cycle. While radio stations play the game with ratings periods, manufacturers and trade publications play the game with conventions.

Now, in the middle of summer, the pendulum is beginning to swing toward the fall NAB convention. What will the NAB Radio Show bring this year?

Everyone attends a convention for a different reason. For attendees, conventions provide an opportunity to meet equipment manufacturers and dealers, renew contacts, evaluate new equipment and services, and participate in sessions and workshops. Exhibitors follow a similar track; their goal is making contact with the attendees. There is a symbiotic relationship. A successful convention needs attendees and exhibitors.

It's not simply a numbers game, however. The quantity of attendees and exhibitors alone does not make a show successful. The spring convention, while still a large convention, attracts many different sectors of the entertainment technology industries, of which broadcasting is one part. The NAB calls this convergence. Radio attendees and exhibitors call this clutter. The spring convention is so diverse; radio is nearly lost in the rush.

The answer has been to hold a radio-only convention in the fall; one that is a holdover from an earlier incarnation for radio programming, the World Media Expo and other sources, to provide a convention that addresses the needs of radio broadcasting. Or does it?

The fall convention has shown a continuing decline in attendance throughout the years. Some speculate that the NAB wants to end the fall show. Others feel that the NAB's radio board has perpetuated the fall convention out of spite and to stroke their own egos. Either way, if things continue the way they are, the fall NAB Radio Show will likely end on its own as it runs out of steam.

The fall convention's demise was nearly sealed when the NAB announced a change in the policy for issuing exhibits-only passes. Instead of providing unlimited passes, the NAB planned to provide each exhibitor with 20 passes total. These passes are one-day passes, with 10 provided for the Thursday show hours and 10 for the Friday show hours. Attendees are only allowed to have one pass each. That means only one day to attend the convention floor. This action would have surely limited the overall attendance on the convention floor.

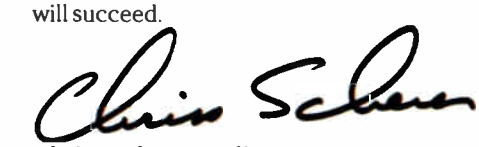
While attendance is important to the exhibitors, the pass limitation would have also affected attendees. There would have been no last-minute effort to get on the convention floor. The one-day limitation would also likely preclude many from traveling to Philadelphia for a single day.

Fortunately, a group of exhibitors approached the NAB to discuss the matter. Following the NAB and exhibitors' conversation, the new policy was lifted and restored to its previous practice of granting unlimited pass distribution. There will be no printed passes as in the past, but attendees will be able to register online.

Does radio really need a fall NAB convention? Time will tell. There are many regional conventions run by SBE chapters, state broadcast associations and equipment dealers. ARMA made a run at it for a short time, with a good formula. Unfortunately, ARMA did not receive industry-wide support. Exhibitors have to choose events carefully to maximize their return on investment.

If you feel that radio needs a fall show of its own, then you need to do your part. The exhibitors have made an extra effort to make it easier for you to attend. If you want the convention to continue, do your part and arrange to go. Philadelphia is an easy trip for anyone on the East Coast. If you're traveling farther, plan to spend the weekend. Philadelphia is packed with history and interesting sights, and it's not as expensive as some other tourist locations.

It's up to you to decide if the fall NAB Radio Show will succeed.



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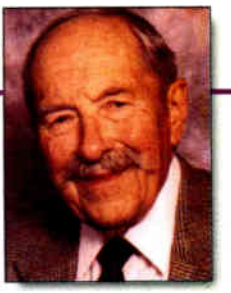

RF amplifier basics

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

With so much attention on IBOC, it is appropriate to step back and review the basic principles of RF amplifiers.

The radio transmitter is a collection of stages. Each stage modifies the signal in some way to produce the desired output. In the first stage, an oscillator or exciter generates the desired operating frequency. The output from this section is then raised to the specified transmitter output value. This power increase may be by means of successively larger amplifying stages or in some cases, where the exciter output is sufficient, directly to the final power amplifier (PA) of the transmitter.

The RF signal transmitted must carry some information. In broadcasting, the information transmitted takes the form of speech or music and is called modulation. With amplitude modulation (AM), the RF carrier is varied in strength (amplitude) at a rate depending on the frequency of the sound.

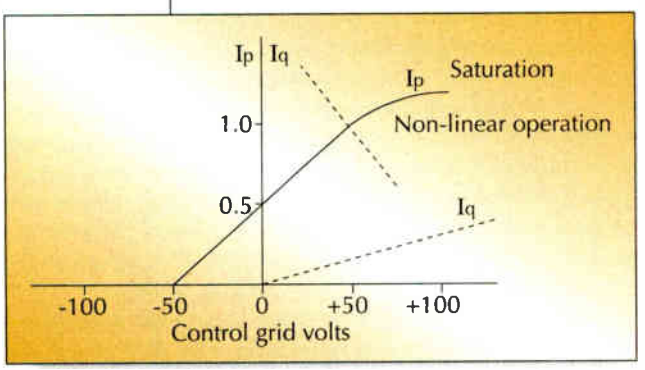

Figure 1. In a Class A amplifier, no grid current flows until the grid goes positive. Nonlinear operation occurs when the grid current stops tracking the plate current.

Regardless of where modulation of the carrier takes place, it is essential that the amplifying stage produces a clean, linearly amplified signal.

From the beginning

The earliest transmitters used amplitude modulation and this has continued in one form or another for about 100 years. It is probably the simplest method of modulation, requiring only the ability to vary the power output of an RF stage by varying the input audio signal.

In the 1930s frequency modulation (FM) was developed. It is accomplished by varying the frequency of the transmitted RF signal instead of the amplitude. Various methods of producing frequency modulation have been developed, including common mechanical and phase changing systems. Phase modulation produces the same effect in an FM receiver as frequency modulation.

The final stage of the transmitter may be directly modulated (in AM), or it receives an already modulated RF signal (FM). Many modern broadcast transmitters use solid-state modules in their power amplifier stages, however, there are still a considerable number of transmitters that continue to use vacuum tubes in their final stages. Solid-state devices provide considerable reduction in operating costs and their use provides the ability, in most cases, to change a faulty module on an operating transmitter without having to shut down.

Know the A, B, Cs

The most important characteristic of an amplifier is linearity. That is the ability of the stage to amplify all parts by the same amount so that all signals are amplified equally.

In a class A amplifier, current flows constantly and is not cut off during any part of the cycle. In a tube design, this is achieved by supplying sufficient negative bias voltage to the control grid to ensure that it never goes positive above 0V at any time in the cycle.

This means that no grid current flows and the source is not required to produce any drive power. For example, if the input signal has a 30V swing and the bias is -30V, the grid voltage would swing between -60V and 0V and no plate current would flow.

Because class A amplifiers are inherently inefficient in terms of required voltage and current, they are not generally used today in commercial broadcast transmitters. Instead, class B and class C amplifiers are common or variations of class B and class C circuits, such as a class AB amplifier.

With the introduction of pulse-duration modulation and digital operation systems, amplifiers have changed considerably, but the basic facts still apply.

The principles of amplification remain the same regardless of whether it is a tube or a solid-state amplifier. Because of the proliferation of high-power transmitters still using tubes, consider the control characteristics of a vacuum tube amplifier.

Figure 1 shows the dynamic characteristics of a triode tube amplifier. The solid line represents the plate current. The intersection of this line and the negative grid voltage axis shows the cut-off point at which the tube is so heavily negatively biased that no plate current flows. As the

negative bias is decreased and passes through zero into the positive region, the plate current increases. The more steeply the plate current rises as the grid voltage becomes positive, the greater the transconductance of the tube. This controls the amplification factor. As the superimposed RF voltage is applied to the control grid, the bias becomes more negative on negative peaks and less negative on positive peaks. However the grid will never become positive so that no grid current will flow.

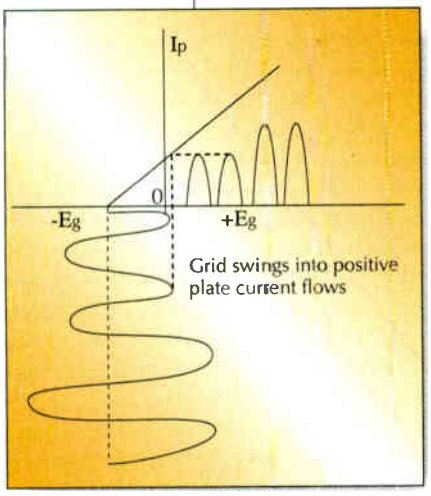

Figure 2. When a Class B amplifier is heavily cutoff, the positive peaks cause grid current and plate current flow in a series of half-wave pulses.

Differences in options

The major difference between the various classes of amplifiers in tube designs is the level of voltage applied to the power amplifier control grid. In class A, because the plate current is never cut completely off, the efficiency of a class A amplifier is low, about 30 percent, and so is the power output. Class AB operation is achieved by allowing a small amount of grid current to flow as required.

In class B operation, the control grid bias is increased so that the plate current is just at cut-off. The positive portion of the applied signal will cause plate current to flow immediately. No matter how far negative the grid goes, plate current will never flow. This type of operation requires sufficient signal voltage to drive the grid positive. The peak plate current is raised and sometimes the average plate current uses two tubes in push-pull operation. Figure 2 shows the operating characteristics. The output is a series of half waves with an efficiency of about 65 percent.

Class C operation is similar except that the control grid is biased far past cut off. Plate current only flows with high excitation and can reach saturation. Efficiency is high, around 90 percent. However, the waveform can be badly distorted in class B and C operation. Because of this, the correct load impedance must contain a resistive component to develop the required power. This is usually the input resistance of the transmission line.

E-mail Battison at batcom@bright.net.

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A station buyer's technical checklist

By Harry Martin

When a company decides to purchase a radio station, the station's technical plant is often overlooked by the buyer.

The Georgia Association of Broadcasters published an article last year entitled *Technical Concerns upon a Station Transfer* highlighting this concern. Written by Daniel Davis of D-Squared Broadcasting Technologies, the article provides a useful checklist of technical items to be reviewed prior to a station acquisition. Here are some highlights:

· Retain an independent consulting or contract engineer to inspect the station's paperwork, unless you have a full-time engineer on staff. Those include the station's main FCC license, as well as those for licensed microwave STLs and remote pick-up units.

· Once you have those materials, the station engineer and counsel should confirm that the licenses accurately describe the station's facilities as constructed. For example, check the geographic coordinates of the station's tower. Incorrect coordinates may have been entered in the Commission's records when the tower was first authorized, or possibly when it was registered.

· Confirm that all the station's auxiliary authorizations are accurately associated with the main station authorization in the FCC's records. Because auxiliary licenses not associated with a broadcast call sign do not renew automatically with the parent station and may have expired, confirm that all the auxiliaries are still in good standing.

· Find out if there are any outstanding construction permits to modify the station. Check the expiration dates of the permits, as well as the state of construction. If construction has been delayed, find out why. And if construction has been completed, make sure that a covering license application has been filed. Determine if the station is operating pursuant to any special temporary authority; if so, find out why and how long the STA will be needed. Tower lighting and registrations also should be checked.

· When towers are sold, the new owners are required to update the tower registration to reflect the new ownership.

· The seller may possess engineering reports that may not be available at the FCC. Such reports should be transferred along with the station's assets. These might include proof-of-performance measurements, copies of related engineering studies, coverage maps and, for AM stations, the most recent antenna resistance measurement report. Buyers should make certain that the original technical manuals for broadcast equipment, are available with factory-test data for the specific transmitter for the station.

· Inspect the station's physical plant, including the studio facilities. Make a list of the essential equipment, check the performance of the equipment and test the station's signal.

· Check for RF exposure compliance, for asbestos in the studio building and for underground fuel tanks anywhere on the property being acquired or leased. You will have to certify to environmental compliance at renewal time.

· For stations using telephone access remote-control systems, the buyer should request copies of the program code list or completed programming worksheets for the system. After closing, user and security codes for the system should be changed to prevent former employees from accessing the system.

· The seller will provide an inventory of all equipment, fixtures and furnishings being conveyed with the station. Compare that with the list compiled by your engineer. If possible, the contract should warrant the performance of the equipment and declare that the seller has title to all property. The contract should also specifically disclose any excluded items that may belong to station personnel or that do not convey with the station.

· Review tower use rights. If the tower is leased, is the lease agreement assignable and under what terms? Are there other tenants on the tower who could create interference for the station? What are your rights under the lease? Has the seller been leasing space to other tenants? If so, make sure those leases are assigned to you.

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

Dateline:

Renewal applications are due Aug. 1 for radio stations in North Carolina and South Carolina. Stations in the following states, commonwealths and territories must file their biennial ownership reports with the FCC, and place their annual EEO reports in their public files and on their websites, by Aug. 1: North Carolina, South Carolina, Florida, Puerto Rico, Virgin Islands, Iowa, Missouri, Alaska, Hawaii, Oregon, Washington, American Samoa, Guam and the Mariana Islands.

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MP-4	4	800 W	$1,250
MP-4R	4	2000 W	$1,750
MP-5	5	3000 W	$2,250
MP-6	6	3000 W	$2,700

FM Low Power Circular Polarization antennas

Model	No. Bays	Max. Input Power	Price
GP-1	1	1500 W	$350
GP-2	2	3000 W	$1.350
GP-3	3	4500 W	$1.800
GP-4	4	6000 W	$2.500
GP-5	5	6000 W	$2.900
GP-6	6	8000 W	$3.500

FM Medium Power Circular Polarization antennas.

Model	No. Bays	Max. Input Power	Price
SGP-1	1	3000 W	$650
SGP-2	2	6000 W	$2,450
SGP-3	3	8000 W	$3,500
SGP-4	4	8000 W	$4,300
SGP-5	5	8000 W	$5,100
SGP-6	6	8000 W	$5,900
SGP-6R	6	15000 W	$6,500

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TV & Radio antenna systems

Installation Profile

Trunk wiring

Front view

RAM is in the ZONE

By Warren Shulz,
ABC Radio Chicago

It was an important goal to design a studio that had space for all the hardware and digital workstation requirements for today's production needs. RAM and the engineering staff of ABC Chicago Radio teamed up to design a studio, which was both functional and easy on the budget.

For durability, a Corian work surface was utilized. All pedestals and over bridges were made of 1-½" thick particleboard covered with a tough laminate. Welded steel tubular rods supported the Corian surfaces.

The over bridge to the right of the operator is supported by RAM furniture to the left and a RAM equipment rack to the right. The over bridge is hinged on the left and swings on a 90 degree arc. Equipment and trunk cable wiring is easily accessible, yet fully concealed from view when the over bridge is in the closed position. The equipment rack base rolls on heavy-duty casters for ease of pulling the rack and over bridge out from the wall on the pivot hinge.

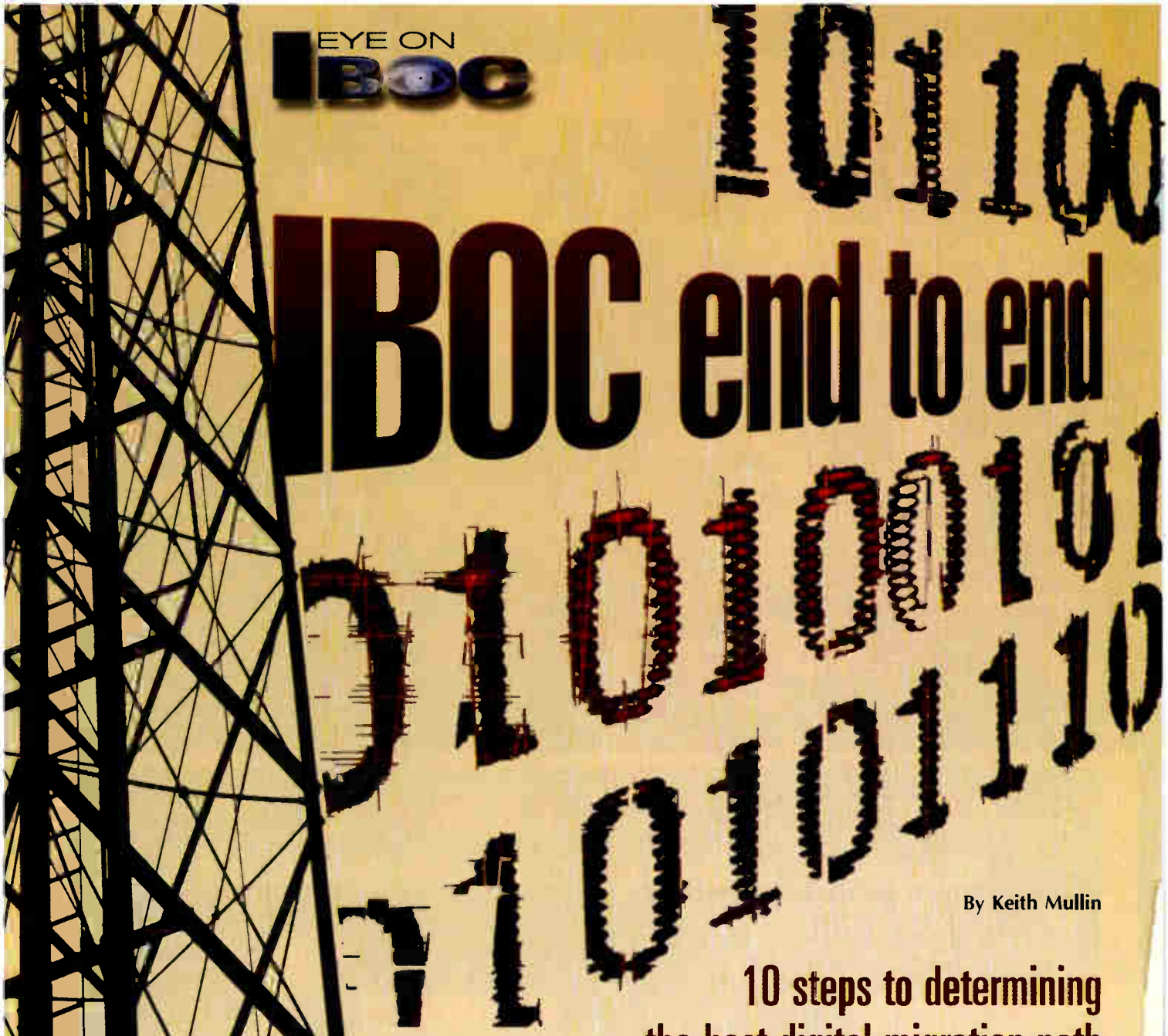
All trunk wiring is concealed by the over bridge and terminated to (easy to reach) wall-mounted RAM high-density punch blocks. RAM digital 110Ω cable is used throughout the facility.

The mixer selected for the facility is an analog Wheatstone A7000. With all the inputs and outputs required in production, a lot of mixer buses and mix-minus features are required. An SAS16000, 16x16 analog switcher is used for inner production studio switching for local equipment. This prevents overload in the existing studio routing switcher and greatly simplifies trunk wiring.

A low-profile overbridge over the mixer meter bridge provides space for four flat screen monitors. Space is allocated on the mixer surface for keyboards. The production room has both ProTools and Audicy editors. The center of the console has the ability to hold either style control surfaces into the mixer center section.

All the equipment was assembled and fully tested at the RAM factory. This permitted progress inspections and reduced downtime on site when the 12-year-old production console and furniture were decommissioned and the new RAM system was installed. ■

Corian is a trademark of DuPont.



IBOC end to end

By Keith Mullin

10 steps to determining the best digital migration path

There is no question that the transition to digital technology will be the biggest change to over-the-air radio broadcasting since its inception. Ultimately, the end-to-end air-chain not only will be capable of delivering higher-quality digital audio within radio's current infrastructure, but it will also enable new services such as datacasting and supplemental audio service over the existing FM channel.

Nevertheless, the benefits will come at a price ranging from a low estimate of $35,000 for AM stations with an IBOC-capable transmitter, satisfactory antenna system and digital infrastructure in place, to $200,000 or more for stations needing a new transmission system, STL and complete studio upgrade. Table 1 outlines typical anticipated station costs.

Given the expense and the lack of a mandated transition time frame like the FCC established for television's conversion to digital, it is likely that most stations will gradually convert to digital. The question is *how*? Even if a time frame for initiating full-digital broadcasts has not been set, there are steps a station can take now to ensure that the most intelligent and cost-effective analog-to-digital migration path is pursued.

Getting started

When it comes to converting to digital, one plan does not fit all—or even some. Your station's plan will be unique, influenced by budget and by your answers to a few critical questions:

· At what point in the air chain will the signal become digital? Earlier is better.

· Where is the studio in its equipment-replacement cycle? With digital, listeners will hear legacy equipment noise.

· What processing changes will be required? IBOC issues range from diversity delay to where the processor is located.

· Will the current STL make the grade? Composite systems will play havoc with the signal; the path may need to support data or supplemental audio and communications.

· What is the condition of the current transmitter site? More equipment means less room, and greater power consumption and cooling requirements.

· Does the transmitter have the bandwidth for IBOC? It needs to be wide and flat with sufficient headroom.

· Is the antenna system up to par?

· Has a digital business model been established? You will be able to offer new services.

To better answer these questions, the following 10 steps can help you prepare for the IBOC transition.

#1: Once the signal is in the digital domain, keep it there

Multiple digital-to-analog (D/A) and analog-to-digital (A/D) conversions, sample-frequency rate changes and varying data compression/decompression (codec) schemes can distort a signal, adding undesirable artifacts and noise. An all-digital studio facility will deliver the best overall signal with the lowest noise level and widest frequency and dynamic range.

Stations running an analog studio will also need to maintain strict level control. If too high of a signal goes into an A/D converter, the converter may overload or run out of bits, causing ugly and unpredictable audio. If the levels run rampant, consider placing a brick-wall limiter in front of the A/D converter.

#2: A new digital console will help you, now—and later

If you have to replace an aging console now, you will find that many new digital consoles offer features that will improve your performance and streamline your operation today and pave a solid path to the future. Even better, many digital consoles cost less than their analog counterparts. An all-digital console that can accept multiple input sample rates and various digital formats as well as analog inputs is becoming common. Even the analog transmission will be improved when the signal originates from an all-digital studio.

#3: Don't ignore the wiring, cabling and clocking

The AES digital audio signal must be as clean as possible. While proper wiring, termination, grounding and quality cable and connector replacements have always been important, they will be required to get the most out of a digital path.

Many recent installations are using CAT-5 cable instead of digital audio (110Ω) cable. Shielded CAT-5 provides an RFI-free, quick and simple installation with a smaller footprint.

Digital clocking is important. AES audio must be

IBOC end to end

synchronized to a common clock to avoid digital level changes, clicks and pops on the air. A small studio may be able to get by with a digital console with an internal clock that allows for silent switching and routing of various inputs. Multi-studio and other complex systems may be timed via GPS or other synchronizing systems, especially if signal routing is used. Some digital consoles available today include self-timing inputs or a complete networkable routing system that includes distribution of digital audio synchronizing signals.

Item	Average Cost (× $1,000)	Typical Range (× $1,000)
Equipment		
Exciter	20	20
Transmitter	22	0 to 70
Related costs	25	2 to 68
Digital studio equipment	5	0 to 30
Total Capital	72	22 to 188
License Fees		
One-time (@15×FCC)	25	4 to 68
10 yearly payments (@2.8×FCC)	5	0.7 to 13
Total Costs		
Total (one-time payment plan)	97	26 to256
Total first year (yearly payments plan)	77	23 to 201

Table 1. Per-station anticipated costs. Information courtesy of Ibiquity.

#4: Plan for diversity delay

IBOC transmission includes a 6 second to 8.5 second delay from the time the digital audio leaves the console until it is heard by the listener. Off-air monitoring of the digital signal will not be possible. Stations with a talk radio format most likely are prepared for this because of the profanity delay system.

During the IBOC transition, the hybrid mode will contain an analog and digital signal. The analog signal will be delayed accordingly to achieve a smooth blend when the receiver switches between the two signals. This will occur during initial signal acquisition or in areas of low signal strength.

The station will need to change its off-air monitoring practices to one of post-console/pre-IBOC signal monitoring for on-air talent. Most stations will also want to confidence-monitor for RF or audio loss with an automated no-carrier/no-audio detection alarm or have off-air personnel monitor for quality. For on-air personalities who want to hear the fully processed sound of their voices, a mimicking processor can be inserted into the real-time monitor loop. This unit can closely simulate the transmitter processor or produce a custom signature sound. In addition, communication provisions to the studio (other than monitoring the delayed air signal) should be made for personnel on remote location feeds.

#5: Locate the audio processor where it will do the most good

With digital, even the location of the audio processor will come into question. Should it be located in the studio or at the transmitter site? The heavy compression and processing that most stations currently use on their analog signals will not be compatible with creating high-quality, artifact-free IBOC signals. In general, stations

should consider moving their existing audio processing equipment to the transmitter site and placing it in the path of the analog transmitter only at a point after the diversity delay.

A separate audio preconditioning system designed for the complex requirements of a data-compressed digital audio transmission system can be added in front of the IBOC exciter. This preconditioning system uses psycho-acoustic algorithms that preserve optimal signal quality at a lower bit rate, freeing part of the bandwidth in the channel for other uses. For example, the preconditioning system can actually enable primary FM and a supplemental program service to be broadcast simultaneously on the same FM channel.

This processing technology can clone the analog sound signature and apply it to the digital transmission chain without generating the artifacts associated with hard pre-processing.

#6: Maintain quality and consider streamlining communication at the STL

Early IBOC adopters have found that inadequate STL systems—STL systems that fail to maintain high linearity across the bandwidth and use compression algorithms, especially after a studio codec—can cause big problems. In fact, as IBOC service is initiated, STL issues are second in importance only to the transmission system.

Whether the station is replacing an STL or installing its first system, pay close attention to the input and output capabilities. The station may be adding a data stream or supplemental audio to its hop. The STL system should support IBOC's 44.1kHz sampling rate and be expandable to handle frame relay and IP transmission. New IBOC-ready STLs and upgrade kits for late-model STLs are now available.

This may also be the time to consider streamlining the station's communication systems. Multichannel STLs can carry multiple audio streams. Multiplexer systems can be used with wired or wireless communication systems to provide audio, data, telephone, LAN and control paths.

If the station can not replace its composite STL system, a conversion system can be used to meet the AES input requirements of the exciter. Some stations are converting the composite signal back into discrete audio before the A/D converter. However, multiple alternations to the audio should be avoided. This arrangement is not recommended and should be considered temporary.

#7: Evaluate the transmitter building sooner rather than later

Most importantly, is there enough space at the transmitter site? Another transmitter may only be the start. Allow room for a combiner, a mask filter (depending on the transmitter manufacturer), a transmitter/antenna switch, a UPS and a second equipment rack. Now is the time to determine what equipment will be added. Once it is specified, allow an extra two to three feet of clearance on all sides to avoid surprises.

Most likely, the power (and associated backup generator) requirements will also increase considerably. Once the power requirements for new equipment have been calculated, add 20 percent for headroom and minor equipment additions.

Combiner losses, reject load-generated heat or

IBOC end to end

less efficient power amplifiers will generate heat and require additional airflow. If the building can not handle additional heat, consider locating the combiner or load in a separate "hot room" or an outside enclosure.

#8: Grounding and protection are even more critical with digital

Stations using a phone line or other dedicated hard-wired link for remote control or monitoring should ensure that all connections are properly terminated and isolated. Stations planning to provide datacasting services will need a phone/data line surge and lightning protection throughout the serial system.

Like PCs, some digital equipment must boot before it is ready for service. If these devices are in the station's critical chain, power must be routed through a UPS to prevent the agonizing 30-second to two-minute lapse of dead air or noise. The UPS should be large enough to support all critical components for the required amount of time. Power conditioners will also help to safeguard against line voltage fluctuations and ac line noise.

Innovations in wireless technology can provide systems with broadband capabilities. Connections can carry several types of audio and data at once.

#9: Understand the transmitter options

AM stations have only one transmission option: low level combining of the analog and digital signal through one transmitter. Determine if the current transmitter will be suitable for IBOC transmission.

For the low intermodulation distortion (IMD) that is necessary, the AM transmitter should provide audio bandwidth of 50kHz at the modulator to amplify the 30kHz audio component and 100kHz phase modulation of the carrier. Because high linearity is also essential, the transmitter should also provide low incidental quadrature modulation/incidental phase modulation (IQM/IPM) specifications (between -35dB to -45dB).

To date, no known tube transmitters are capable of reaching the -45dB IQM figure. Stations that own a solid-state PDM transmitter should talk with the manufacturer to evaluate whether it is suitable for IBOC, investigate what modifications will be needed, and how much they will cost.

FM stations have more options—but most likely will need a new transmitter no matter what the implementation path. If the station's current FM transmitter is not capable of passing the IBOC signal because of narrow bandwidth, non-linear class C operation or little headroom, but it is still fairly new with up to 10 years of service remaining, separate amplification—high-level combining with a new IBOC transmitter—will probably be the best choice. Most tube transmitters will not be able to pass the IBOC signal without substantial and cost-prohibitive modifications. Also keep in mind that to maintain its existing analog coverage, the current transmitter will have to boost its output power by 10 percent to 11 percent above the current total output power to overcome any combiner losses.

On the other hand, stations that operate a lower-power FM station with a late-model transmitter running 30 percent or more under its maximum power may be able to upgrade to IBOC at a fairly reasonable cost. In this case, the FM analog and digital signals would be low-level combined in the same transmitter, using the common amplification method.

A third FM option—space combining—is currently being tested. At present it is only allowed under special temporary authorization (STA) from the FCC.

#10: Don't overlook the antenna and transmission line

There are four key reasons to evaluate the final elements: to prevent interference, to maintain coverage, to prevent equipment damage and to conform to safety regulations. Given the importance, consider a site survey to ensure that the station can properly pass the digital signal—especially for AM.

The survey will sweep the feedline, tower and antenna to determine frequency response across the band, impedance bandwidth and VSWR symmetry. These figures will become more important than ever with digital because poor numbers will translate into increased bit error rates that will reduce coverage.

For most modern AM transmitters, IBOC requires that attention be paid to the load and that it be flat and symmetrical, exhibiting *Hermitian* symmetry out to 5kHz with a VSWR of 1.2:1 or less at 10kHz and 1.4:1 or less at 15kHz either side of carrier. Hermitian symmetry occurs when the upper and lower sideband frequencies at a given offset from carrier exhibit reactance of equal but opposite sign. For example, a load impedance that is 50Ω+j0 at carrier may be 46Ω-j5 (capacitive) at 5kHz below carrier, and therefore should be about 46Ω+j5 (inductive) at 5kHz above carrier. The symmetry requirement actually applies to the output of the PA combiner and not necessarily the transmitter output connector, so phase rotation occurring in the output network must be taken into account if measurements are taken at the output connector.

Most FM antenna systems are proving to be IBOC-capable with little or no alignment. VSWR needs to be no greater than 1.1:1 at analog center carrier frequency (F_c) and then flat or at worst a small smooth rise up to 1.3:1 at ±250kHz out from F_c. Deviation from this may require adjustment—especially for side mount bays.

IBOC end to end

IBOC is not radio as usual

The digital infrastructure will provide capabilities for new services and revenue streams that were undreamed of in an analog world. This data could be used as a source for additional program-related data (PAD) or for independent services. Other possibilities include subscription services and Internet broadcasting. FM stations will be able to offer a supplemental audio channel.

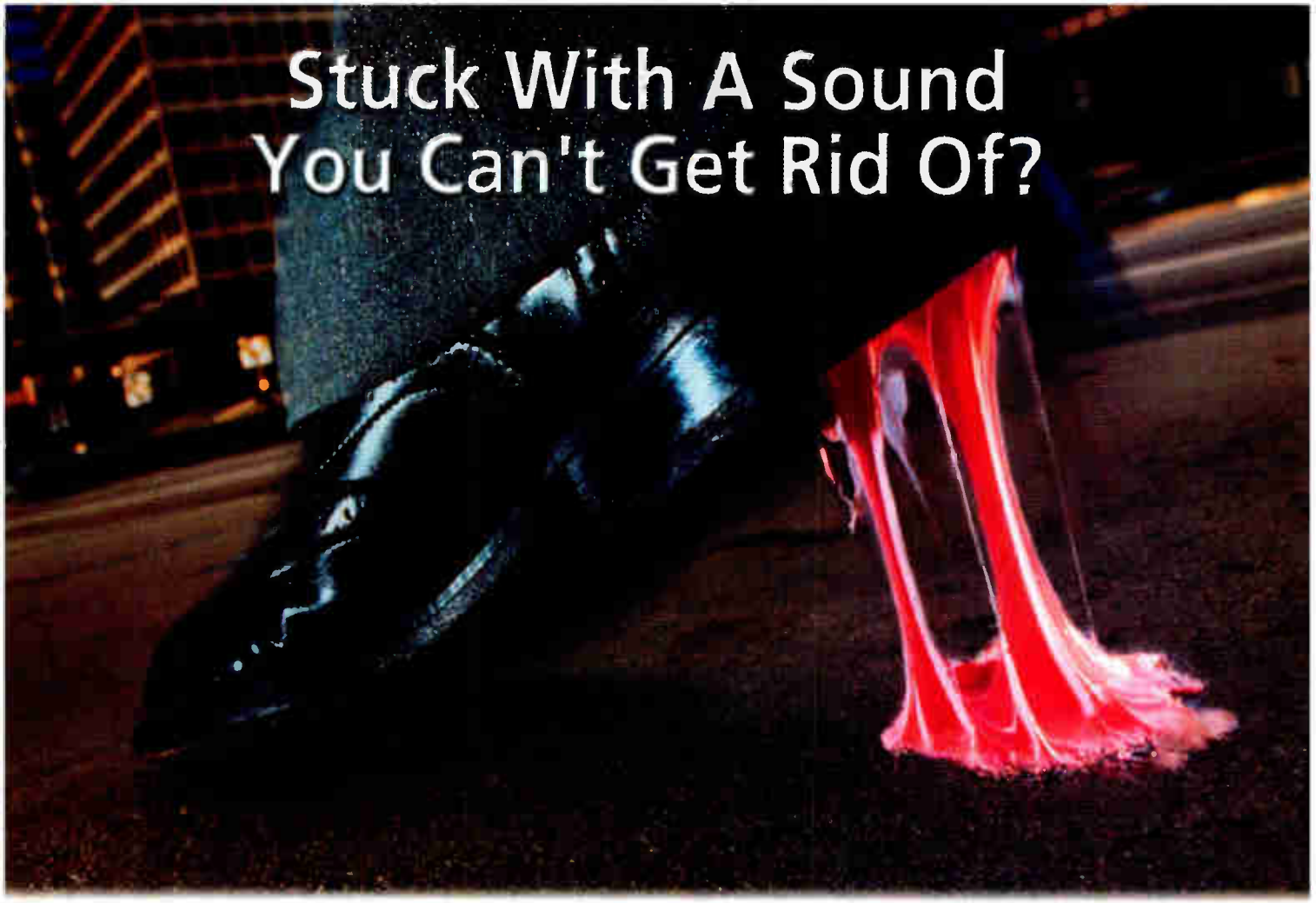
Although the transition to digital will be complex and costly, it can represent more than an enhancement to the station operation. I believe that it is a defining moment in radio—a moment when the future will be limited only by our imaginations. Now, when even AM can broadcast "in color," the future should bring new forms of information and entertainment over the airwaves that have served us well for so long.

Mullin is a technical writer and instructor for Harris, Broadcast Communications Division.

Ensure that there will be sufficient room to house the equipment necessary for IBOC operation. Combiners and filters may be housed in a separate room.

Tracking the transition

Follow the industry transition online at www.beradio.com. Click on Eye on IBOC to see the stations that have commenced IBOC operations.



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Capturing audio in the field

Recording high-quality audio in the field is easier than ever as the recorders get smaller and more robust.

By Chriss Scherer, editor

Recording audio easily in the field combines a careful balance of several elements, including audio quality, recording format and equipment load. Thanks to the continuing miniaturization of electronics and mechanical devices, a great deal of recording power, quality and reliability is available in some highly compact devices.

The uses for portable recording vary widely, but the most frequent application is for gathering news, interviews or actualities. Because of the fast-paced nature of these events, recorders with minimal or easy-to-use controls and features allow recordings to be made quickly and without errors. Many options are available in portable recorders. The most basic models may have an internal mic or mic connector. Some have line-level inputs. Additional features added to the basic package include a built-in speaker, various selections for the recording speed or format, multiple inputs, stereo or multiple tracks, multiple power options or extended battery-time options, editing and transmission capability. As more features are added, the retail price naturally increases. The operational complexity may also increase.

When choosing a model, tailor the features to the application. A reporter on a daily news beat may only need basic recording with a built-in mic and maybe a line-level input for an audio pool feed. He will likely return to the studio after each element, so the editing and transmission features are unnecessary and may hinder easy operation.

Likewise, do not overlook the possibilities that the additional features may provide. If the extra items are out of the way and do not interfere with basic operation, you may find that these features are useful as new situations and needs arise.

The **Denon DN-F20R** uses Compact Flash media up to 192MB. The sampling rate is selectable between 24kHz or 48kHz, and the bit rate is variable from 16kb/s to 128kb/s (MPEG). The two memory card slots allow continuous recording. The unit supports MPEG 1, MPEG 2 and linear PCM (.WAV).

www.usa.denon.com/pro

The **Sonifex Courier** records onto PC Card drives or memory cards up to 2GB and provides recording in MPEG Layer II, .BWF and .WAV formats. In addition, the unit offers POTS and ISDN connectivity with an internal phone book, a USB port for file transfer and a scrub wheel for on-board editing.

www.independentaudio.com

A sleek design makes the **Maycom Handheld II** easy to use for quick interviews. Using Compact Flash cards to record linear or MP2 files, the unit can also be placed into an accessory docking station to download audio files and provide additional I/O and battery recharging.

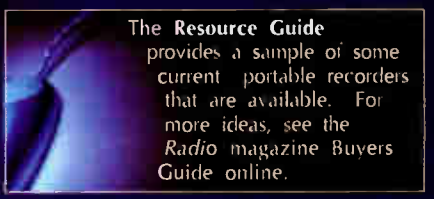
www.maycom.nl

The **Marantz PMD690** includes a built-in microphone, a built-in speaker and professional mic/line inputs and outputs. It records in stereo or mono to a PC Card or a Compact Flash memory card. Features include an automatic level control and a pre-record audio cache. Audio files can be saved as .WAV, .BWF or MP2.

www.marantzpro.com

Inside the extras

With a few basic differences, the audio quality of most recorders ranges from



The **Resource Guide** provides a sample of some current portable recorders that are available. For more ideas, see the *Radio* magazine Buyers Guide online.

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Capturing audio *in the field*

good to outstanding. When a poor recording is made, it can usually be attributed to an incorrect input level or an inferior-quality mic. Some recorders have internal mics, which may yield satisfactory results. They are convenient and simplify operation, but to eliminate background noise or get closer to the audio source, an external mic may be needed. A rugged dynamic mic can make a significant difference.

The external mic connection on a recorder can be a problem. Most connector choices are XLR or 3.5mm. Because of its size and locking capability, the XLR provides a more reliable connection, and it is less prone to being broken. The drawback is that an XLR connector is substantially larger. This is a limitation in the quest to design more-compact recording devices, but in most cases, an XLR connector will probably be the preferred choice.

Once the audio is recorded, it will most likely need to be transferred to another system. Removable media makes this easy in the studio. For digital formats, it may be quicker to transfer the file directly from the field unit through a direct connection, such as a USB port. In cases where the reporter will not return to the studio, the ability to transfer files via telephone may offer a practical solution. Some recorders offer direct POTS or ISDN connectivity to facilitate these transfers.

Choosing a format

Part of the decision process in choosing a portable recorder is to consider the media format. There are five basic formats in popular use: cassette, DAT, Minidisc, Optical (CD-R and DVD-R) and solid-state (PC Card and Compact Flash). Each format offers its own advantages and disadvantages. While all of them have proven to be practical and provide quality results for contribution material, certain aspects may make one more favorable over another.

When deciding on a format, consider the format's quality, the cost of the format media, reliability of the transport, availability of media and transferability of the media to other devices.

While cassette is still a popular choice, its analog format is an obvious disadvantage to digital formats. CD and DAT record linear digital audio, which yields the highest quality. Solid-state recorders typically offer several encoding formats, so the audio quality can vary by the choice made. Minidisc uses ATRAC audio encoding, which sounds good. In the end, all of them provide acceptable contribution-level audio.

When it comes to media cost, CD-R wins the race. When purchased in quantity, the price per piece can easily be well below one dollar. DVD-R is priced higher, but will see continued

The **Tascam DA-P1** DAT recorder features 48kHz and 44.1kHz sampling rates, S/PDIF and RCA unbalanced analog I/O, balanced XLR mic/line inputs with 48V phantom power, a 20dB pad and limiter, a backlit LCD display for low-light conditions and a headphone jack. It will run for as long as two hours on a single charge.

www.tascam.com

The **Pocketrec** runs on a PocketPC PDA. The PDA can also run other applications. Audio files are created and stored within the unit or on solid-state memory cards. Record time is limited by the storage capacity. Files can be transferred through the PDA's connection methods. Basic audio editing can also be done.

www.pocketrec.com

The **Sony TC-D5PROII** cassette recorder is a lightweight stereo recorder and features a capstan-servo disc-drive system, external dc power input, balanced XLR mic inputs, VU metering with peak indicators, Dolby B noise reduction, a limiter and mic attenuator, a headphone jack and built-in speaker. A stereo line output is available on RCA jacks.

www.sony.com/proaudio

Capturing audio *in the field*

price reduction in time. Cassette and Minidisc are relatively inexpensive, with DAT prices being slightly more. Solid-state media has the highest cost, but it never wears out and can offer long recording times.

For reliability, nothing can beat a system with no moving parts. Solid-state recorders win in this arena. The tape formats require periodic cleaning. The optical formats also need clean lenses. Alignment and repair of the mechanical transports can also be a problem. The mechanical formats are also susceptible to problems from vibration.

It is unlikely that you will own a recorder and keep only one piece of recording media with it. It is always useful to have a spare. If a recorder sees frequent use on the road, the need to obtain backup media on short notice can arise.

I conducted my own unscientific research on this by visiting an electronics department store and a discount department store to evaluate the availability of various media formats. At both I found that CD-R and to a lesser extent DVD-R had the greatest representation in the displays, which was not surprising. Solid-state media was also popular at the electronics store, but was in the laptop and digital camera sections and not with the recording media. The next most popular was cassette.

The **HHB Portadisc MPD500** minidisc recorder has balanced XLR mic/line inputs, RCA phono line outputs, a headphone jack and S/PDIF digital I/O. A USB interface allows for real-time transfer of files to editing systems. Basic editing functions are also available on the unit itself. A memory buffer prevents errors from vibration and a six-second pre-record buffer adds additional confidence.

www.hhbusa.com

The **Fostex PD-6** is a DVD-R recorder with a six-channel mixer that accepts mic-level (with 12V T-power and 48V phantom power) or line level signals. Each channel features adjustable input gain, a variable high-pass filter and limiter. AES-3 and S/PDIF I/O is also provided.

www.fostexdvd.net

The **Mayah Flashman** records onto Compact Flash cards, which allow more than eight hours of recording on a 256MB card. The removable card can be read by standard PC card readers for file transfer. Its features include 32kHz/44.1kHz/48kHz sampling rates, S/PDIF I/O, XLR mic input, RS-232 data port and a stereo line output.

www.mayah.com

Minidisc had a small showing, while DAT was almost nonexistent. Granted, any of these formats can be easily found through other outlets, but for a last-minute need, this is something to consider.

The ability to play the recording in another location can be convenient. Once a facility adopts a standard format, there is the option to play recordings in the studio. Even with this in mind, CD players are everywhere, and cassettes are common, making both convenient choices. Minidisc and DAT are somewhat rare outside the studio. Solid-state media will only be playable in the original recorder or perhaps on a PC.

Other choices

Personal recorders for the consumer market are everywhere. While these devices offer long recording times, they usually do not provide professional features such as an external mic connection or the ability to download recorded data, and they may not be as rugged as professional designs. They may also use inferior coding algorithms.

The **Maycom Easycorder** is a portable PC Card recorder that includes a graphical editor. A large illuminated screen and illuminated buttons, a mechanical and electrical lock during recording, a large gain control knob and presets for many operational settings add to the Easycorder's functionality. Storage is via the internal memory or via removable PC Cards.

www.maycom.nl

The **Sony PCM-M1** DAT recorder is the company's smallest and lightest DAT unit. It features selectable 48kHz/44.1kHz/32kHz sampling frequency selection, as long as 3.5 hours of continuous recording with supplied NiMH rechargeable batteries, selectable ID6 (SCMS copy protection), record margin indication, start ID level select, a back-lit LCD display, mic/line input, headphone output and line-level output.

www.sony.com/proaudio

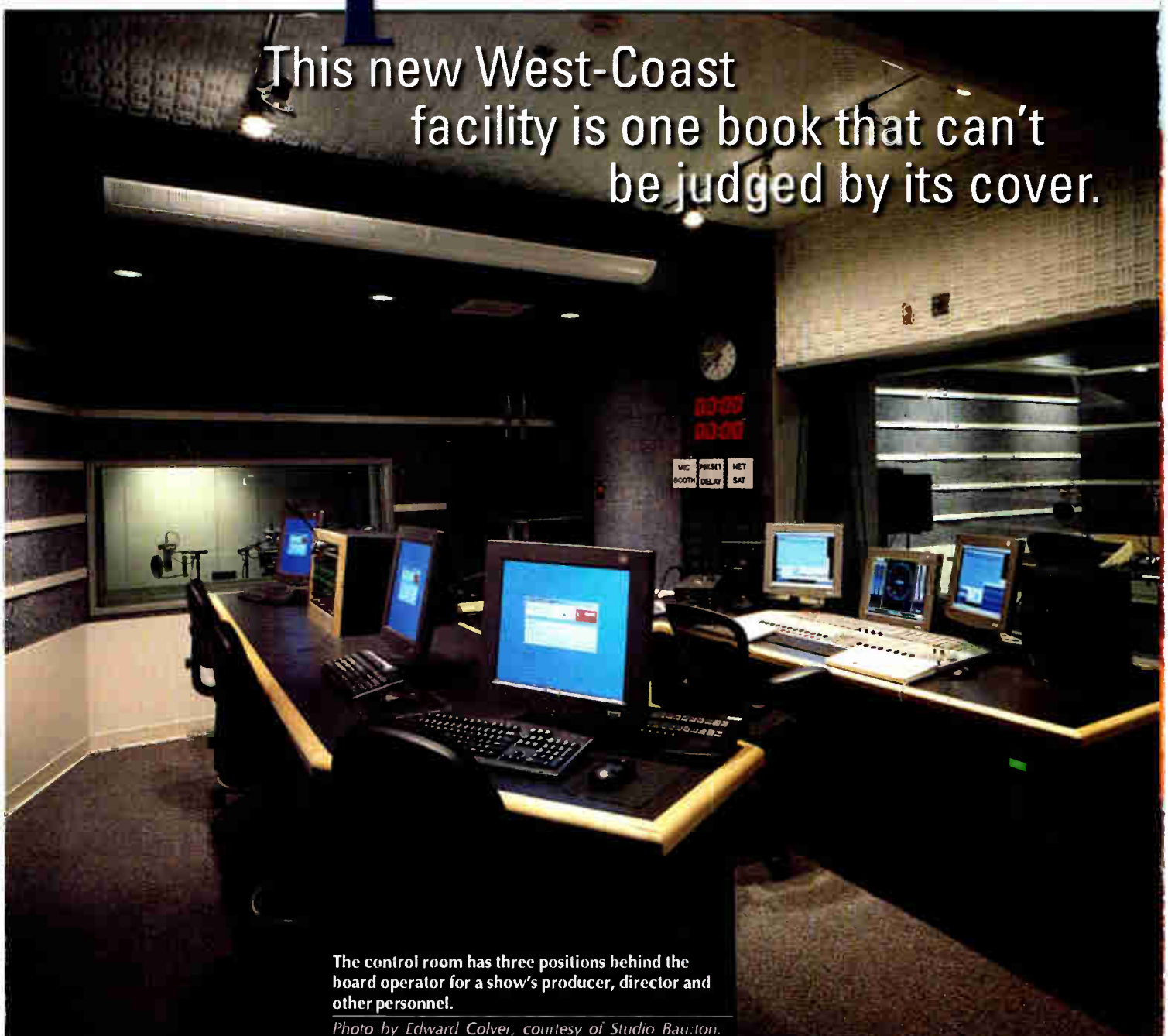
The **Marantz CDR300** features stereo XLR and ¼" mic/line inputs with 48V phantom power, S/PDIF inputs and outputs and an internal microphone and speaker. Record levels can be adjusted automatically or manually. You can also record your own CDs from audio sources such as CDs, LPs, cassettes or DAT.

www.marantzpro.com

While others CONSOLIDATE, NPR expands

By
Kent Kramer,
CBRE

This new West-Coast facility is one book that can't be judged by its cover.

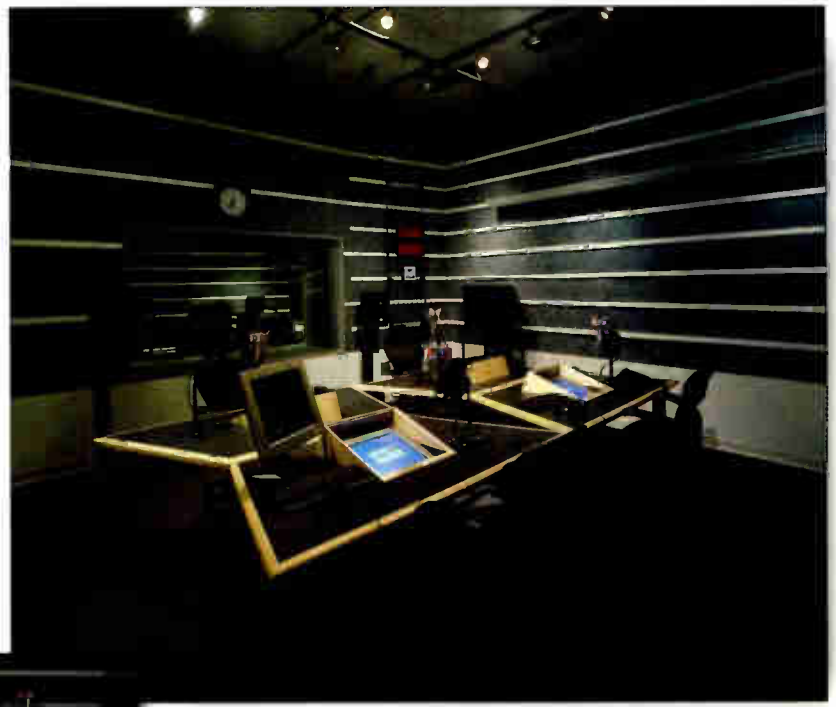


The control room has three positions behind the board operator for a show's producer, director and other personnel.

Photo by Edward Colver, courtesy of Studio Bauston.

On arrival at National Public Radio West in Culver City, CA, the building is reminiscent of an old manufacturing facility, but once inside the building is open and inviting. The roof of the building is constructed with wood trusses that span almost the entire building. This provides an interior that is open and spacious. Skylights in the roof provide lots of natural light during the day. Though the building maintains its factory feel throughout, its design provides a nice contrast to the high-tech surroundings of the studios.

The past tenant, an Internet video production firm, left the building with a technical infrastructure that most engineers can only dream about: a high-capacity electrical service with a matching generator transfer switch, a large UPS and a large number of items that could be modified for NPR's use with little effort.



Studio B is used for *The Tavis Smiley Show*. Four independent tables on wheels and umbilical cords allow for the room to be reconfigured.

Top photo by Edward Colver, courtesy of Studio Bauhaus. Left photo by Kent Kramer.

Offices flank the outside wall on one side of the building and a large, open area outside the offices, filled with cubicles for programming and production staffs, allow for comfortable working spaces for everyone. Centered in the building and directly inside the lobby is a kitchen and lounge that provide a comfortable place for everyone to take a break from their desks while remaining close to their offices. The common areas also benefit from skylights that provide natural light to the office spaces.

The studio area occupies the other side of the building. When planning began on the facility, NPR was determined that the building should provide redundant facilities, similar to the Washington, D.C., operation. This was also NPR's chance to enhance its West Coast presence. The overall plans also included room for additional growth. Studio A was left open and undeveloped with tentative plans to build a studio capable of being used as a large performance and recording facility. Plans also included an associated control room.

Both main and backup

Because this is NPR's second-largest facility, it has the duty of providing backup to the network operations. After the events of the past few years, plans were included that would keep the network active and on

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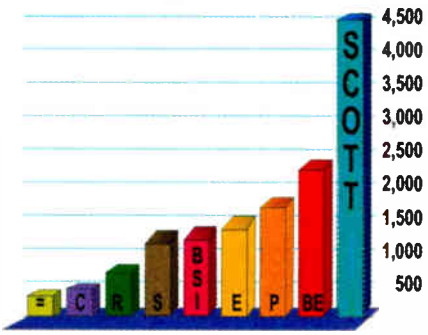

More radio stations choose Scott Studios' air studio systems than the number two and three vendors combined.

Scott sells the most because of the way we work closely with our customers. We send our Scott training technician to visit every new client. We learn what our stations do and how they want to do it. We fine-tune our system to do the job right for them. Then we stay as close as their phones, 24/7.

Air personality Alex King with Scott's SS32 touch-screen at one of Journal Broadcast Group's Knoxville FM stations.

Scott Studios listens. We learn from our client stations. We give them new features they want in free software updates.

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In the top ten markets, 180 stations use Scott Studios.

In the five largest markets, 85 stations use Scott Studios.

Of the 25 largest radio groups, all but one have bought new Scott Studios systems recently.

Marconi Radio Award winner for Major Market Air Personality, Big Boy, KPWR FM, Los Angeles.

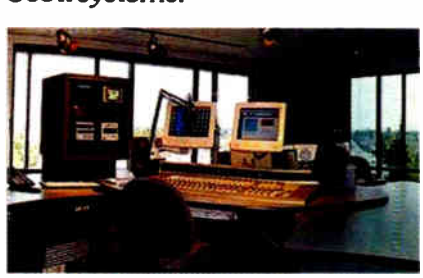
When group broadcasters standardize on one digital system, nearly all choose Scott.

Citadel has nearly 200 stations running Scott systems. Shown is Program Director Doug Fischer in an air studio at WTRX, Flint, Michigan.

Emmis' WKQX FM, Q-101, Chicago studio for Mancow, featured on a cover of Radio magazine.

Also in Radio was WYJZ FM, Indianapolis. Radio One uses Scott and Computer Concepts' systems.

Scott Studios' popularity is growing faster than ever. Group owners now have experience with many different brands. They appreciate the simplicity, power, reliability and more useful features they get with Scott systems.



SS32 at K-Wave FM in Santa Ana, California.

Computer Concepts Corp.
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Several dozen Infinity/CBS stations use Scott Studios systems, including legendary KMOX, St. Louis.

Scott Studios' Voice Tracker sends song heads and tails over the Internet. Several major groups say our distant city Voice Tracker is the best in the business.

You may have heard the adage that some ideas don't get put into practice because they weren't invented here, but not so at Scott Studios! Our ego doesn't get in the way of improving our service. In fact, we're happy that our best features came from our clients' ideas. We have more customers, and they include great broadcasters. So Scott Studios delivers more features that really matter to radio stations.

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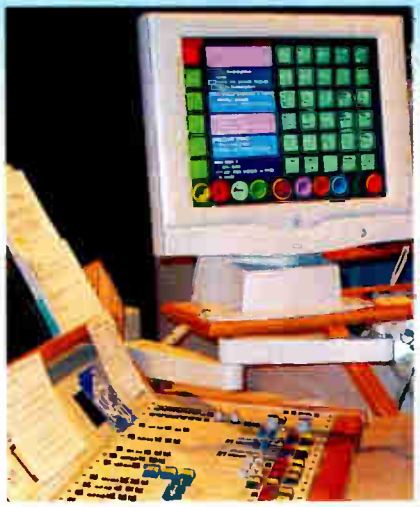
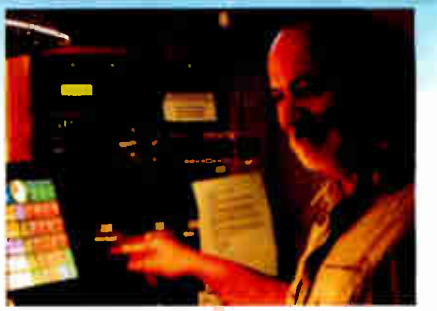


SS32 user KCBI FM, Dallas, was named Radio Station of the Year at a National Religious Broadcasters convention.

Software features requested by clients (and delivered by Scott Studios) include timing stretch and squeeze without pitch shift, touchscreen Instant Play buttons, and easy log shuffles.

Here's Cox's WMMO FM air studio, using Computer Concepts' Maestro and EpiCenter for all digital audio. Cox uses Maestro almost exclusively.



Brother Jon Rivers, longtime host of "Powerline" and "20: The Countdown Magazine" uses his Scott SS32 daily on K-Love's national network.

Other user ideas were our phone recorder with waveforms and audible scrub, live copy on screen, preview endings while cuts are on air, heads and tails Voice Trackers in any studio, segue editor, and integration with News Rooms.

The cover of April's Radio Guide shows this multi-screen SS32 from Citadel's WGFX FM, Nashville.

No other supplier has so many customers. No other vendor is as responsive to customer suggestions as Scott Studios. It's a fact: no other digital system is as good as a Scott.

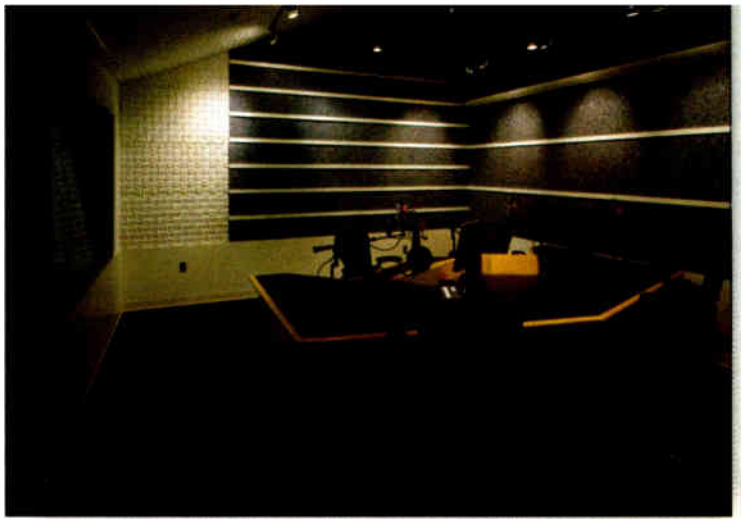
Scott Studios

13375 Stemmons Freeway, Suite 400
Dallas, Texas 75234 USA

NPR expands

schedule should the Washington facility become unavailable. Nearly 5 terabytes (TB) of RAID-5 storage provide plenty of linear audio storage. The Los Angeles facility was built from the ground up with the plan to operate with linear audio. Plans to convert the Washington facility to linear audio are in place now as well.

A technical operations center (TOC) provides the central control point for the facility. From this point, technicians are able to control the Dalet audio system and the Klotz Vadis control surfaces in each room. All of the computers in the facility are on Raritan Computer KVM switches. With the KVM switches, the person manning the TOC can bring up any terminal in the facility to aid in troubleshooting or to answer operational questions by users without the need to make a trip outside the TOC. The TOC also acts as a central recording facility for incoming feeds.



Studio C has positions for two hosts and two guests. The Control Room is visible from all positions.

Photo by Edward Colver, courtesy of Studio Bau:ton.

Situated around the TOC are five edit suites. The edit suites are housed in prefabricated sound booths built by Wenger. Each suite is centered around a four-fader Vadis console and a Dalet 5.1 workstation. Sony DAT machines and Neumann U-87 microphones complement the rooms. Edit 4 and 5 are also outfitted with Telos Zephyr Xstream ISDN codecs to enable a direct connection to Washington should the need arise. Denon CD and minidisc players are also available in each room. As in all the studios, all analog-to-digital and digital-to-analog conversion is done by the Klotz system.

Remote control

Control Room B with its associated Studio B plays host to *The Tavis Smiley Show*, which provided many challenges during the construction. Because of the host's considerable commitments to his charitable foundation, Smiley originates his show from his offices in the Crenshaw District of Los Angeles. A T1 circuit ties his studio to the NPR facility and Control B. The challenges came when allowing for the amount of information needed to be shared between the facilities during the show. Some of that is computer-level data.

The main audio switching station provides direct access to all the audio sources and destinations.

Photo by Kent Kramer.

For the show to run smoothly, Smiley has to have all of the same indicators available to him as he would if he were in the NPR facility. Mic tally, IFB, time code and the "Hey, Tavis" light were just a few of the items that are duplicated between the facilities across the T1. CDQ Primas on each end of the T1 provide the connectivity. For better control over the microphone gain, NPR uses Aphex remote-control mic preamps over an IP link.

Because redundancy is a primary mission within the facility, the control rooms operate with redundant Dalet workstations. The GPIs are linked to keep the systems operating in sync. Dalet Navigator is used for playback and the Surfer 4 wave editor is used for on-the-fly editing. A Telos 1x6 telephone interface provides a link to the listeners while a Telos Zephyr Xstream provides the link to other studios and serves as a backup link to the network. An Airtools 6100 profanity delay is also used. Because we live in the information age, each control room is equipped with a Panasonic wide-screen plasma display to bring outside news sources to the talent.

To keep the Klotz mainframes close to the control rooms, but out of the rooms themselves, each control room has a Klotz room. The Klotz room is nothing more than a small room outside the entrance to the control room that houses two equipment racks. The racks hold the Klotz mainframes and the computers for each room that are on the office LAN/WAN.

Studio B is a simple room with four small tables that have recessed openings for CRTs. Each table is on wheels to simplify reconfiguring the room. Studio C features a table that has a provision for two hosts facing Control C and has room for several guests on the other side.

In several places around the studios the system integrators, TGS, custom built panels to provide connectivity into and out of the rooms. Connectors for telephone, headphones, Ethernet, speakers and microphones, as well as various other connections are neatly and clearly presented on an engraved panel.

A main terminal room holds several IBM servers used for the Dalet system. With T3 connectivity for phone, data and audio between Washington and Los Angeles, users in both facilities have drag-and-drop capabilities for sharing files between facilities. Each of the studios uses a CDQ Prima on the T3 for transmitting and receiving audio to and from Washington. Telephone extensions

Facility Focus

the technology behind NPR West

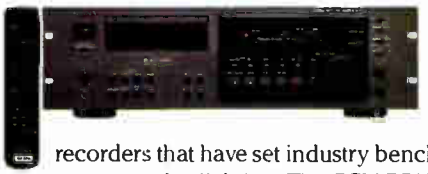
MUSICAM USA Prima LT+

The Prima LT+ is a very popular codec with major broadcasters and production studios. The LT+ is unique in that it can accept three internal ISDN TA's. This enables broadcasters to multicast to six sites. Small networks can save big on satellite up-link fees. The Prima LT+ can combine six ISDN channels to deliver contribution grade audio. NPR and the Metropolitan Opera use this bonding mode to deliver the highest quality program for up-link.

MUSICAM USA's new NetStar takes another big leap forward. Besides MPEG layer 2, 3 NetStar adds AAC/Low Delay AAC, J57 and J41 coding. It's now possible to deliver stereo audio at 96kb/s or lower. Or use Linear J.57 coding for digital master quality audio at 1.5 or 2.0Mb/s over IP, T1/E1 circuits.

www.musicamusa.com
732-739-5600

Sony PCM-R500



This DAT studio recorder is the latest in a long line of professional DAT recorders that have set industry benchmarks for performance and reliability. The PCM-R500 is a true professional machine, offering the audio accuracy of 16-bit linear digital recording, consistent performance, excellent durability, an industry standard format, and a broad array of professional features—including digital I/O and XLR connectors to properly interface with studio equipment. Sony DAT recorders have been used professionally for over 15 years in a wide-range of audio applications.

DAT media represents a low-cost, high-performance legacy of millions of tapes in use by audio and video professionals for playback and archiving. Sony continues to support the DAT format with a full line of portable and studio recorders, including PCM-R300 for home studio recording, PCM-R700 for confidence monitoring, the compact PCM-M1 portable recorder and the PCM-7040 time-code DAT recorder.

www.sony.com/proaudio
800-472-7669

Genelec 1031A Active Monitor

Celebrating our 25th year of Active Monitoring, Genelec is pleased that the new NPR facility in Culver City, California has chosen our 1031A Active Monitors for its reference monitor.

The 1031A is a modest sized bi-amplified active near-field monitor designed to fit the needs of many different listening environments. It utilizes an 8" woofer and a 1" metal dome tweeter set into a Genelec Directivity Control Waveguide (DCW), each with its own 120 Watt amplifier. In order to help tailor the sound to various acoustic environments, the 1031A also has a unique set of tone controls that assist in resolving the monitor-to-room frequency response.

Originally introduced in 1991, the 1031A is widely renowned in the audio industry as the premiere reference standard for broadcast. music, and audio post-production recording facilities.

www.genelec.com
508-652-0900

Studio Technology Furniture

Studio Technology designs, constructs, delivers and installs studio furniture to the broadcast industry nationwide. Broad-based design and construction expertise enables the company to provide a range of custom furniture to its clients. Studio Technology can provide a simple custom configuration that is competitive with modular furniture pricing, as well as higher-end furniture using solid surface or other alternative materials. Studio Technology now owns and maintains production facilities on both sides of the country. This enables us to increase our production capability while reducing shipping costs. Studio Technology has participated in major consolidation projects on both coasts and in Hawaii. The company will work with any systems integrator or your local staff and provides complete delivery and installation of the furniture it manufactures.

www.studiotechnology.com
800-676-0216

NPR expands

from Washington are piped to Los Angeles providing the employees intercom capabilities to co-workers in Washington.

With the spacious, new, state-of-the-art facility, NPR has ensured that it is ready for growth in the future. At completion, the facility was tested under fire. Completed just days prior to last year's fall elections, the facility passed with high marks.

Kramer is chief engineer of Liberman Broadcasting, Los Angeles.

The technical operations console routes programming between the studios, the Dalet system and the Washington studios. This room is also used for scheduled program feed recording and technical-support calls.

Photo by Kent Kramer.

Key players

Servers and Mass Storage Integration Champion Solutions Group; Boca Raton, FL

Network Integration and Cisco Hardware Networking Concepts; Columbia, MD

Architects Studio bau:ton; Los Angeles, CA

System IntegratorTGS; Chantilly, VA

Equipment list

ADC patch bays
Airtools 6100
Audio Technologies (ATI)
AES distribution amplifiers
Dalet Advanced Radio Suite v5.1
Deneke timer displays
Denon DN-C680 CD
Denon DN-M991R minidisc
Genelec 1029A
Genelec 1031A
IBM servers and mass storage
Klotz Vadis DC II
Klotz Vadis 880
Klotz Vadis 501 LCD button controllers
Leitch UDT-5701
Mackie Designs HR-824
Masterclock TCD-100A
Musicam USA Prima LT+
Neumann U-84
Raritan Computer KVM routers and extenders
Sony CDP-XE270 CD player
Sony DTC-ZE700 DAT
Sony MDS-JE470 minidisc
Sony PCM-R500 DAT
Sony STR-DE185 receiver
Sony TC-WE475 cassette
Studio Technology furniture
Tascam RW-2000 CD recorder
Telos Systems One hybrid
Telos Systems Zephyr Xstream
Wohler Technologies VMDA-4

The Best 10 Years of *Radio* magazine

1994 & 1995

The first issue of *Radio* magazine appeared in January 1994 as a supplement to *Broadcast Engineering* magazine. The new publication was a sign of the times; the broadcast industry was changing. *Broadcast Engineering*, founded in 1959, had served radio and television well for nearly 60 years. While convergence has continued across electronic media and entertainment, the individual needs of the component industries has become more specialized. Because of this, *Radio* magazine provided a special focus for the radio audience. In 1995 the supplement became a stand-alone publication.

In the coming months, we will look back on the past 10 years by highlighting events and technologies that have directed the course of the radio industry. In all, these installments will cover the best 10 years of the radio industry and *Radio* magazine.

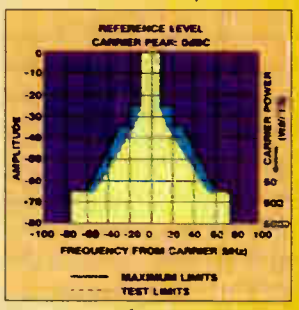
Time Line

1994

- The changes in duopoly rules are still being developed.
- A variety of digital audio encoding schemes debut. Concerns rise over the effects of transcoding errors and interoperability issues.
- At NAB94, the first RBDS test decoders and analyzers are introduced.
- ISDN BRI increases in availability. It begins replacing Switched 56 service.

May 1994: Digital exciters provided better sound and stability.

- Digital FM exciters are introduced, as are digital and digitally controlled on-air processors. Digital cart machines and STLs are introduced. Digital consoles are available, but considerably more expensive than their analog counterparts.
- On June 30, AM stations are required to comply with the NRSC-2 spectrum mask requirements.
- At the end of 1994, more than 20 percent of all the stations in the U.S were part of a duopoly or under an LMA.
- The Emergency Alert System is adopted in December 1994.



June 1994: The NRSC-2 AM RF mask.

1995

- Seiko and Timex/Data Broadcasting Corporation develop wrist watch data receivers.
- ISDN codecs hit the market strong.
- Surveys report that 100 radio stations have websites.
- Interfaces between DAWs and automation systems are popular at NAB95.
- The EIA begins the RBDS rollout.
- Forty-three radio stations and networks broadcast from Cleveland's Rock and Roll Hall of Fame and Museum opening.
- The FCC determines the AM expanded band allocations, adopts rules covering unattended station operations and lifts operator permit requirements.

September 1995: Cleveland's Rock and Roll Hall of Fame and Museum opens.

More online

- See the Pick Hits from 1994 and 1995 and a gallery of past covers.

The beginnings of DAB

Digital radio is as popular a topic today as it was nearly 10 years ago. While there is one system currently under evaluation, there were many contenders under evaluation when the DAB pursuit began.

In early 1994, the EIA and NRSC developed a plan to evaluate the various systems so it could make its recommendation to the FCC and to the broadcast industry.

November 1994: The AT&T IBAC system under test in 1994.

At this time, it was still undecided as to what type of system would work best. Other parts of the world were reviewing the Eureka 147 system.

AT&T was developing an in-band adjacent-channel (IBAC) system. AT&T also partnered with Amati to develop two in-band on-channel (IBOC) systems. Thompson was working on two Eureka 147 systems. USA Digital Radio had three IBOC systems under the name Project Acorn. Two were for FM and called System 1 and System 2 FM. The third was an AM system. Finally, the Voice of America and the Jet Propulsion Laboratory were developing two S-band satellite systems.

The systems were gathered in Cleveland at the NASA Lewis Research Center, where they began the evaluation process that took more than a year to complete. Following the start of the lab tests, listening tests were held in Ottawa, Canada at the Communications Research Centre beginning in June 1994. The next phase included field tests in San Francisco.

April 1995: The USA Digital Radio mobile demo van at NAB95.

At NAB95, USA Digital Radio provided mobile listening demonstrations of its system.

During all this, the plans for a satellite digital audio radio service (S-DARS) were being laid. On Jan. 12, 1995, the FCC released a Report and Order designating 2.31 GHz to 2.36 GHz for S-DARS use. On the international side, Worldspace held its first organizational meeting in January 1995.

At NAB95, broadcasters discussed the idea of proposing restrictions to the FCC on the S-DARS licensees, proposing that the satellite licenses would not be issued until a terrestrial standard had been approved and adopted.

By the end of 1995, L-band and S-band systems were eliminated from consideration for terrestrial radio. The International Telecommunications Union meanwhile adopted Eureka 147 as its DAB standard.

Harris Broadcast Congratulates *Radio* Magazine for Ten Years of Broadcast History

After a Decade, Harris Continues to Lead the Way in Radio Broadcast Technology

Harris Broadcast Communications founded in 1922 as Gates Radio, has always blazed the way in developing cutting-edge broadcast technology. From its humble beginnings in a rented apartment in Quincy, IL, Harris has rapidly grown to become a global digital technology powerhouse providing products, systems and services to customers in more than 125 countries.

During its 80+-year history, Harris Broadcast Communications has introduced well over 70 major technological breakthroughs—important "firsts" including many world standards that have literally changed the way our world sees and hears itself.

Innovation Leader

In radio alone, Harris has pioneered such inventions as the condenser microphone and remote amplifier, radio automation system, solid-state AM transmitter and MW exciter, digital FM exciter and all-digital FM airchain, and the world's first uncompressed digital 950MHz Studio-to-Transmitter Link (STL). Harris also has developed the AM modulation standards used by virtually every transmitter manufacturer, including Pulse Duration Modulation (PDM), Polyphase PDM, Pulse Step Modulation, Digital Amplitude Modulation and Digital Adaptive Modulation.

As over-the-air radio broadcasters in the United States begin their transition from analog to the digital broadcasting – HD Radio, Harris is setting the pace with the development of core technologies that will provide a smooth, safe and cost-effective migration path. The sky is quite literally the limit when it comes to the possibilities and opportunities that HD Radio offers with datacasting over a wider broadcast "pipeline". Broadcasters will be able to scroll text information for songs, news, scores and weather information. A growing number of new cars offer or will offer a Global Positioning System (GPS) unit that will eventually enable broadcasters to tailor their text messages with personalized and localized information.

As radio's digital leader, Harris is the only manufacturer with solutions for all digital standards and has the largest installed based of HD Radio- and DRM-capable transmitters and DAB systems. Harris also offers an utterly flexible family of STLs and network access solutions including the Intraplex line and the world's first 950MHz uncompressed digital STL, a full range of PR&E consoles from full-featured yet cost-effective standalone models to full networking platforms, and complete end-to-end systems.

The 165,000 sq. ft. Harris Broadcast Headquarters houses Harris' Advanced Digital Engineering Center.

Harris Opens Advanced Digital Engineering Center

A milestone mid-way through *Radio* magazine's first decade for Harris was the grand opening of the Broadcast Communications Division's new corporate headquarters and Advanced Digital Engineering Center in Deerfield Township, northeast of Cincinnati, OH, in 1999.

The new 165,000 square foot corporate headquarters centralized Harris' three broadcast business units with key design and engineering resources, and features state-of-the-art laboratories for technical development, a high-power transmitter test laboratory, warehousing shipping and support services for the thousands of products that Harris distributes, and a systems assembly area for building newsgathering and production trucks and staging radio and television systems projects.

Bruce M. Allan, president and general manager, Harris Broadcast

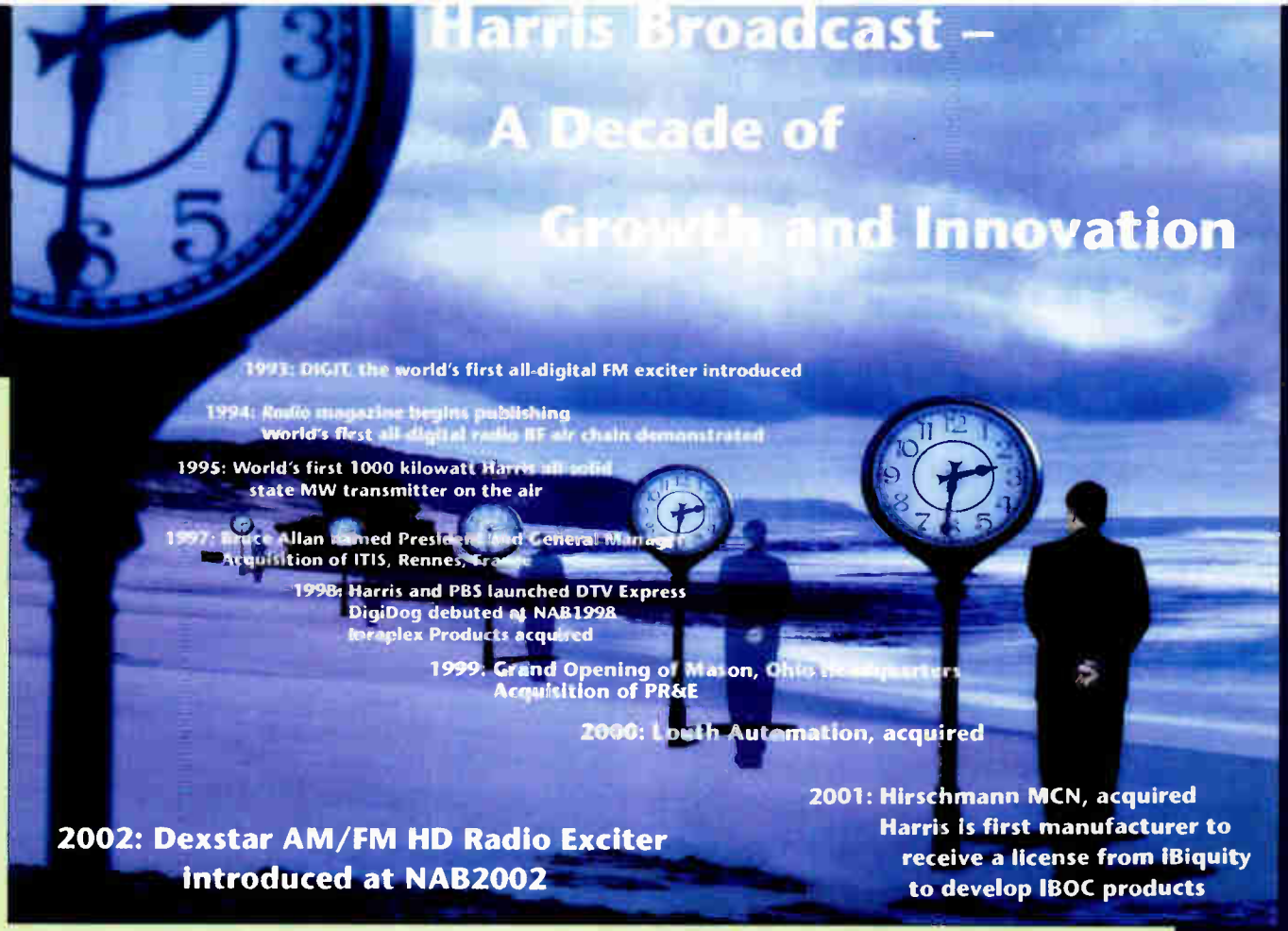
During dedication ceremonies at the new headquarters, Bruce M. Allan, president and general manager of Harris' Broadcast Communications Division, noted, "The digitization of broadcasting is rapidly blurring the lines between television and radio," Mr. Allan said. "Today's technical innovations in one area very often will have significant applications in another area. We are already seeing the benefits of a single strategic location in terms of efficiency and operational effectiveness."

End-to-End Digital Solutions

Today Harris is focused on providing the most responsive end-to-end digital solutions in hardware, software, systems integration and services for the delivery, automation and management of digital audio, video and data with its three business units:

· Transmission Systems designing, engineering and manufacturing the world's #1 line of analog and digital

Harris Broadcast – A Decade of Growth and Innovation



radio and television transmission systems (U.S. and European standards) and digital cable systems;

· Studio Products and Systems offering radio and television studio products including the BMX-*digital*™ and Legacy™ On-Air Digital Consoles and the recently introduced VistaMax™ Audio Management Hub, digital audio preconditioning technology, which enables 5.1 surround sound and supplemental audio applications, digital network access solutions, a new approach to network-wide audio management, scaleable broadcast management systems for centralized operations, prewired systems, and custom-designed and integrated studios, facilities and networks;

A recently installed studio at Maricopa Community College, Phoenix, Arizona.

· Harris Automation Solutions developing ingest-to-playout workflow management solutions that automate labor-intensive processes, eliminate duplication, originate live productions outside of Master Control, and share media seamlessly throughout a media enterprise.

Each unit is backed by the best service, training and support in the industry.

Future Forward Thinking

Looking forward to radio's digital future, Harris is deeply immersed in defining and developing digital broadcast technology for the 21st century. At NAB 2003, radio broadcasters got a glimpse of this technology with the unveiling of Harris' remote control products that feature computer access capabilities from literally anywhere in the world via the Internet. If you imagined that your transmitter could talk to you via page or e-mail when problems arise, then Harris' remote control products, ReCon™ and eCDi™, have realized that vision today. And for the future, Harris engineers promise even more connectivity and synergy in the digital air chain as IT, wireless and RF merge.

BMX*digital*™ on-air console (above) with the VistaMax™ (right) delivers state-of-the art networking capabilities.

This is an exciting time for all of us in the broadcast industry as we explore exciting new broadcast formats and opportunities. In many ways, we are like those early broadcast pioneers who had to literally invent the radio/television business as we re-invent this mass media, all over again. ■

Clear Channel Cleveland

Short turnaround

By Mark Krieger, CBT

On Aug. 28, 2000, Dave Szucs, director of engineering for Clear Channel Communications Greater Cleveland operations received word that a lease finally had been signed for the company's new 59,000 square-foot multi-station facility. At the time, he could not decide whether he felt more panic or anticipation as he realized that operations from the new Independence, OH, location had to begin within seven months.

It was a formidable timetable. The first station to occupy and commence operation from the new location was the leviathan WTAM-AM 1100, a 50kW full-service news/talk station that also serves as network flagship for the city's NFL, AL and NBA professional sports franchises. This meant dealing with a morass of telecom and satellite issues, multiple studios and a newsroom with 14 networked audio workstations. Stretching the schedule, the station hit the air from its new home on April 28, 2001.

This was just a warm-up. Over the next six months, the group's five FM stations moved in on a roughly 30-day cycle, making the journey from three other pre-existing facilities. The occasion also served as a step-off point for an upgrade of the existing Prophet WAN audio servers to the Prophet Nexgen platform, a process that tested the nerves of IT and programming staffs already undergoing transitional strains.

When the dust settled, Szucs and his crew found themselves facing a sizable punch list. With 27 studios (and provisions for an additional four) the need to generate designs and documentation on the fly (a process known as concurrency among defense contractors) often had engineers working double shifts.

As with any consolidation of this scope, there were unexpected complications. A 70-foot microwave antenna tower designed to

Deceivingly tranquil here, the newsroom comes alive when its 14 workstations are occupied. A central master clock display keeps things in sync.

Large-graphic logos mark the entrances to the FM studios along the central corridor. The AM news/talk area is at the end of this hall.

provide sufficient clearance for the multiple STL paths of the six stations was stymied by a local zoning board, and all but one of the stations found themselves operating via T1 Intraplex links. Studio configuration preferences of individual stations, temporarily set aside in favor of interoperability, had to be accommodated over time through studio customization. Likewise, removing, cataloging and deciding where existing equipment could be incorporated into the new facility was an ongoing process. But by the end of the first year, it was time to breathe easier and declare victory, as the largest single migration/integration of radio facilities in Cleveland broadcast history was essentially complete.

The layout

While glancing over a studio floor plan, there is a noticeable line of demarcation between the AM news/talk operation and the music-based FM stations. The WTAM design has a dual focus, one centering around a comfortably large talk studio/control room configuration with two adjoining news studios, and the other dominated by the newsroom with its 14 Newsready workstations, master clocks, satellite video and radar displays. The remainder of the AM side has a Protools-powered production studio, still another news studio, and a live sports studio that sees double duty as a sports network master control point and production room. This same studio uses one of two legacy consoles brought from the previous FM studios, an enormous PR&E BMX III-32, refurbished and well suited to its multi-role mission.

The FM studios, in contrast, are laid out in a regimented, cookie-cutter approach. The six parallel sets of rooms, or modules, are identical in dimension and function. Each module consists of a show prep room, production studio, news/voice tracking studio and an air studio equipped with a Harris/PR&E Airwave console. Even though there are only five FM stations in the local cluster, the

Clear Channel Cleveland

extra set of studios allows for overflow, redundancy and network origination of syndicated content. Rounding out this studio block is a live performance studio complete with a control room suited for additional production work. To lend a sense of individual identity, each station has its logo emblazoned on the wall next to that module's entrance off the main corridor.

Throughout the entire studio core, the basic design principles are exemplified by the use of non-parallel studio walls, magnetic seal doors and central cable trays. Studio cabinetry is a standardized modular design allowing interchangeability and simple layout.

Connectivity between studios, workstations and the outside occurs at several levels. Prophet Nexgen (music and commercial inventory) and Newsready (news/sports copy and integrated audio) supply digital source material not only to the Cleveland hub, but also to outlying company properties via Clear Channel's WAN. This system provides tremendous programming flexibility. Meanwhile, the routing and distribution of real-time audio and digital sources is handled by a Sierra Audio Systems 64000 router with 128 inputs and 56 outputs.

Remote broadcasts are a staple throughout the industry and Clear Channel Cleveland is no exception. Sixteen Telos Zephyr/Zephyr Xstream ISDN codecs carry the day-to-day load, backed up by four Comrex POTS codecs. But remote pickup is not limited to hardwire alone—the facility is also served by a high-tower, narrowband RPU repeater system for news and traffic as well as a two-channel, four-site network of wide-band RPU receivers providing audio links for a small fleet of remote trucks.

Monitors and keyboards overwhelm the BMXIII-32 console in the sports network control studio.

Seating a host, producer and as many as six guests, there is no room for confusion about whose studio this is.

Today and tomorrow

In many ways, this snapshot of Clear Channel's Cleveland build-out is a template for the kind of synergy promised by large market consolidation. Yet it remains a work in progress. Several new studios are being built, while some existing studios are undergoing further modification and refinements. For engineers that like to stay busy, life just doesn't get any better than this.

Krieger is a contract engineer based in Cleveland.

Equipment List

- 360 Systems Instant Replay
- 360 Systems Shortcut
- Acoustics First studio sound panels
- ADC Pro Patch
- ADC-I-24B wire termination blocks
- AKG 414 B-ULS
- Audioarts R-5
- Audiometrics DA16000.b
- Audiometrics mic booms
- Baird satellite mounts
- Benchmark HPA-1 headphone amps
- Broadcast Tools ICM 16 intercom
- Cabinetworks Unlimited studio furniture
- Circuitwerks telephone autocouplers
- Comtech 3.8m satellite dish
- Digidesign Pro Tools
- Dixon NM-250 newsroom mixers
- Electro-Voice RE-27 N/D
- Fidelipac 340 on-air lights
- Gentner SPH-10
- Gepco 24 pr. control cable
- Gepco GEP-552624GFC 24 pr. 110 ohm multiconductor
- Harris Airwave 20
- Harris Intraplex Plus System
- JBL 4408A
- Mackie d8b
- Mackie DB-8
- Middle Atlantic equipment racks
- PR&E BMX III
- Prophet Nexgen
- SAS 64000
- Shure SM-7
- Symetrix 528E mic processors
- Telos 1A2 Interface
- Telos Delta 100
- Telos Delta hybrids
- Telos One
- Telos Zephyr Xstream
- Newsready 32

Facility Focus

the technology behind Clear Channel Cleveland

Gepco 552624GFC

Gepco International, Inc. is expanding the 5526GFC series of 110Ω AES/EBU digital audio multi-pair to include the 24-pair 552624GFC. In conjunction with the existing four-, eight-, 12-, and 16-pair versions, the 552624GFC provides a convenient way to interconnect between digital audio consoles, recorders, processors and routers.

As with all other 5526 series products, 552624GFC features an exacting 110Ω impedance, low jitter and attenuation, ease of termination and flexibility. Pair construction consists of two stranded 26-gage conductors, foam polypropylene insulation, 100 percent foil shield with drain wire and a color-coded and alphanumerically numbered PVC jacket. Each pair also features a non-conductive polyethylene rod that maintains the impedance, lowers the capacitance and provides structural integrity.

The outer jacket is extruded from Gepco's extra-flexible GEPFLEX compound, which remains extremely flexible in both high- or low-temperature environments and provides superior abrasion resistance and durability. It is rated UL type CM.

www.gepco.com
800-966-0069

AKG C 414 B-ULS

The AKG C 414 B-ULS has a well-deserved reputation for flawless performance in recording and broadcast studios. Its crisp, full-bodied, naturally open sonic character has made it one of the world's most widely used studio condenser microphones.

Made in Vienna, Austria, the C 414 B-ULS has dual 1-inch gold-sputtered diaphragms coupled with premium electronics that deliver exceptionally flat response and very uniform off-axis transitions. Four polar patterns and two bass filter settings allow customization of the microphone for any voice or application. A 3-position pad allows the C 414 B-ULS to be used in sound fields as high as 160dB with less than 0.5% THD. The C 414 B-ULS comes complete with shock mount, windscreen, case and 3-year warranty. Thanks to Clear Channel for using AKG!

www.akgusa.com
615-620-3800

Acoustics First

Acoustics First manufactures and distributes a range of acoustical products to control sound and eliminate noise. Concern for sound quality at the source eliminates the need for excessive electronic processing of the audio.

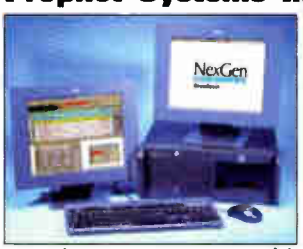
Acoustical control devices include fabric covered, high density acoustical fiberglass panels, quarter round corner traps and polycylindrical diffusers that are true bass traps as well as sound scattering devices. All products can be color matched and come with the hardware for wall mounting.

The company's Sound Channels® - 2 acoustical wall fabric is available in 61 colors and may be installed like wallpaper to provide a uniform minimum sound absorption on all walls.

Acoustics First also manufactures the patented "binary array" Art Diffusor® and the Cutting Wedge® line of standard acoustical foam.

www.acousticsfirst.com
888-765-2900

Prophet Systems Innovations NexGen



NexGen Digital Broadcast is the full-featured digital audio system, powerful enough to meet the needs of the largest multi-site radio operations, but scalable and cost-effective enough for single stations. NexGen contains many customer-driven enhancements that assist Cleveland's operation, including an expanded multi-layered approach to fault tolerance, redundancy, and data backup. Our WANcasting feature enables bulk file feeds and off peak time delivery. Digital Reel to Reel increases control of external hardware devices, provides more options for recurring recordings, and a centralized view for any user in the system to monitor the real-time status of recordings.

And now you can research and buy online! NexGen 2 Studio Suite includes all the Prophet software needed to run your station, packaged into hardware that maximizes your investment of money and time.

www.prophetsys.com/Studio1.asp
877-774-1010

Cleveland photo by Louis Anderson

APT/Pulsecom PCAU

By Rodney Belizaire, CBRE

Since its inception in 1936, WQXR-FM has built a strong reputation as New York City's premier classical music radio station, and is proud of the fact that it was the first commercial classical station in the United States. Now owned and operated by The New York Times Company, which acquired it in 1944, WQXR is the most listened-to classical station in the United States and presents regular news, analysis and commentary, often featuring correspondents from the *New York Times*. WQXR's signal emanates from the top of the Empire State building and covers the five boroughs of New York City, northern New Jersey, Long Island, Westchester, Rockland and Putnam Counties and Fairfield, CT.

WQXR-FM has always been at the cutting edge of technological innovation. Major Edwin Armstrong conducted the first FM stereo tests on WQXR, and our AM outlet was the first AM stereo station in New York.

Performance at a glance

20Hz to 15kHz frequency response
Low latency; less than 4ms
Front-panel status LEDs
Uses the Apt-x algorithm
Standard 2B1Q U interface

During 2002, WQXR decided to move the station's newsroom from its main Union Square District studios on 5th Avenue to the Times' newsroom located in the *New York Times* building on 43rd street in the heart of Times Square. The advantage being WQXR's news people could use the resources at the Times, as well as collaborate with their colleagues at the newspaper and NY Times Digital, which creates the *New York Times* on the Web.

Moving an entire newsroom and announce booth a distance of 30 blocks was an issue in itself, but the bigger challenge was routing the news feeds on an hourly basis from the *New York Times* to WQXR. In addition to construction and acoustical issues, this meant establishing a new bi-directional link between our studios and the *New York Times* offices.

Historically, the local telephone company could, with sufficient notice, install balanced copper circuits for remote or studio-to-transmitter links. However, in recent years this technology has become harder to support and the onerous task of balancing the circuits has resulted in the telephone company's decision to no longer support this service.

Faced with this situation, I began looking at alternative technologies that might fill the vacuum. The best of these invariably required proprietary HDSL availability, thus adding a considerable delay to installation time. There were also loop-length issues involved, and problems with preserving dynamic range throughout the broadcast chain—something that is particularly important when you're dealing with classical music and traditional jazz.

After much deliberation, our local telephone company, Verizon, recommended a service using a Program Channel Access Unit (PCAU). This encoder/decoder card, which was developed as a joint venture by Belfast-based Audio Processing Technology (APT) and U.S.-based Pulse Communications (Pulsecom), uses APT's Apt-x 4:1 data compression algorithm as its core technology. It will pass an 8kHz or 15kHz mono signal over 64kb/s or 128kb/s links respectively, enabling broadcast-quality audio from any D4, DLC or NGDLC carrier system. In the PCAU format, the Apt-x algorithm is implemented on boards incorporating Pulsecom's ISDN U interface and featuring plug-and-play Type 400 mechanics and network standard loopbacks.

I worked with the Apt-x algorithm before in an STL product and an automation product, and was satisfied with the performance of the compression algorithm, particularly with the low delay (latency) and the good audio response. This was reaffirmed after an in-house demonstration from Verizon.

However, once convinced of the technology, I had to order the service—in this case a 15kHz mono, full-duplex link that I required for the news feeds. The bandwidth was necessary to implement the maximum performance of the PCAUs and the return feed was needed for talkback and monitoring.

With four weeks to go before we were scheduled to move the newsroom, my main concern now was how long it would take to install the service. I also was concerned about the number of central offices that

would be used to route the signal. Would both issues result in unworkable or unmanageable delays?

The Verizon staff surpassed their best efforts and managed to install the service in less than two weeks, routing the signal via three central offices at 18th St., Broad St. and 42nd St. The speed of the install was aided by the fact that the PCAU cards use telco-standard 2BIQ 128kb/s technology for data interface. Once installed, the low-coding delay of the Apt-x algorithm—less than 4ms end-to-end at a 32kHz sampling rate—allowed our newscasters to monitor their own voices off air after the program content had gone from WQXR to the *New York Times* newsroom, back to WQXR and then via STL to broadcast from the Empire State Building. The total delay was a manageable 20ms, and it sounded excellent.

I ran some tests on the link and the dynamic range was close to the maximum of 96dB for 16-bit audio. Headroom was 24dB and the response was flat from 20Hz to 15kHz. With the front panel indicating power, network, far-end synchronization and audio level, I had status at a glance, which is always a comforting feature for a station engineer.

For WQXR, the PCAU card addressed a number of problems without compromising audio quality or delay. The newsroom is running successfully from its new location and to date we are satisfied with our chosen solution. The problem was solved so effectively that now I am considering the PCAU card for additional voice and music circuits in the near future.

Belizaire is chief engineer of WQXR-FM, New York.

APT

P	323-463-2963
F	323-463-8878
W	www.aptx.com
E	customersupport@aptx.com

Editor's note: *Field Reports are an exclusive* Radio *magazine feature for radio broadcasters. Each report is prepared by well-qualified staff at a radio station, production facility or consulting company.*

These reports are performed by the industry, for the industry. Manufacturer support is limited to providing loan equipment and to aiding the author if requested.

It is the responsibility of Radio *magazine to publish the results of any device tested, positive or negative. No report should be considered an endorsement or disapproval by* Radio *magazine.*

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Super Session
John Walsh
America's Most Wanted
ABC Radio Networks

Thursday, October 2
NAB Marconi Radio Awards
Reception, Dinner & Show

Master of Ceremonies
Steve Harvey
Comedian & Host
KKBT-FM, Los Angeles
Syndicated by Radio One

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Thursday, October 2
Keynote Address
Rush Limbaugh
Premiere Radio Networks

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Thursday, October 2
Group Executive Session

Moderator
Sean Hannity
The Sean Hannity Show
ABC Radio Networks

Group Executives including:

Mary Quass
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Hubbard Radio

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AM/FM Antenna Certification Workshop

Wednesday / October 1 / 8:00 a.m.-4:00 p.m.

Ben Dawson
Hatfield & Dawson

Ron Rackley
du Treil, Lundin and Rackley, Inc.

Tom Silliman
Electronics Research, Inc.

Bob Surette
Shively Labs

Digital Radio Certification Workshop

Thursday / October 2 / 9:00 a.m.-5:00 p.m.

Steve Church
Telos Systems

Scott Stull
iBiquity Digital Corporation

Glynn Walden
iBiquity Digital Corporation

Jeff Detweiler
iBiquity Digital Corporation

AM/FM Transmitter Certification Workshop

Friday / October 3 / 9:00 a.m.-4:00 p.m.

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Harris Corporation

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Liebert Foundation MCR

By Kent Kramer, CBRE

In today's climate of consolidation, doing more with less is fast becoming a standard operating procedure. Engineers are being asked to put more equipment into smaller spaces. Three things must be considered when reliability is concerned: cooling, cleanliness and clean power.

When Big City Radio chose to move its Ventura, CA, station to a new location, it chose a communications site that was already home to two other radio stations. The stations would share a concrete block building that was about 30' x 30'.

With all three stations sharing the building, cooling is a major issue. Air is forced into the building through a filtered blower on the roof. To allow the forced air to escape, every third concrete block is turned on its side on the top of the building on three sides. Additional cooling is provided by two consumer-style window air conditioners mounted in the walls. One is directly behind the air intake on the Class B station's transmitter and the other is in a corner opposite the air inlet from the roof blower.

Performance at a glance

- Adjustable rack rails
- Threaded or square rack rail holes
- Climate-controlled rack
- Integral UPS
- Optional monitoring capability

The Class B station ducts its transmitter exhaust directly outside, while the Class A exhausts into the room. Because of the lack of minimal positive pressure on the room and it being open to the outside, the room environment is dirty from dust and pollen. With the various circulating patterns generated by the air conditioners, the roof blower and the various fans in the transmitters and auxiliary equipment, any dirt that enters the room is held inside by the almost random air patterns.

While the room environment was less than ideal, the tower location was ideal. We were not willing to sacrifice system reliability when constructing the site. One option was to seal the room and install cooling adequate for all three stations. This proved to be too expensive and not worth the return on investment.

The solution to our problem was the Liebert Little Glass House. The Little Glass House (LGH) is an environmentally sealed equipment rack. Since we purchased our LGH units, Liebert has developed the next generation of enclosure and named it Foundation Mini Computer Room (MCR). It has the same basic principles of operation, but offers added improvements to the original LGH.

The racks of the MCR contain a rack-mounted environmental cooling module (ECM) at the bottom of each unit. The cooling modules are designed to keep the interior temperature below the exterior temperature and not maintain a specific internal temperature. By using two racks we were able to distribute the cooling load of our equipment between the two.

To maintain separate cooling, the racks could not be ganged together to form a single unit. Two approaches were considered. One was to place one transmitter and exciter in each rack and separate the main and backup audio equipment to provide failure protection. The other was to separate the equipment into two categories, RF and audio. In the end, the physical size of the hardware dictated that the left rack holds the main and auxiliary transmitters and both exciters. The right side rack holds all of the audio, monitoring and telemetry equipment.

Installation

In an effort to help with the heat loading of the building, we built a wooden platform behind the racks to act as a plenum to help direct the heat from the exhaust of the rack out of the building. Liebert manufactures a product designed to duct the exhaust heat away from the rack, but it would still require a platform to cover and protect the ductwork. The plenum seemed to be the better choice.

The MCR system cools the contents by recirculating air around the equipment. Air is directed up one side and pulled back through the Environmental Cooling Module (ECM) on the other side, creating a circular airflow inside the rack. Air is pulled from the front of the rack through a filter and exhausted at floor level in the back to cool the coils.

With the Foundation MCR, should the ECM fail, there are options available to maintain some level of cooling. We opted for the single fan mounted on the back door. Louvers on the front door and rear door open when the

temperature inside the rack reaches an adjustable limit. Filtered air is drawn in and through the rack to draw heat out. When the emergency fan is not in use, the louvers are kept sealed by magnets to prevent dirt from entering. The new Foundation series racks feature several configurations for primary and auxiliary cooling.

Power distribution inside the rack is by a factory-installed plug mold. All of the electrical connections to the LGH and the Foundation rack are designed to be plugged into a wall outlet.

Continued development

The Foundation series offers several options. There are a variety of sizes from a custom height of 44" (22RU) to 84" (46RU). The standard height is 78" (42RU). The optional fan-based cooling packages have high-ambient temperature or low-noise options depending on the usage. All of the hardware operates on 120V, single-phase power.

To include UPS power to the rack, Liebert can integrate a rack-mounted UPS. We felt that instead of having two separate UPS systems, it would be more advantageous to provide a UPS for the entire site. This also reduced the heat load inside the rack and gave us more available rack space.

Kramer is chief engineer of Liberman Broadcasting, Los Angeles. He prepared this article while working for Big City Radio.

Liebert

P 800-877-9222
F 614-841-6022
W www.liebert.com
E info@liebert.com

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New Products

By Kari Taylor, associate editor

Digital on-air radio board
Audioarts Engineering

DX-16: This console features a compact footprint and a built-in router that assigns any source to any input or monitor. The unit controls 16 input channels and two caller phone channels. It is equipped with digital bar graph metering and alpha source displays. This product provides analog and digital stereo PGM and AUD, mono 1 and 2 output buses, in addition to four mix-minus outputs. Assignable machine control ports are optoisolated. Direct access to rear DB-25 I/O connectors facilitate easy countertop installation.

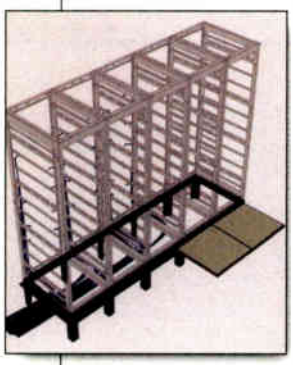
252-638-7000; fax 252-637-1285
www.wheatstone.com; sales@wheatstone.com

Combiner and filter
Dielectric

FM/HR Radio: The combiner and filter enables an FM station to implement HD Radio by combining the output power of a digital transmitter with an analog FM transmitter for use with an existing antenna system. A high-performance, dual-elliptic band-pass filter is included for special filtering of the digital transmitter. This filter design has exceptionally uniform response across the channel bandwidth for group delay performance and negligible effect on the digital waveform. High suppression of out-of-band energy ensures compliance with the spectrum mask and digital occupied bandwidth requirements of the FCC.

800-341-9678; fax 207-655-7120
www.dielectric.com; dcsales@dielectric.com

Riser bases
Middle Atlantic Products



RIB series: A series of riser bases, raised floor rise feet and support angles, these risers provide broadcast engineers with a time-saving and effective means to install equipment rack enclosures and related cable management in raised floor broadcast facilities. The riser bases can be used as standalone units or in conjunction with the feet and angles to meet a wide range of raised floor challenges. The RIB series riser bases are designed to elevate equipment racks 2-½" above the floor to provide a lower cable chase between rack enclosure systems in multibay applications. The bases are also useful for performing field rough-ins before rack enclosure systems arrive on site.

973-839-1011; fax 973-839-1976
www.middleatlantic.com; sales@middleatlantic.com

Automation system
Arrakis

Digilink-Xtra: Besides all the features of the company's Digilink-Free, this version uses off-the-shelf PC sound cards. It can be used live on air with a jingle array and six-cart stack or in full automation. The built-in scheduler features a one-week rotating schedule. Manual or timed audio recording can be built into a schedule. The system supports two sound cards, allowing users to preview audio files during on-air use. This also allows the system to operate on air while a schedule is built from the same computer.

970-461-0730; fax 970-663-1010
www.arrakis-systems.com; sales@arrakis-systems.com

Audio acquisition tool
Dalet Digital Media

Trackfilerplus: An audio acquisition tool, this product is designed to help editors and journalists enrich the Dalet database in a quick and easy way. With plug and play, files from a Nagra digital recorder or tracks from a CD can be easily ripped without thinking about file conversion. This unit performs the following operations automatically: converts audio files to a pre-selected format, copies in an automatic batch audio files to Dalet central server from local storage (CD or Nagra via USB port), incorporates metadata for easy retrieval and Nagra via USB connection. This tool connects with the Nagra handheld audio recorder/player ARES-P/RCX220 via a standard USB port. Once the device is plugged, the journalist highlights the files to be transferred in the Trackfilerplus window and then clicks and the transfer begins. The transfer speed is several times the real time. It works on any Dalet version.

212-825-3322; fax 212-825-0182
www.dalet.com; sales@us.dalet.com

Digital asset management
Fastchannel Network

Traffic Channel: This audio trafficking system allows for: multilevel user access, superior quality MP2 and MP3 files, automated and on-demand spot retrieval, traffic document attachment, instantaneous online delivery, guaranteed next-day delivery offline, online access to pending deliveries, current inventory and traffic instructions for any authorized users on a network 24/7 technical support.

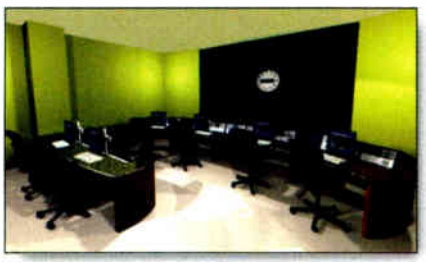
866-321-FAST; fax 781-898-6501
www.fastchannel.com; info@fastchannel.com

FM exciter
Armstrong Transmitter

FMX-30B: The Armstrong FMX-30B is the next generation in frequency-agile exciters. The transmitter offers low distortion and intermod values, combined with a high signal-to-noise ratio. This microprocessor-controlled unit features a front LCD screen, which displays all system parameters on a scrolling menu including modulation, power output, frequency and power supply parameters. Other unique features include: front panel frequency agile, advance microprocessor control system, built-in low pass filter and directional coupler, LCD display of all system parameters, full remote control and status indicators, alarms for over temperature, VSWR foldback and mute and MPX and dual SCA inputs.

315-673-1269; fax 315-673-9972
www.armstrongtx.com; sales@armstrongtx.com

Console
Forecast Consoles



Masterrail: The Masterail system is available in a modular component console style and an Imagemaster workstation. All devices mount anywhere along the rail and are completely independent of each other, as well as, the rest of the structure. This feature allows both console types to be completely reconfigured, repurposed and reused, quickly, easily and inexpensively, now and anytime in the future. The system incorporates current materials, precision laser-fabricated parts and third-party accessories.

800-735-2070; fax 631-253-0277
forecast-consoles.com; info@forecast-consoles.com

Connector plugs
Neutrik

RCA phono connectors: The RCA phono connectors feature isolated, recessed sockets in nickel or black chrome housing, and are available in D-series style for use with universal mounting plugs. Either housing can be ordered in black, red, yellow or white to enable color-coding. The new plugs, which feature gold-plated contacts, can be ordered to match the colored rings available on the company's NYS373 plugs. The RCA phono sockets feature a high current and voltage rating. The shell and contacts are brass with gold plating, and the D housing features nickel or black chrome plating.

732-901-9488; fax 732-901-9608
www.neutrik.com; info@neutrikusa.com

Upgrades and Updates

V-Soft releases 03 arc-second

The new, more accurate 03 arc-second terrain database was released to improve the existing United States Geological Survey (USGS) 03 arc-second terrain elevation database. The database was derived from the latest release of the USGS National Elevation Dataset 30 meter data, the most accurate terrain dataset currently available. Contact V-Soft at 319-266-8402 or info@v-soft.com.

Telos finds new Superset supplier

The Mitel Superset IV telephones, once a popular system on their own, have become harder to obtain at an affordable cost as demand has decreased. The sets are used with the Telos Direct Interface module. While factory-new phone sets are no longer available, Telos can provide professionally refurbished units that are programmed and checked for proper operation with the Direct Interface through a new supplier. Contact Telos at 216-241-7225.

TDM releases EAScriber Pro v.2.0

Following a three-month beta cycle, the new software version is available. EAScriber Pro installs on a single PC and monitors EAS activity through the serial ports included with most EAS receivers. New functionality in version 2.0 includes more baud rate configurations, discrepancy reporting for seven-day and 30-day test delays and MSRP support for Sage ENDEC users.

Voxpro PC Adds Networking

Voxpro PC Software now includes the Voxpro PC Network functionality, which enables two or more Voxpro PC workstations to link for instantaneous file transfer between workgroup members.

APT plug-in added

The APT plug-in that permits Apt-x audio encoding and editing in Syntrillium's Cool Edit Pro is available as a download from APT's website at www.aptx.com/prosoft-cooledit.asp. The plug-in allows Apt-x users to import and edit files directly, eliminating the need to decode and re-encode audio files.

LAN/IP audio distribution

MDO UK

AudioTX Multiplex: One or more server PCs take multiple, live, audio sources and make them available across an existing network. Any PC on the network can receive the audio feeds by running a small receiver module, which emulates a tuner by selecting a channel. New sources and destinations can be added by loading the appropriate software. Work with standard Windows hardware and sound cards. The system uses multicast technology, and installation tests have shown that 50 stereo audio channels at broadcast quality occupy only six percent of a 100Mb/s network. Audio can be broadcast as linear .WAV, MP3 or MP2 files. Users can purchase the software only or MDO can supply configured servers.

+44 121 256 0200; fax +44 121 256 5109
www.audiotx.com; sales@mo.dutta.org

Audio level interfaces
ATI

Matchmaker line: UB400i, BU400i, BI400i, UB800, BU800, UB1000, BU1000, UB200-Pro, BI400-Pro and UB800-Pro provide from two to 10 channels of conversion from balanced to unbalanced audio and vice versa. The new models feature high-performance and low noise signal converters. Each features front-panel gain controls. Gold-plated RCA and XLR connectors are used on all models except the eight and 10 channel versions, which use plug-in Euroblock connectors. The Pro models feature proprietary transformer-isolated outputs for driving long lines up to 2,000' without signal degradation and flat frequency response down to 20Hz.

215-443-0330; fax 215-443-0394
www.atiguys.com; sales@atiguys.com

Multistream audio adapter
Audioscience

ASI6122: The ASI6122 is aimed at high performance broadcast applications requiring MP3 record and play with analog and AES/EBU digital interfaces. The adapter uses a 150MHz Texas Instruments TMS320C6711 DSP and provides two stereo outputs, two stereo inputs, two record streams, two play streams and a powerful multirate digital mixer. Audio format choices include MP3, MPEG Layer 2 and linear PCM. This product features four stereo playback streams and two stereo record streams. MRX technology supports digital mixing of multiple stream formats and sample rates. Two balanced analog and digital play outputs and 24-bit analog-to-digital and digital-to-analog converters are available. Soundguard transient voltage suppression protects against lightning and other high voltage surges. There are as many as eight cards in one system and 8M bytes DRAM allow for on-board buffering. Windows 95/95, Windows NT, 2000, XP and Linux software drivers are available.

302-324-5333; fax 302-738-9434
www.audioscience.com; sales@audioscience.com

Flywheel-based UPS
Active Power

Clean Source UPS: An uninterruptible power supply, this system delivers the highest level of power availability, conditioning and harmonics cancellation for sensitive digital broadcast systems. These power protection systems protect networks, transmitters and microwave uplinks from the most common power disturbances that can interrupt broadcasts. While combining a rugged steel flywheel with solid-state power electronics, this technology incorporates a flywheel motor-generator that stores kinetic energy in its constantly spinning, quiet, low-friction steel disc. Stored energy from the flywheel is instantly converted to electricity that powers the critical load during short power fluctuations. During prolonged power outages, the UPS seamlessly transfers to a stand-by generator for continuous power.

512 744 9461; fax 512 836 4511
www.activepower.com; jlozier@activepower.com

FM exciter/transmitter
Bext

Lex 30: The first Bext exciter and transmitter in a single rack unit size, the Lex 30 from Bext is a 30W unit with a menu-based digital display and built-in stereo generator at no extra charge (the stereo generator can be defeated for composite input).

619-239-8462; fax 619-239-8474
www.bext.com; sales@bext.com

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Contributor Pro-file

Meet the professionals who write for *Radio*.
This month: Field Report, page 46.

Rodney Belizaire, CBRE
Chief Engineer
WQXR-FM and WQEW-AM
New York, NY

Belizaire has worked in radio for 20 years, all of them in New York. He has been with WQXR since 1993, where he became the chief engineer at the beginning of 2001.

His experience includes a great deal of experience as a remote broadcast engineer, which has afforded him the opportunity to travel all over the country. His work includes the first ISDN remotes from Venice, Italy and five years as the remote engineer for the New York Giants home games.

He is a live music mixer and has mixed live cabaret broadcasts all over the city and in his studios almost every week for five years.

Radio
THE RADIO TECHNOLOGY LEADER

Written by radio professionals
Written for radio professionals

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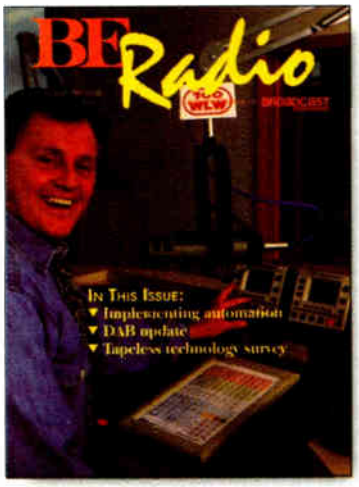
Shaping radio today and tomorrow

By Heidi Hueseman

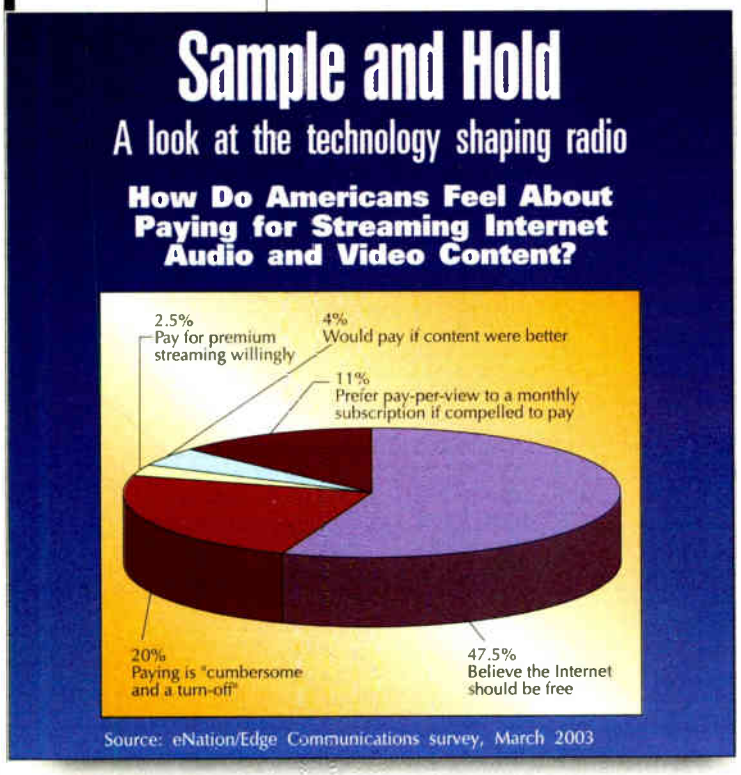
Do you remember?



In July 1995, the FCC issued a Notice of Proposed Rulemaking (NPRM) regarding a new satellite digital audio radio service (DARS). The NPRM outlined that the service would provide 30 or more channels of national digital audio programming to fixed and mobile receivers, with the potential for each licensee to offer CD-quality audio channels.

Licensing options included assigning all of the available spectrum (2.31GHz to 2.36GHz) to only the four current DARS applicants, licensing some of the spectrum at the time and holding some in reserve for future applicants or opening the spectrum to all interested parties.

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



That was then

In 1993, Fidelipac's Dynamax DCR1000 series digital cartridge machine was introduced. It was designed to directly replace analog cart machines by using 3.5" floppy disks as carts. This allowed it to support standard high-density 2MB and triple density 13MB diskettes. Audio could be sampled at 22.05kHz, 25.75kHz, 32kHz and 44.1kHz and encoded using the Apt X-100 coding algorithm.

The system was made up of two components: the DCR1020 master player and the DCR1040 record module. All units were 1/3-rack space wide, measuring 5.5" high × 5.5" wide × 12.875" long. They could sit alone as tabletop units or could be mounted in an optional rack-mount adapter.

The front panel of the master player also featured a backlit LCD display showing machine status, cut identification, time, title and outcue on a two-line, 24 character-per-line screen. In addition, the record module's front panel contained peak-reading LED audio level meters and an overload indicator.

The Fidelipac Dynamax DCR1000 involved simple and familiar aspects of machine operation in spot recorder/players. It provided the quality of digital audio for about the same price as the analog cart machine.

The capacity of a 2MB floppy was just less than one minute of stereo audio at a 32kHz sampling rate. The triple-density floppy provided longer recording times, but they never gained popular acceptance. Other digital recorders and computer-based automation systems were introduced soon after the DCR1000.

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