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Satellite uplinks and downlinks - page 36

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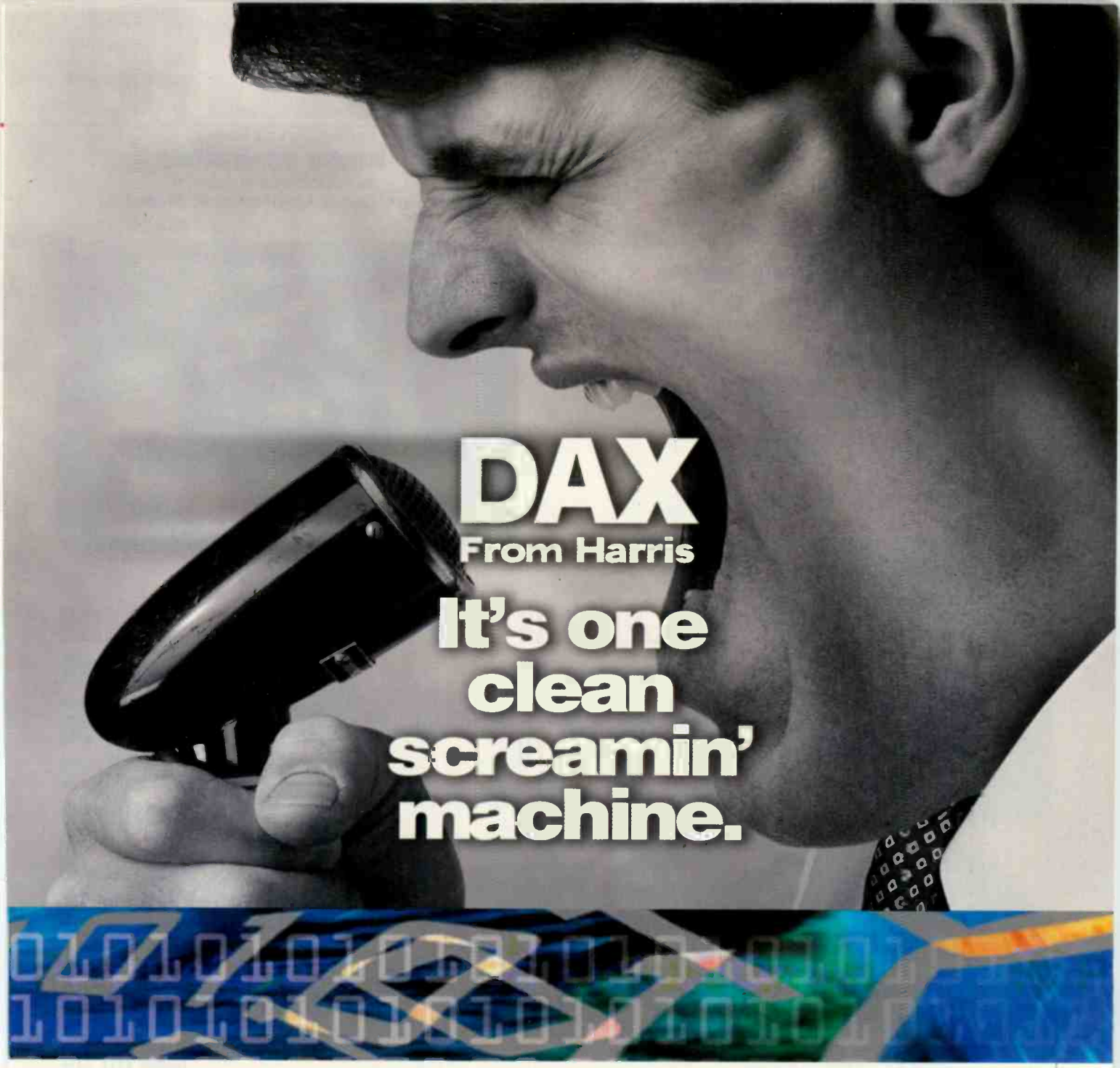

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HARRIS

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Radio Magazine
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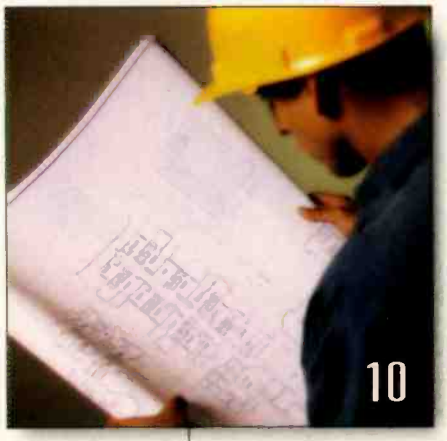

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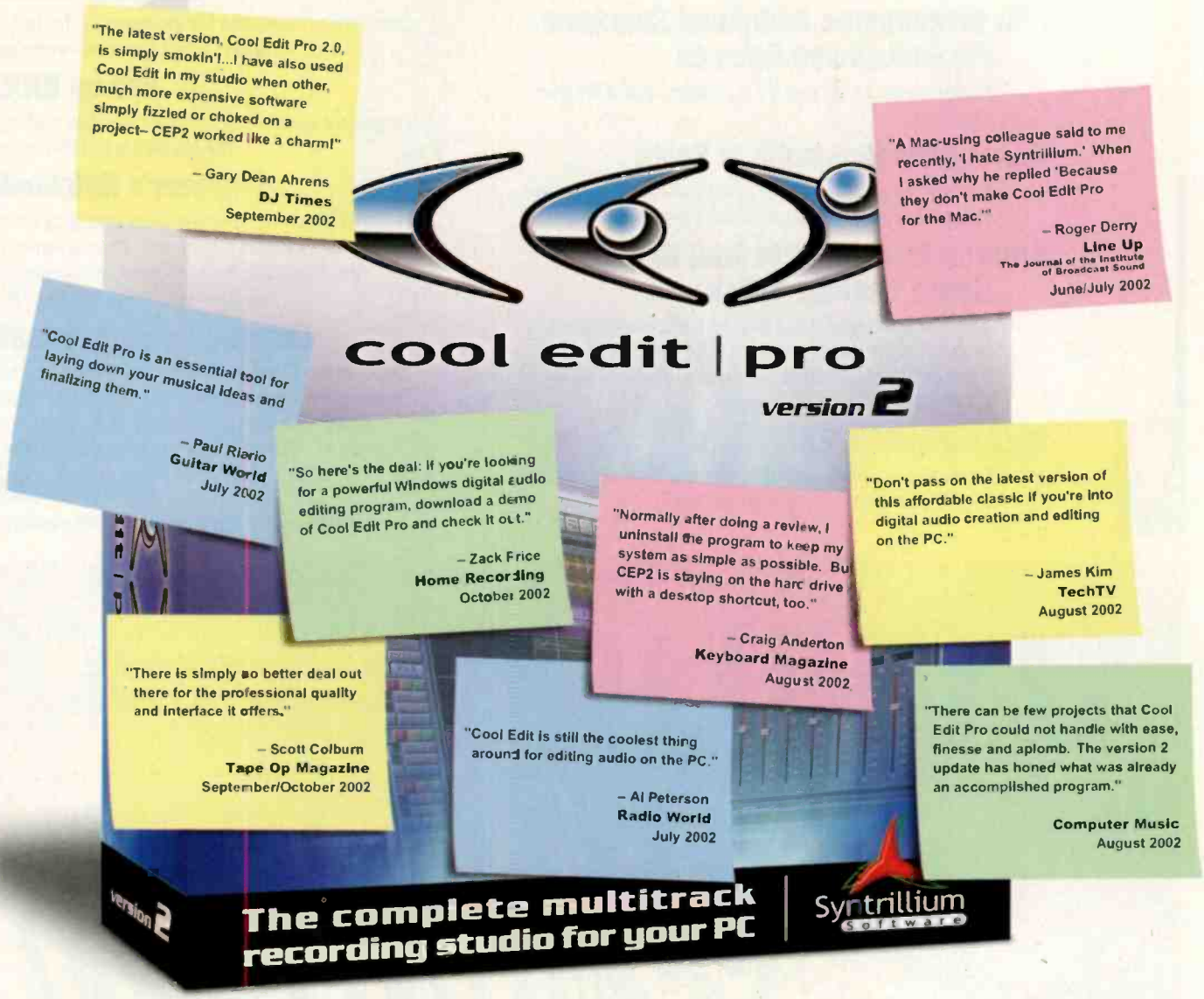

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Currents Online

Highlights of news items from the past month

FCC Investigates Additional Spectrum For Unlicensed Devices

Notice looks at unused TV spectrum and 3.65GHz to 3.7GHz.

Harris Adds Highsmith in Sales

Jeff Highsmith joins the Harris Broadcast Communications Division (BCD) as a sales representative.

Arbitron Extends PPM Trial Due to Single Encoder Glitch

Arbitron will extend the ratings comparison portion of the Portable People Meter (PPM) market trial through March 28, 2003. An error in audio level at KYW-AM prompted the extension.

Sacks Heads to ERI

Marty Sacks joins the staff at Electronics Research, Inc (ERI) as director of sales on Jan. 1.

Site Features

Currents Online

Don't wait two weeks for the news of the radio industry . Read it online everyday.

Eye on IBOC

A regularly updated account of stations making the transition to HD Radio.

Engineer's Notebook

A collection of problem-solvers and tricks that you can use around the station. Also download the Starguide Relay Logger mentioned in *Satellite Technology* on page 36.

Currents Weekly E-mail

Receive the Currents Online headlines in your e-mail box every Monday morning. Start your week with the latest information about the technology of the radio industry.

Demo Room

View online equipment demonstrations.

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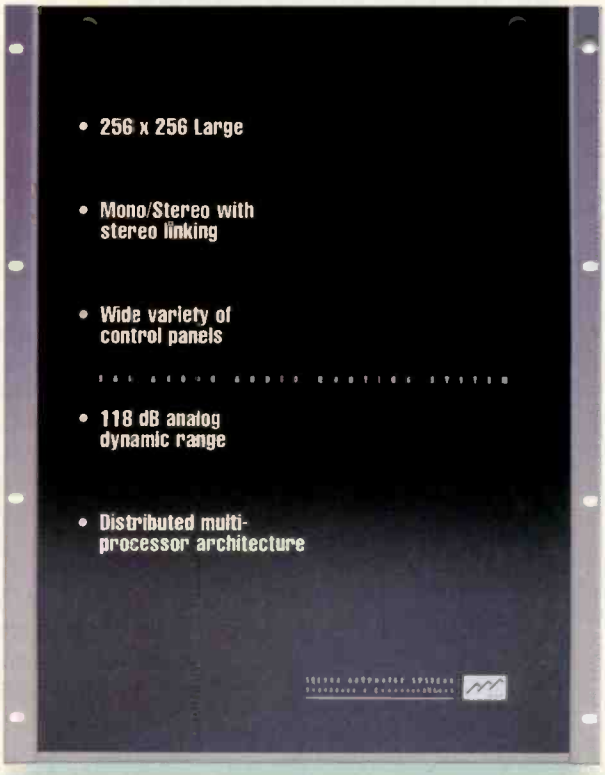
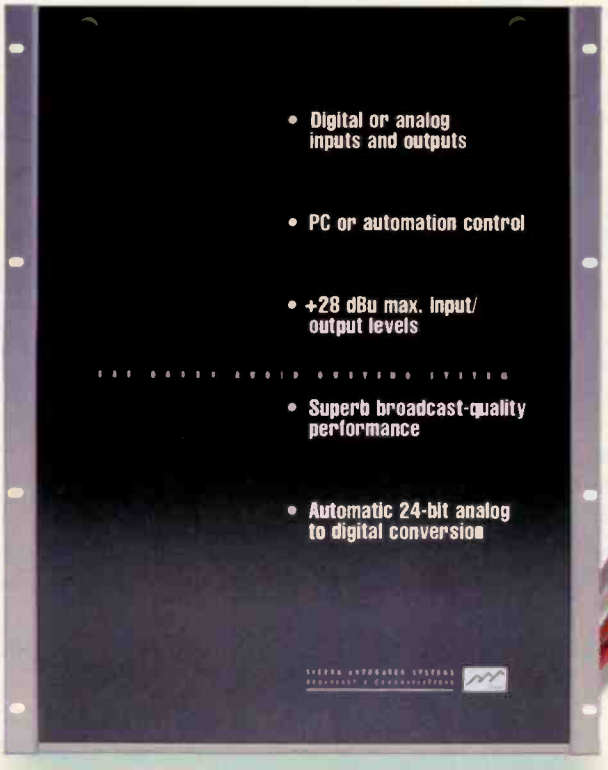


Mix and !

SAS64000 AUDIO



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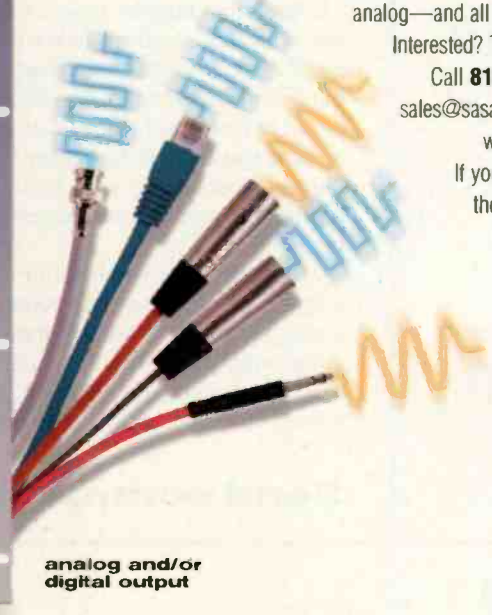

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New quest for a new year

In the never-ending saga of the FCC seeking new ways to further congest the airwaves, the end of 2002 saw a Notice of Inquiry that could once again create havoc for some spectrum users. While the latest issue doesn't carry the same potential effect to radio as the creation of LPFM, it is broad enough that it could lead to similar encroachment.

Based on the work of an FCC spectrum-policy task force formed in June, Chairman Michael Powell indicated his intention to look at the wasted spectrum that broadcasters occupy. In remarks made during a visit to the University of Colorado, Powell rejected the notion that there is not enough broadcast spectrum to go around. He cited FCC tests that showed that there are many unused spectrum holes because a portion of the airwaves are used only at certain times. It is in these times of non-use that the space could be better utilized.

In the quest to reclaim this vast emptiness that exists, the FCC planned to review its own policies and move beyond its 90-year-old spectrum-management methods. Funny, did basic physics change at some point? The FCC believes that new technology can be used to build smarter receivers that can filter the interference. While there has been work done to build smarter receivers, it's not that simple.

In the same address Powell stated that one of the FCC's core missions is to prevent broadcasts from interfering with one another, and then added that this mission needs to be revised. The FCC is less interested in managing the spectrum than ever before. Now all they want to do is sell it again and again and let the buyer figure out how to make it work.

In the middle of December, the FCC issued a Notice of Inquiry seeking comments on creating new unlicensed spectrum to meet the growing demand from consumers. This comes as no surprise; after all, the FCC knows that the airwaves are already underused. It is surprising that this covers unlicensed spectrum: there will be no revenue from licensing.

Where are they looking? Not in the AM and FM bands — at least not yet — but it is an area close to our concern. The Notice seeks comments on the feasibility of allowing unlicensed devices to operate in the TV broadcast spectrum at times and in locations when spectrum is not being used. This is further complicated by the DTV transition that occupies twice as much spectrum during the transition period.

The notice also seeks comments on the feasibility of permitting unlicensed devices to operate in other bands, such as the 3.650GHz to 3.7GHz band. While this is not the radio broadcast band, it is regularly used for radio. You know it better as C-band. The notice suggests allowing unlicensed use of power levels higher than other unlicensed transmitters with only the minimal technical requirements necessary to prevent interference to licensed services.

The "minimal technical requirements" part bothers me. We already have unlicensed use in many frequency bands. It is possible for licensed use and unlicensed use to coexist peacefully. Unfortunately, if this notice proceeds to its full effect, there will be that much more hash in the same space. In my experience, unlicensed users do not understand interference issues. They won't coordinate the use of the frequency or find a less-congested area. Instead they will find ways to turn up the power.

It's not open season yet, but this does present the potential for increased terrestrial interference from a cordless phone or wireless home LAN.

Chriss Scherer, editor
cscherer@primediabusiness.com

This year marks the 10th year that *Radio* magazine has been delivering the most useful and accurate information on radio broadcast technology. Our industry has changed significantly in the past 10 years, and we will highlight these changes throughout 2003. Look for these special features in the coming months.

Send comments to: E-mail: *beradio@primediabusiness.com*
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Working contractor to contractor

By Mark Krieger, CBT

In no way has the post-regulatory era of radio broadcasting made itself felt more than by today's wholesale movement and consolidation of station facilities. One result of all this activity has been a frenzy of new construction projects, in which engineers frequently find themselves playing an intermediary role between station management and building trades. For those experienced in such things, the demands and frustrations of working with contractors are daunting enough, but for the novice, the experience can be overwhelming. Here are a few tips to help grease the rails of your next construction project.

The players

Every construction-related move usually includes the following cast: a client (station management) who pays the bills, a general contractor and related subcontractors who actually oversee and perform the work, building inspectors who inspect the work and ultimately issue occupancy permits, and you, the engineer charged with seeing that the client winds up with a functional facility. Although architects are typically included on many projects, it is not uncommon for them to be cut out of small jobs, such as renovations, in the interest of saving money. In these situations, the general contractor actually draws the construction plans. In either case, the challenges are the same.

The process

Once a decision is made to move or build, the planning process begins. This is a phase in which every engineer should be thoroughly involved, yet all too often isn't. Try to avert this mistake by suggesting that the client will actually save money by including you in the planning process at the outset. As one contractor put it: "planning is everything...it's where you maximize your return on investment." Radio stations are highly specialized operations, making it critical that the architects and contractors understand not only what has to be done, but *why*. Take the time necessary to educate them about the unique need for soundproofing, room noise reduction, isolated grounds, HVAC, electrical and low-voltage cabling requirements. If possible, identify a local or regional facility that you consider a model for what you have in mind and arrange a tour that includes the key players—you'll find it to be time well spent.

After plans have been drawn, review them carefully with the general contractor (G.C.) to be sure there are no omissions or conflicts between different mechanical elements such as HVAC, electrical, safety (sprinklers/alarms) and partition systems. Remember that every electrical circuit and outlet needs to be detailed in the planning phase. Likewise, pay close attention to HVAC ducting and partition design to ensure the integrity of soundproof areas. Be sure to review the equipment grounding plan with the electrical subcontractor to see that it will meet all applicable codes, and whether low voltage audio and control cabling can be installed without a permit. While it's true that you can make changes or additions during construction, the price penalties incurred at that stage are usually substantial.

As construction begins, get the G.C.'s approval to visit onsite for inspections and informal meetings with subcontractors on a regular (sometimes daily) basis. Plan on getting up early—the best time to meet with the crew is when they arrive at the job, which is often no later than 7 a.m. Treat everyone with respect and don't be afraid to teach them about radio as they teach you about construction—your interpersonal communication skills can pay big dividends. And, always be sure to bring coffee and doughnuts. Make these folks feel like they're a part of the radio team and you'll be amazed at how responsive they can be.

During the build-out, stay in close contact with the G.C., who may or may not be a regular presence on the job site.

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Be available for questions (via cell phone or e-mail) to the G.C. and the subcontractors at all times. Keep detailed notes and don't be afraid to take pictures of things you perceive to be issues. Keep in mind that the subcontractors are actually working for the G.C. and that, while it may be OK for you to answer their questions and provide guidance, any actual changes in the work must be handed through a change order issued by the G.C.—for an additional fee, of course.

As construction wraps up, work with the client and the G.C. to develop a punch list that details the inevitable discrepancies and omissions in work performed and provides for their timely resolution. Be fair, courteous, but insistent that each job be completed properly.

One on one

Often, you'll be working on smaller-scale projects where no general contractor has been hired. The same rules apply, but now you are responsible for overseeing all the details. Be sure to plan everything in consultation with your contractor and put it all in writing.

Regardless of the size of the project, the same supervision requirements apply.

Generate drawings that clearly show details and dimensions. Ask lots of questions. For example, who is responsible for permit applications and inspections? What exactly is the contractor providing, in terms of hookups and testing of systems? Finally, who will clean up and be responsible for making cosmetic fixes to drywall, paint, flooring or landscaping? Spell all of these things out in the contract. This point cannot be emphasized strongly enough.

In sum, working with other contractors is intense, detailed work that requires every ounce of concentration, patience and perseverance that you can muster. But with realistic expectations and the right approach, you and your client will be rewarded with a facility you can both be proud of.

Krieger, Radio's consultant on contract engineering, is based in Cleveland and can be reached at mkrieger@drfast.net.

What CARP means to you

By Kevin McNamara, CNE

Broadcasters have been accustomed to paying royalties for playing copyrighted music over the air to Performance Rights Organizations (PRO) such as ASCAP, BMI and SESAC; but, until recently, broadcasting the same program material over the Internet was basically free. On December 4, 2002, President Bush signed into law the Small Webcaster Settlement Act (SWSA), which requires that owners and performers of copyrighted material receive royalties for material broadcast over the Internet. Creating a method that fairly addresses the issue of copyright owner compensation versus the amount paid by webcasters is a complex issue.

When traditional over-the-air broadcasters simply "stream" program audio over the Internet, perhaps as a value-added service to listeners or to extend reach beyond its terrestrial footprint, it is subject to all of the exclusions, limitations and fees defined within this law as a stand-alone webcasting service. The eventual establishment of fees for the transmission of copyrighted digital material was not a surprise to broadcasters; what was a surprise is that they would need to pay on a *per-performance* (song) basis rather than a simple percentage of gross revenues, such as that used by the PROs, increasing the cost to secure rights to stream audio over the Internet approximately three times that of over-the-air.

Some history

The push to maintain copyrights for materials broadcast over the Internet began in 1995 when congress passed the Digital Performance Right in Sound Recordings Act (DPRA), which permitted owners of copyrighted material to be compensated for broadcasting performances over the Internet, primarily dealing with subscription-based services. In 1998, the Digital Millennium Copyright Act (DMCA) broadened the scope of the DPRA to include the non-subscription services typical of webcasting services currently broadcasting over the Internet.

The DMCA provided for two types of licensing structures, voluntary and statutory, which must be issued to entities engaged in broadcasting copyrighted digital material.

Type of DMCA Service	Webcaster and Commercial Broadcaster	Non-CPB, Non-Commercial Broadcaster			Business Establishment Service
Description	All Internet transmissions, including simultaneous Internet retransmissions of over-the-air AM or FM radio broadcasts	Simultaneous Internet retransmissions of over-the-air AM or FM radio broadcasts	Other internet transmissions, including up to two side channels of programming consistent with the public broadcasting mission of the station	Transmissions on any other side channels	For digital broadcast transmissions of sound recordings pursuant to 17 U.S.C. 114(d)(1)(C)(iv)
Per performance fee	0.07¢	0.02¢	0.02¢	0.07¢	Statutorily Exempt
Ephemeral License Fee	8.8% of Performance Fees Due				10% of Gross Proceeds
Minimum Fee	$500 per year for each licensee				$10,000

In addition, the Register recommends that the Librarian adopt the terms of payment proposed by the CARP, as mocified in the recommendation, and set September 1, 2002, as the effective date for the statutory rates and the terms of payment.

Table 1. Description of fees for various webcasting entities.

Voluntary licenses are generally issued directly by the owners of the copyrighted material based on an agreement between the owners of the material and the entity desiring to make the material available over a digital transmission medium, such as the Internet.

A statutory license is required for a broadcaster to stream a program audio over the Internet. Unlike the voluntary license, where agreements are made directly between the performer and webcaster, statutory licenses are based on a fixed-cost model that defines a payment structure based on the number of performances (songs) broadcast and a royalty distribution scheme that includes payments to the copyright owner, the performing artist, the American Federation of Musicians (AFM) and the American Federation of Television and Radio Artists (AFTRA).

Taking into account the nature of digital transmissions, the DMCA also establishes a an *ephemeral license* that addresses digital copies of copyrighted material which reside on the memory used to "buffer" or temporarily hold digital program material prior to audio conversion. Broadcasters wishing to stream program audio need to pay a fee for both licenses.

E-casting

Enter CARP

Because an industry-wide agreement could not be reached in the case of statutory licenses, the U.S. Copyright Office and the Library of Congress ordered that a Copyright Arbitration Royalty Panel (CARP) be established. The CARP proceedings began late in 1998. After a long period of proposals and negotiations between both sides, CARP released a report in early February 2002 recommending rates and terms for statutory licenses.

The fees for webcasting are based on the type of entity. Non-commercial broadcasters pay a much lower rate than commercial entities for retransmission of program audio or up to two channels of copyrighted non-program material, providing it is consistent with the public broadcast mission; if non-commercial broadcasters desire to program three or more channels of audio, they will pay the same rate as commercial broadcasters/webcasters. Digital broadcasts within business establishments are exempt from the performance fee.

All entities are still required to pay ephemeral license fees based on 9 percent of the calculated performance fee. See Table 1 for details.

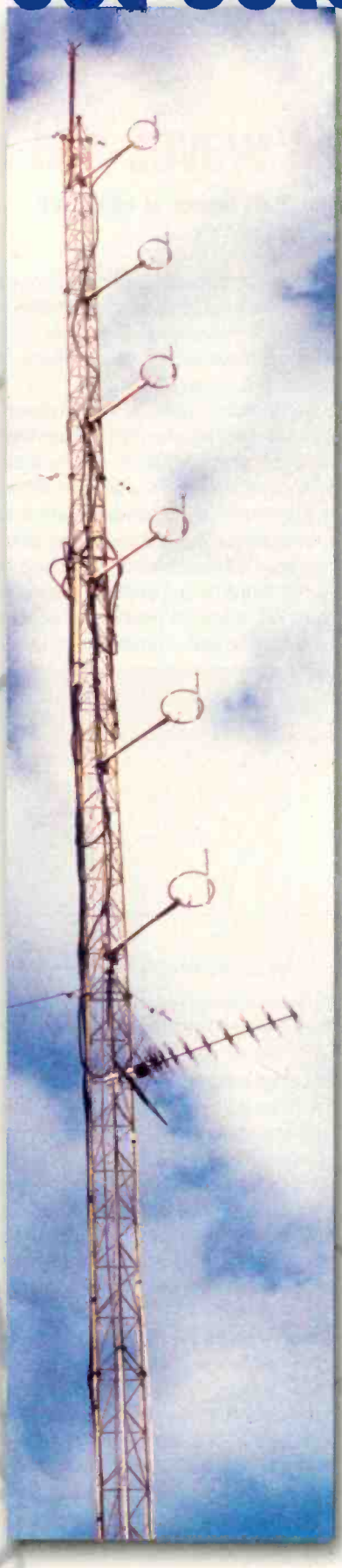
Required reporting

Since the licensing fees are determined on a "per performance" basis, it will be necessary to capture and report a significant amount of data for each performance. The software for many digital audio storage/playback systems will need to be upgraded in order to store the additional information and provide a proper report. Perhaps the most difficult aspect of this will be the time required to enter the information for each track on a station's playlist.

The fees for statutory licenses are retroactive back to October 28, 1998, however the SWSA provides a mechanism that permits the designated receiving agent for the fees, the SoundExchange, to negotiate the past fees prior to December 15, 2002 with individual commercial webcasters and extended the obligation period for non-commercial broadcasters to June 20, 2003.

McNamara is president of Applied Wireless Inc., New Market, MD.

The best selection



FM Educational Circular Polarization antennas.

Model	No. Bays	Max. Input Power	Price
MP-1	1	500 W	$250
MP-2	2	800 W	$650
MP-3	3	800 W	$950
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

Standing waves and antennas

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

Maximum transmission efficiency occurs when the load impedance matches the generator impedance. Engineers do this to eliminate standing waves, which can severely damage equipment.

Transmission lines in AM stations are more likely to be mismatched than those in FM transmitters. In FM, the desired transmitter-to-antenna match is accomplished using pre-established standard antenna and transmission line impedances that are designed to match each other, and separate antenna tuning units are not required. Most FM antennas provide some form of final tuning and adjustment to be made once the antenna is installed on its tower. When problems of abnormal VSWR occur, they generally result from mechanical or electrical damage due to the transmission line or antenna, and frequently to heavy ice formation on the antenna. When ice is allowed to build up the VSWR increases and the protection circuit trips the transmitter before any serious damage can occur.

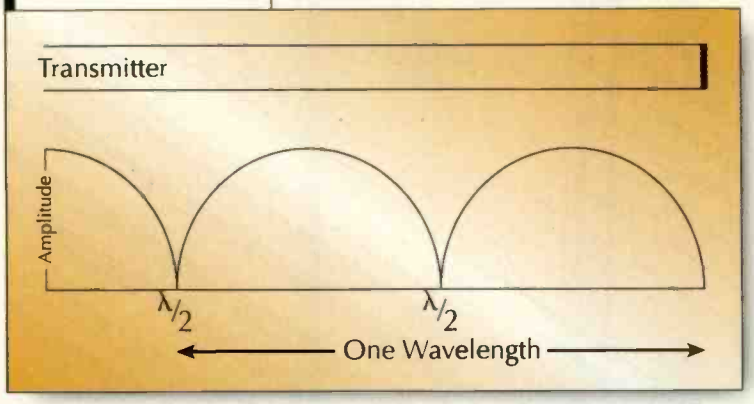

Figure 1. The voltage nulls appear at half-wavelength points, coninciding with the short in the Lecher wire.

The view in general

FM engineers are likely to experience more severe VSWR problems than AM engineers. Almost every FM transmitter has a built-in VSWR meter associated with a protection circuit to turn the transmitter off if the VSWR becomes excessive. The considerably higher operating frequency, and consequently shorter wavelength, means that path lengths can become critical and it is easier to develop unexpected standing waves.

In AM work misadjustment of ATUs and other devices in the transmission line circuit can result in a severe mismatch that goes unnoticed. Sometimes a bad mismatch can exist for years in a nondirectional AM operation that has sufficient transmitter power output to overcome the losses produced by the mismatch. In AM operations, coaxial transmission lines normally have a 50Ω nominal impedance. However, other values can be used without diminishing antenna operating efficiency, because the ATU matches the transmission line impedance to the antenna impedance. VSWR, although important, is usually less critical in AM transmission than in FM, and a small amount is often tolerated without noticeable problems. Over the years as the ATUs and phasor are adjusted, small errors are often introduced and standing waves begin to occur, which can cause problems such as heating in the transmission line and ATU components.

Easier methods

Long before electronic frequency measuring devices, radio engineers had to measure frequency using Lecher wires, which amounted to a yardstick. There weren't any pocket frequency meters that would tell show the frequency at the press of a button. Instead, it was necessary to measure the distance between the brightest (strongest) or the weakest (null) indications on a pair of long straight parallel wires supported on insulators and (transmission line) spaced two or three inches apart. The indicator was a neon bulb that tended to extinguish suddenly and made it difficult to find absolute nulls. Any simple indicator that does not load down the Lecher wires can be used. Areas of high voltage are normally quite broad while nulls are narrow. This is why the engineer should measure at the nulls.

Lecher wires provided a good understanding of standing wave ratios and their effects on antenna transmission lines. The basic principles demonstrated by the Lecher wires helped to develop high-power transmission lines. Early single-wire antenna connections soon gave way to balanced and unbalanced transmission lines, and eventually to coaxial cable.

Figure 1 shows a Lecher wire with the far end shorted. Zero volts appear at the far end. If the probe is moved back toward the origin, a maximum will be found one quarter wave back from the end. Moving on from the quarter wave, a null is found at a half-wavelength point. Moving a quarter wavelength farther will bring us to another maximum at a half wavelength point. The distance between two maxima, or two nulls is a half wavelength. Multiplying this distance by two gives the distance for one full wavelength. From this

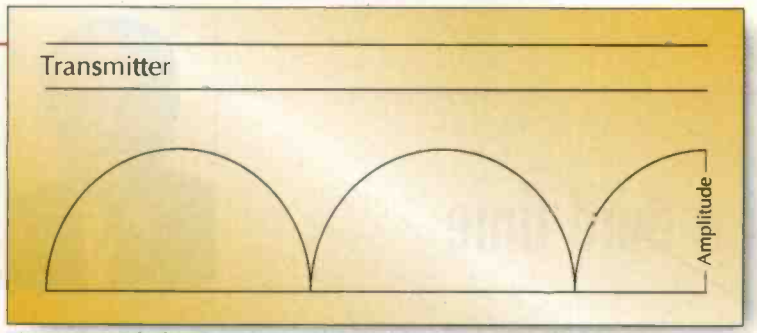

Figure 2. With the short in the Lecher wire removed, a high voltage appears at the open end.

compared to the dimensions of items that can cause delay. Delays are caused by the finite time required when energy moves along a transmission line.

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

we can calculate the frequency by converting to kilohertz. The reflection coefficient is -1 because the signal is completely reflected back and there is no power absorbed in the short.

When a signal reaches the short circuit a certain amount of signal will be reflected back and the remainder dissipated in the short if there is dissipative resistance. The phase of the reflected signal is controlled by the coefficient of reflection.

Figure 2 shows the effect of an open circuit at the receiving end. The receive end voltage is maximum. Measuring between two adjacent nulls shows a half wavelength. In the case of an open circuit, or a short circuit, no energy is taken from the line (provided there is no dissipative resistance). Instead, the signal is reflected back in the opposite direction. Because the reflected signal has the same amplitude and phase as the outgoing wave, both voltages are added and the voltage is at a maximum at the open end.

Should the line be terminated by a reactance that has absolutely no resistance, no power will be absorbed in the receiver end or load. In the case of a high-powered transmitter this could have disastrous effects. Putting power into a line that is not terminated will have the same effect because in both cases there is no resistance across the terminal, and the transmitter could be badly damaged by the high voltages developed.

If a line is not correctly terminated the outgoing and reflected waves will pass each other, going in opposite directions. The two voltages will add in some places and subtract at others, and the resulting voltage will be lower or higher than the original signal. Because the two signals go in opposite directions and at the same speed, the nulls and the maxima will not move around but will stay in fixed positions. This produces the familiar and sometimes troublesome standing wave.

An RF transmission line is not an ordinary circuit. AM lines should never have problems with delay effects because the longer wavelengths of the AM frequencies are large

FCC tackles EEO for a third time

By Harry Martin

The FCC has adopted new EEO rules that closely resemble Option A of the FCC's prior EEO rules. The new rules will become effective 60 days after their publication in the Federal Register, unless there are postponements under Congressional or OMB review procedures. The projected effective date is mid-February.

The new rules require broadcasters to disseminate notice of full-time job vacancies and to participate in a specified number of recruitment activities. Stations must maintain records of vacancies filled, the recruitment sources used for the vacancies and the number of referrals received from the sources, with the information placed in station public files and on station websites. All stations must submit this information to the FCC at renewal time and most stations must also submit the information midway through their license terms. Stations need not maintain records of the gender and ethnicity and nationality of persons interviewed or hired. According to the FCC, it will evaluate stations based on their recruitment efforts only and not on the gender and ethnicity/nationality of employees.

Recruitment. The new recruitment rules require licenses to:

- widely disseminate notices of all full-time (30 hours or more) job vacancies, except for rare emergency hiring situations;
- provide notices of all full-time job vacancies to organizations that have requested to receive vacancy notices;
- participate in a specified number of recruitment activities every two years, such as fairs and scholarship and internship programs. Station employment units with five to 10 full-time employees or which are located in smaller markets must participate in two such activities, while station employment units with more than 10 full-time employees located in larger markets must participate in four activities. (A station employment unit is one or more stations operated by the same staff.)

Record Keeping. In addition, under the new rules detailed records must be kept of:

- all full-time job vacancies filled, identified by job title;
- the recruitment sources used for each vacancy, identified by name, address, contact person and telephone number, with a separate list of the sources required to be notified because they requested vacancy notices;
- all advertisements, bulletins, letters, faxes and e-mails announcing vacancies all with dates;
- documentation necessary to demonstrate participation in the required recruitment activities;
- the total number of persons interviewed for each vacancy and the referral source of interviewee;
- the date each job was filed and the referral source of the person hired.

Reporting. Licensees must place in the station's public file and on the station's website reports containing lists of:

- all full-time vacancies filled during the proceeding year, identified by job title;
- all recruitment sources used for the vacancies, identified by name, address, contact person and telephone number;
- the recruitment sources that referred the people hired for each vacancy;
- the total number of persons interviewed for each vacancy and the total number of interviewees referred by each referral source;
- the required recruitment activities in which the station participated, together with a brief description of those activities.

Additionally, all licensees must:

- at renewal time, and for radio stations with 10 or more employees, midway through the license term, file with the FCC the reports (described above) placed in the station's public file for the past two years;
- beginning in September 2003, annually file a report with the FCC on the gender and race and ethnicity of the station's employees. (The FCC says this information will be used only for statistical purposes and not to evaluate a station's compliance with the EEO rules.)

Part-Time Employees. The FCC also commenced a further rulemaking proceeding to determine whether and how to apply the EEO rules to part-time jobs.

Commentary. By effectively adopting the former Option A, which had been approved by the D.C. Circuit, the FCC is hoping to avoid any further losses in court on the EEO front.

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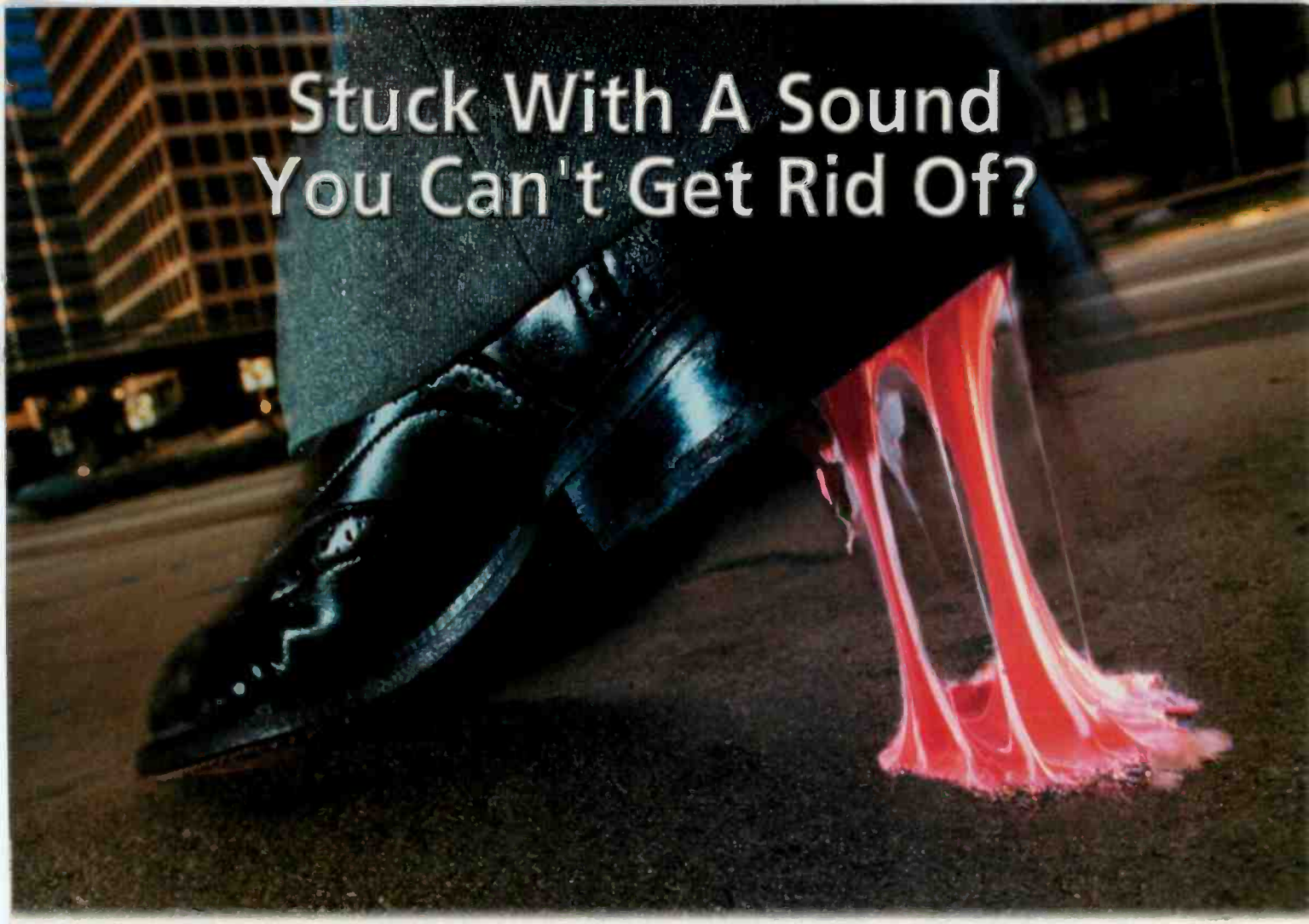
Dateline:

Stations in D.C., Maryland, Virginia and West Virginia must begin their pre-filing renewal announcements on April 1, 2003.



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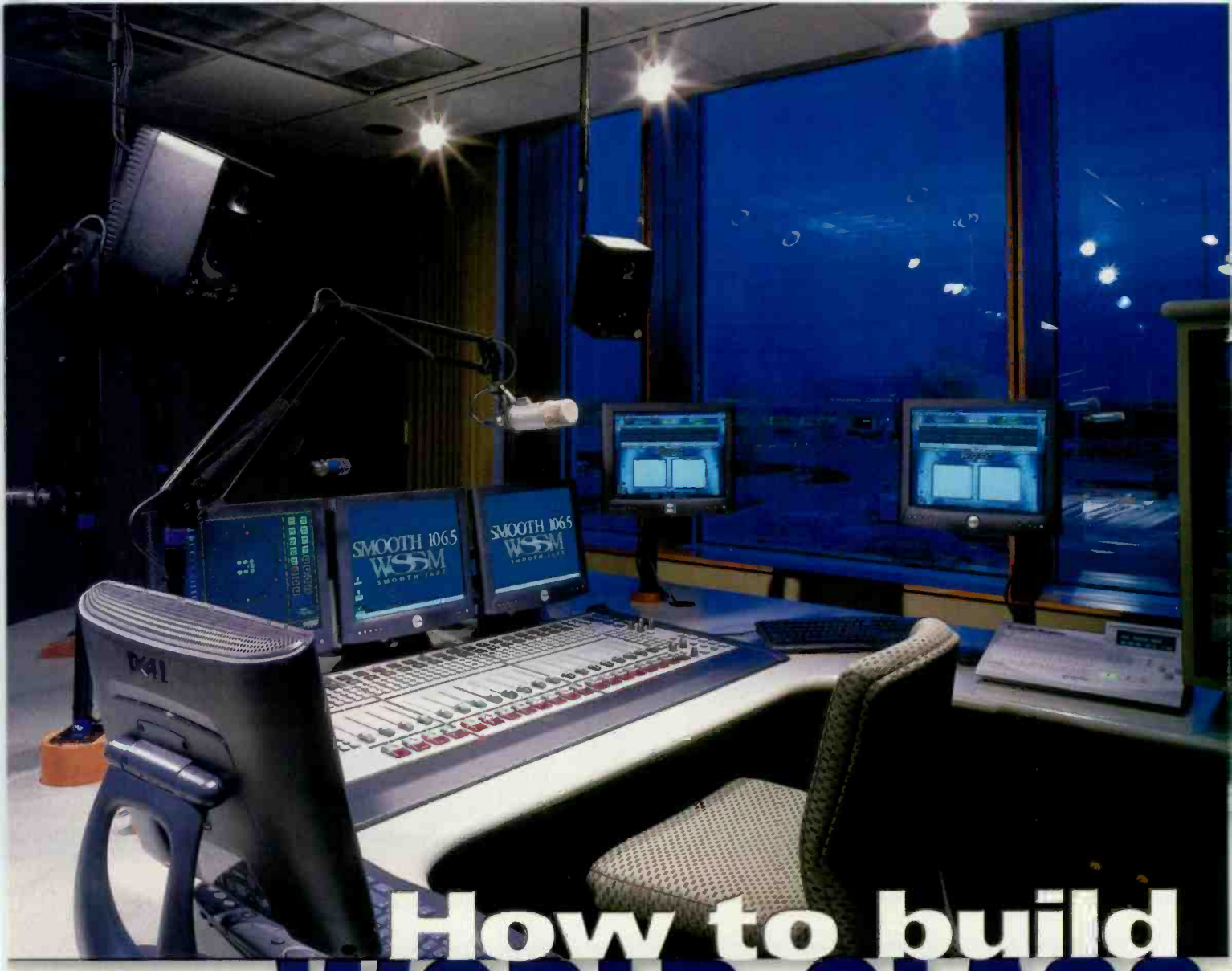


How to build WORLD-CLASS

By Michael Patton

Learn the finer points of studio design and construction techniques that make the difference between a top-notch facility and a real mess.

Great studios aren't just wired, they're built from the ground up. First, size does matter. While other constraints often force studios to be smaller than optimum, it is easier to build and to service equipment in a room that was not previously a closet. Find enough space to have the studio furniture away from two walls and preferably three. This provides good options for reaching the back of equipment racks and for punch block access that does not require you to become intimate with the on-air talent.

For the best sound isolation, use double-wall construction between different studios and staggered-stud construction on outside walls or between studios and the rest of the facility. All studios should have hard ceilings. Even if a suspended ceiling is installed for acoustic purposes, the walls should go up to the building's hard ceiling and be well sealed at the top. Use commercially available sound isolation doors or build copies of them. The same is true for windows. Double- or triple-pane windows should use glass panes of different thicknesses. This provides the maximum efficiency to prevent sound transmission because the panes will resonate at different frequencies. Make sure the glass rests on rubber gaskets, too.

Air handling is a vital but often overlooked component of sound isolation. Make sure that the heating, ventilation and air conditioning (HVAC) contractor understands the issues of sound isolation and wind noise. Low-noise registers in a sufficient quantity will ensure low air flow velocity. Sound baffles or multiple bends in the supply ducts will reduce blower noise. Use a minimum of 25 feet and three bends between any blowers and a studio. Each studio also needs its own return register with baffles or multiple bends. Do

Photo of WSSM St. Louis by William Mathis of Mathis-Jones Communications and courtesy of the Murray Company, St. Louis.

not use the plenum space above a suspended ceiling as an air return, it will result in sound leakage from studio to studio. I have successfully used pigtails on plenum return systems, which consist of about 20 feet of flex duct snaked with several bends in it in the plenum space. One end is open to the plenum and the other is connected to the return register. This provides excellent sound attenuation while not impeding air flow.

Construction details

Studios should be fairly dead, acoustically speaking, but the best live mic sound is obtained when there is some warmth to the room and instead of being completely anechoic. There are some studio acoustics basics that should be kept in mind.

Different acoustic treatment techniques work better at different frequencies, so use a mix of different types. A suspended ceiling that does not cover the entire room, typically floating about a foot from all the walls, is an excellent bass trap and is unobtrusive. For an aesthetic touch, paint the hard ceiling above the float black or some other dark color. Sound absorption panels are available in different thicknesses and colors to match the decor. Wooden baffle-type sound diffusors, while expensive, are excellent acoustics treatments to prevent slapback echoes on walls behind talent, and they can be quite attractive as well. Another trick that enhances acoustics is to build the studios with non-parallel walls, although this usually takes some serious explaining to management. The offsets don't have to be large; a foot longer on one wall than the opposite wall is enough offset to reduce acoustic standing waves, but odd-shaped rooms take some getting used to. One way we dealt with this in a recent station-cluster project was to build all the studios as wedges around a circle. This worked well acoustically and looked impressive, too.

I prefer wood floors to carpet because they are more durable if a sufficiently hard material is used. This will put more strain on the rest of the acoustic treatment, especially the ceiling. Use a hard wood, such as oak or Australian cypress, and do not use the pre-finished type. Instead, have it sanded, finished and sealed after installation—this makes for the toughest, spill-resistant floor. Wood

STUDIOS

floors last much longer when chairs with special wheels intended for wood are used, so make sure the person who specs the studio chairs knows the difference.

Equipment layout

Get the people who will be using the studio involved in the design process of that studio. Draw a set of studio layout sheets for each studio with the proposed rack layouts, equipment placement and console channel assignments generated with input from programming and production staff. Then submit this documentation to the client. Have the client's general manager or program director sign off on the design—literally. Have him sign each sheet. This allows a minimal chance for misunderstanding, and if any last-minute changes are wanted, it's easy to document justification for additional labor charges, if needed.

There is enough prefabricated furniture available for just about everyone's taste and budget, so I don't see much point in having a local carpenter of unproven experience with broadcasting build furniture. Either way, make sure that the cabinets are deep enough for the equipment, that the placement of equipment suits station

How to build WORLD-CLASS STUDIOS

personnel, that there is sufficient access behind and underneath equipment for servicing and ventilation, and that there are large built-in wiring channels and punch-block areas. Look for quality details like inlaid Formica or other surfacing, and real wood instead of pressboard. Free-standing furniture can be shifted as needed and can be disassembled without ripping it from the walls in the event that the studio must be moved. Generally speaking, built-in furniture cannot be moved. It involves too much hassle, too much damage to the furniture, and too little likelihood that the new room will be the same dimensions as the old one. Free-standing furniture can move relatively easily.

Photo courtesy of Wheatstone

Studio furniture serves as the equipment support structure and must also provide sufficient ventilation and cable access.

Studio wiring

How many engineers have seen neat and well-documented wiring in new studios? Probably a fair number. How many have seen neat wiring in five-year-old studios? Not many engineers have, because it is almost impossible to build studios, no matter how neat and well-documented, that retain the same level of organization and coherence after several years in the real world of last-minute remotes, unexpected equipment failures and format changes made without notice to the engineering department. It seems almost impossible to stay ahead of the game, but it's not.

Expansion will happen. I have never seen a studio or studio facility that didn't need to be expanded within a year or so of its construction. Provide plenty of room for expansion by running extra wire and cable pairs, by allotting additional space for equipment and for wiring blocks, and by providing additional capacity in the entire infrastructure.

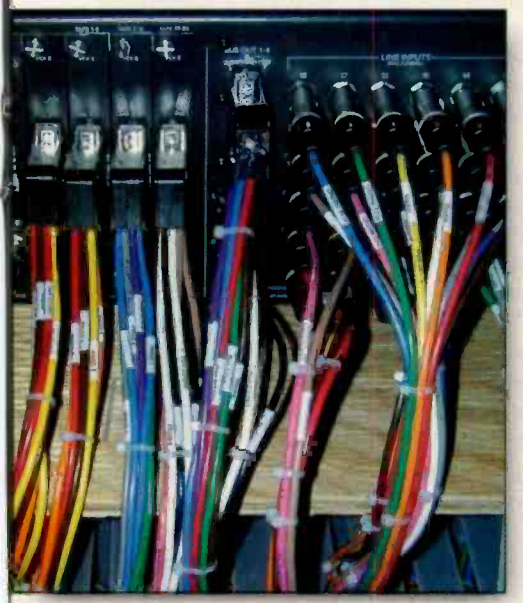
Pull more pairs than needed from each rack or cabinet to the wiring block area in each studio and from each studio to the rack room. Order cabinets and racks large and deep enough to accommodate new source equipment, new satellite and remote equipment, and especially new computers. Size generators, UPS units and HVAC equipment to handle additional loads. Save space in the building for future studio areas. Size the rack room to accommodate additional racks, but resist the temptation to let the current wiring expand to fill that available space.

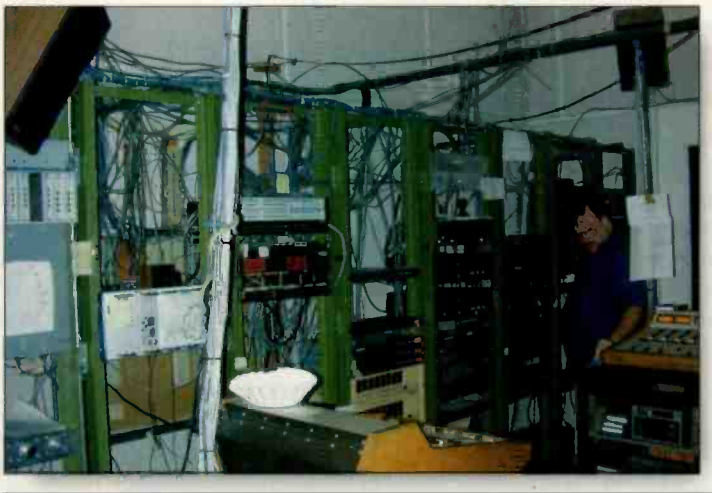
Use only smart wires. Don't wire a studio using anything but AES-3 compatible cable. AES-3 requires a twisted-pair cable impedance of 110Ω while traditional analog twisted-pair is typically 30Ω to 40Ω. Analog wire should not be used to carry an AES signal more than a few feet. Even if your current need is for analog audio only, the AES cable does it no harm, and will be in place when and if your station makes the digital transition, which will become more and more likely as digital equipment prices continue to fall and performance and ease of use rises. The good news is that 110Ω cable is quite common and is available in single pair, multiple pair or snake cable and microphone-tough cable in wire sizes as small as 26 gauge. All Ethernet cable (CAT5, CAT5E and CAT6) cable is rated at 100Ω, which is within the AES-3 audio specification. Ethernet cables are available in 4-, 8-, 12- and even 25-pair configurations, which today are cost-effective compared to traditional individually-shielded, twisted-pair cables. CAT5 is available with overall shields too, although balanced, line-level, low-impedance audio does not usually require shielding.

Multiple-pair, twisted-pair, 110Ω ribbon cables rolled in a tough jacket—and even shielded—are also available. These can be quickly and easily mass terminated to connectors or bulk punch-block connections.

Label the wires clearly. My first experience with heat-shrink labels used white pieces of heat shrink mounted on plastic tabs, like cartridges

Maintaining an organized wiring scheme is not difficult (below), but it requires sticking to the original design plan and not taking short cuts, like what was done in the photo to the right.





on an ammo belt, that could be loaded into a modified IBM Selectric typewriter. While they were expensive and time-consuming, the level of professionalism they brought to my wiring generated many positive comments. Today there are improved versions of this that are quicker and cheaper.

Personally, I use sheets of self-laminating laser printer labels that will fit on most cables of less than 1" diameter. I have settled on four fields on each label to indicate where each end of the wire goes, what type of wire it is and the color. The first two fields are for troubleshooting, and the last two are so that my crew doesn't put the label on the wrong wire. Color-coding can be a great tool; just be sure that none of your installers is color-blind.

Whenever possible, use wiring blocks. Traditional telephone-type 66 blocks are easy to find, offer lots of accessories and can be purchased from stock from several telecom and electronics distributors. Keep in mind that CAT5-rated 66 blocks should be used for AES-3 signals. ADC, AVP, Krone and others make excellent, high-density, high-reliability wiring blocks designed for professional and digital audio.

Keep the wiring blocks neat. Allow enough room to mount all the blocks needed for the current installation and include space for several spares. Because shielding is usually not needed for balanced, line-level analog audio or for AES-3 digital audio, cross-connects on punch or other wiring blocks can be unshielded twisted-pair cable like the phone company uses. Using this type of cable helps

keep punch block areas and walls neat and uncluttered. CAT5 cross-connect wire is also available. Not terminating shields increases the density of punch blocks, too. There is almost never any need to carry shields through punch blocks, and the user throws away 1/3 of the block's capacity trying. If using a shielded cable, remember to terminate only one end. I prefer to make a pigtail of all the shields and solder or crimp-connect it to a ground bus bar running near the blocks. Bring the permanent cables in behind the punch blocks, or permanent in one end and cross-connects out the other, so that permanent and cross-connected wiring is as separate as possible.

I have reluctantly decided that wiring channel, such as that made by Panduit, is a mixed blessing at best. Never mount a wire-trough channel upside down. As soon as you remove the cover, all the wires fall out. If you mount it sideways, put a wire-tie anchor inside it every so often, or anchor a Velcro wire-tie instead so the wires can be held up and to the back of the channel, out of the way of the cover. Another drawback is that the first time a cable has to be added in a hurry, the wiring channel covers tend to get removed and then not put back afterwards. Instead, use metal or plastic D-rings. Use the plastic ones that have a little seam that you can thread wires through without having to pass the end through each ring. They also have screw holes to anchor them down. Placing one about every foot and in corners will keep wires organized but not inaccessible—and there are no covers to lose. When appearance is paramount, like running wires that are in public view, opt for the wiring channel.

Clear Channel Hartford rack room by Scott Frances and Courtesy of the Lawrence Group Architects, St. Louis.

Allow enough space in the rack to provide for any future expansion, whether it is adding another station to the facility or accommodating a new format.

There is no such thing as too much documentation, a point that cannot be stressed heavily enough. Because I usually work with a crew of several people, I generate lots of documentation. In addition to the layout sheets I mentioned earlier, I generate a wiring and cross-connect list for each wiring block plus a wire running list for each

Photo by: Don Danko, CBRE CBNT

Various methods exist to create neat and practical labels, some of which are quite advanced and offer bar codes to simplify accessing data.

room. That way I have created essentially a complete virtual studio on paper. Once this is done it's easy to go back and verify that the crew actually ran the wires as they were intended. It also serves to verify the documentation. It's easy to create documentation in a spreadsheet, database or forms program. I'm planning to document my next studio project in HTML, complete with hyperlinks for the cross-connects. The advantage is that it can be viewed on any browser and easily modified—with the right passwords.

Good old-fashioned written documentation is not yet obsolete, either. Take a big three-ring binder and use tab separators for each studio and sheet protectors for each page. Mark the revision date or number on each page, so it is obvious which version of a page is out of date. Generate and give the client multiple copies of the documentation and multiple copies of any digitally-stored documents too. Keep copies for yourself. Stations lose paperwork easily during ownership or engineering personnel changes.

Test, test and test again

Before a studio is finished, ring out every wire and every cross-connect, either with an ohmmeter or a cable tester. Test cables for continuity, shorts and polarity. Some wiring blocks will have trouble with AES cable, due to the larger insulation required to make the higher cable impedance, and the engineer may need to punch the occasional wire down twice or take other remedial action.

Jocks and production people can't use features they don't know exist, and who better to show them than the installer himself? Show the program director and the production director everything the studio will do. Make sure they are happy with how it works. This is often the last chance to ensure that the studio's users' needs have been met.

This is an exciting time to be building studios. While the pressures to keep costs down are great, and the flexibility and features desired of a modern studio are many, the tools for accomplishing these goals are plentiful. With proper planning and wiring techniques, the experienced installer can build first-class studios that will also pass the test of time without busting the budget.

Patton is president of Michael Patton and Associates, Baton Rouge, LA. Contact him through www.michaelpatton.com.

Say goodbye to the WEAKEST LINK

By Steve Fluker

Amidst the bustle of updating studio facilities and transmitter sites, don't overlook the link between the two.

The old saying "You're only as good as your weakest link" is true in almost everything, including the complete air chain of a radio station. A good side effect of consolidation is that it has brought us into the age of complete digital studios that provide features unheard of ever as little as 10 years ago. Now that the FCC has accepted IBOC, we will see even more improvements as sites are updated with digital exciters and solid-state transmitters. With all of these advances in technology, don't overlook what can become the weak link: the method used to get the audio from one location to another. This can be getting the program audio from the studio location to the tower site, or trying to get audio from a remote broadcast location back to the studio.

Look closely

I've had the opportunity to tour many radio stations and have been impressed by their new all-digital facilities, only to then walk into the rack room to find a more than 20-year-old STL system. While outlasting much of the other equipment speaks highly of the construction and design quality, these systems become the weakest link. All of the work involved in creating the perfect digital studio is lost if the digital audio is converted back to analog so it can be sent to the tower site.

If you're still running one of these old classics, it may be time to look into updating the system. While traditional, analog composite and discrete STL transmitter and receiver packages are readily available, and might be adequate in some cases, take the time to do the homework and fully explore the available options before buying the same old thing.

The basic digital upgrade

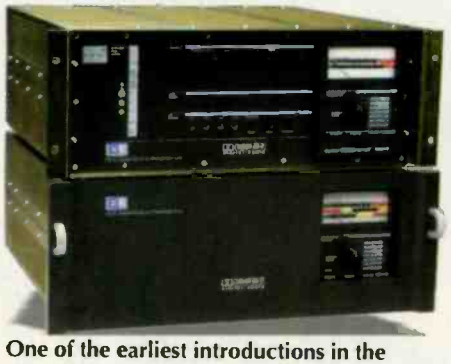
Digital STLs are not new. The first one hit the market more than a decade ago in the form of an add-on digital converter. These units are still available today and offer a way to convert an existing composite link to a 16-bit digital path without taking a huge bite out of the station's capital budget. These simplex codecs are placed at each end of the signal path and will provide up to four 15kHz, 16-bit audio channels through a single data stream. The codecs use the composite ports of existing analog composite transmitters. This is accomplished with a moderate amount of data compression. In addition, the path will provide an RS-232 data path along side the audio. This port can be used for transmitter remote control, or to pass data to an RDS encoder at the tower site. While this add-on will help to reduce signal interference noises in the path, the data compression might produce undesired audible digital artifacts in the audio. To get the cleanest STL audio possible, look into replacing the entire system rather than just upgrading the existing equipment.

Linear choices

With the demand for higher quality came the release of the linear digital STL. With program audio coming from so many sources, it's not possible to guarantee that the audio will always be linear. Satellite transmissions use data compression to fit more programming channels on the bird. Commercials received via the Internet have also been compressed, as are other sources such as Mini-Discs. While a single level of data compression is virtually unnoticeable, each time the signal passes through another compressed link it will add to the audible artifacts. To keep the sound as pure as possible, it is best to use linear audio everywhere.

WEAKEST LINK

This endeavor brought about the challenge to eliminate the data compression on the STL to a tower site, while still fitting within the bandwidth allocated in Part 74 of the FCC rules. To achieve this, the first of these units had to reduce the number of 15kHz channels from four to two, which is suitable for most FM applications. If additional audio channels are needed, there is enough spectrum remaining to add an optional single 12kHz channel or two 6kHz channels to this link. These additional audio paths are ideal for subcarrier audio. These systems also provide two RS-232 data ports for accessories.



One of the earliest introductions in the digital STL arena was developed by Dolby and is now available through Marti.

While the two-channel STL is fine for most applications, there was still a demand for more 15kHz channels for companies consolidating not only their studio locations, but also their transmitter sites. Through the use of quadrature amplitude modulation, creative engineers have been able to achieve four linear 15kHz audio channels over a single 950MHz link. This is great in areas where this STL band is crowded. You can also use a system like this to save money on your equipment needs. Rather than purchasing redundant transmitters and receivers for two radio stations, you can simply buy one system per station, using the auxiliary channels as the back up.

Location, location, location

Placing the audio processor at the studio has long been preferred, mainly for creature comforts. It allows a quieter listening environment and places the processing in a more convenient location for the program director. Most digital STL systems deliver only discrete left and right channels to the tower site, requiring the installation of a stereo generator at the transmitter site. This can be done in more than one way. Perhaps the easiest solution is to upgrade to a digital exciter with a built-in digital stereo generator. The AES-3 digital audio output of the STL is connected directly to the input of the exciter, resulting in a totally digital air chain. If this isn't an option, or if the backup transmitter still has an analog exciter, install a digital STL with an optional stereo generator installed in the STL receiver. This offers the feel of a traditional composite link that interfaces directly to the exciter. In these receivers, the digital and composite outputs are active at the same time, making it easy to feed two transmitters at once. Pay close attention to where the pre-emphasis curve is generated, however. Some of these stereo generators do not have the pre-emphasis option, and the engineer has to select it in the processor at the studio.

If you don't want to give up the composite STL, a new one was introduced last year that offers a full 16-bit composite digital

link in the standard 950MHz band. This allows him the full processing adjustments, including pilot injection from the studio end.

Planning for IBOC

With the FCC's acceptance of IBOC, the attempt to keep the processor at the studio may become a moot point. The IBOC/HD Radio exciter needs a linear unprocessed audio signal at its input. It then provides an output to feed to the main carrier audio processor and a second output to feed an IBOC audio processor. Because this new exciter must be at the tower site, the user will be forced to move the processor out of the studio. Fortunately, most new processors offer RS-232 port options and software to adjust them via a PC from any remote location.

A second issue with IBOC is the ability to transmit audio bandwidths up to 20kHz. The standard composite and digital STLs pass 15kHz, although we are now seeing some manufacturers addressing this issue.

The RPU is still alive

The typical STL system is only a one-way path. It will channel audio and data from your studio to your tower site, but it cannot get anything back. If you try to use the RS-232 ports, you can send data out, but you can't get the return information needed for things such as remote monitoring and metering of the transmitter. In the past, it was common to use a narrow band 450MHz data channel or even a dial up telephone line to return the data.

Another need for a return link is for remote broadcasts. While many remotes are now being handled by ISDN and POTS audio codecs, there are still those times when it's necessary to use a RPU system. RPUs are still valuable for the one-time-only broadcast when it doesn't make sense to pay the money to install a telephone line. They are also convenient for broadcasts from outside locations such as parks or beaches, or other areas where it isn't possible to easily install a telephone line. Low power, portable transmitters are also a great way to get audio out of a large building, such as a shopping mall, convention center or even a courtroom where it can be received by a remote vehicle that can then repeat the signal back to the studio. While their use has decreased, the RPU will still be around in some capacity for many years to come.

To get a better coverage area for an RPU system, many stations locate the receiver at the tower site to gain the extra height for the antenna. This leaves the challenge of getting the audio back to the studio, though. Typically a repeater is used to relay the audio back to the studio site, but this ties up

The uncompressed digital STLs deliver digital quality without the artifacts of audio coding.

more channels and provides yet an additional area prone to interference.

The next level

If a station's needs include a data return channel or RPU repeaters, consider looking at a bi-directional STL system. These typically come in the form of a rack mount chassis with a variety of plug-in modules to customize the system to an individual's needs. There are several choices in audio cards alone, and the user can send audio channels in either direction, and choose bandwidths ranging from 7.5kHz to 20kHz. The user can select analog or AES-3 digital inputs, and choose to stay linear or incorporate data compression if more audio channels are needed. One possible configuration might be to use a high-quality linear audio module to send the program audio to the tower site, and use multiple lower bandwidth audio channels to return the RPU audio channels back to the studio. Include a 15kHz return link to the studio and install a back-up satellite dish and receiver at the tower site for emergencies.

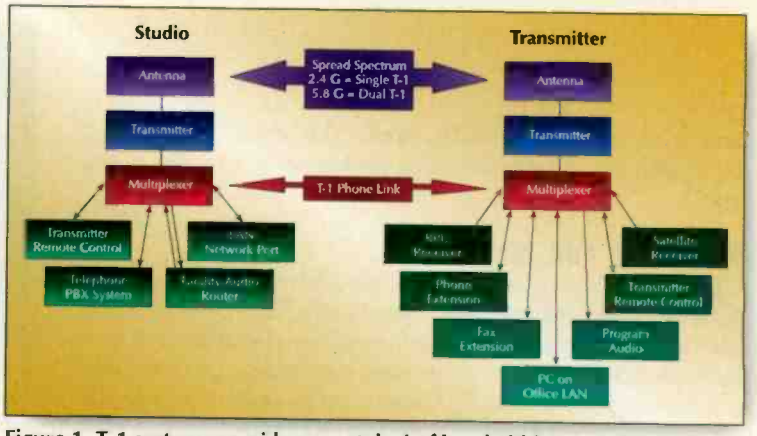


Figure 1. T-1 systems provide a great deal of bandwidth to use for more than just program and contributed audio.

Quadrature amplitude modulation has made it possible to send four linear digital audio channels over conventional STL paths and frequency spacings.

Be creative with the system, too. Add a LAN module and take a computer to the tower site. This will allow direct access to the office network files, e-mail and Internet access without monthly connection fees. Every engineer has taken a trip to the tower site, only to get a call from the sales or business office with a computer problem the second he walks into the transmitter building. Now he can log on and take care of problems without driving back to the studio. Connect a camera to the PC and send security video over the Internet connection to monitor the site from anywhere. RS-232 and RS-422 ports can be added, which work bi-directionally and offer a solid connection to the transmitter remote control system or to talk

When used with a V.35 codec, the Moseley Aries 400S provides a digital link in the RPU band.

to an RDS encoder. When IBOC forces the station to relocate the audio processing to the tower sites, use these data ports to adjust the audio from the PC on a desk in the office.

To save money on monthly expenses, add a telco module to the chassis, then install an extension on the office PBX system at the tower site. Calls can be directly transferred from the receptionist to the tower site. Install another extension to add a fax machine at the tower site and take advantage of the group long distance rates that the office receives. Eliminate telephone service at the transmitter site, which might be important for towers in remote locations where telephone service might not otherwise be available. Figure 1 shows just how versatile these types of systems can be.

Avoiding T-1 costs

The downside to these bi-directional STL systems is that they won't operate on a standard 950MHz channel allocation. The most common method is to use a T-1 phone line to connect the two ends. Unfortunately, the monthly fees for these lines could make this idea cost prohibitive. In some locations, a remote tower site may not have telephone service available.

There is an answer to this problem. Data and audio multiplexers can be connected together via a spread spectrum RF link. These are available in two bands, a 2.4GHz band, which gives the equivalent bandwidth of a single T-1 line, or in a 5.8GHz band, which will double that capacity to the equivalent of two T-1 circuits. Because these channels are not licensed, it is in the station's best interest to do whatever is possible to protect the station from interference. Use a high gain, highly directional antenna and install it as high as necessary for a clear line-of-sight path, but not any higher. These antennas are so tight that they can operate at distances as far as 30 miles with excellent rejection of other signals. Spread spectrum is being used successfully in many locations across the country, however if you still are concerned about interference, keep the old 950MHz STL channel in operation as a back-up link to the tower.

With IBOC on the way, think ahead and make choices wisely. While a bi-directional system may look expensive, consider all of the other components it will be replacing and it is really a bargain.

Fluker is director of engineering for the Cox Radio stations in Orlando.

Downlinks and antennas

By Conrad Trautmann, CPBE

As a radio engineer, you probably have had some experience with satellite reception. In the United States most of the radio networks are on the radio community satellite, currently called AMC-8. General Electric, who used to operate GE-8, sold the satellite division to SES-Americom. The radio networks that operate a carrier on AMC-8 include Westwood One, ABC, Premiere, Clear Channel/NSN, Jones, Learfield Communications, WITF Radio Pennsylvania, Peninsula Communications, Morris Communications and Waitt Radio. The advantage to being on the same satellite, operating in the same polarity (all are vertically polarized on odd transponders) is that only one dish and a single LNB are required for most networks. While AMC-8 sees the bulk of the radio activity, other satellites that carry programming, mostly for regional, state or sports networks, include Clear Channel's AMC-1, AMC-2, AMC-4 and PAS-8 and NPR's Galaxy IVR.

Relative locations for several commonly accessed satellites.

C-band (3,700MHz to 4,200MHz) is used for the national networks because of the robust reception. Direct TV or Dish Network users know what rain fade can do to a signal. C-band is less prone to fading due to bad weather because it is lower in frequency than Ku and uses a larger dish. Ku-band frequencies are about 10,900MHz to 12,750MHz, with DBS using 11,750MHz to 12,500MHz.

Downlink equipment includes a dish, LNB and cable run to a receiver or multiple receivers with audio and data ports to feed the equipment.

The equipment

First, let's look at the antenna. The FCC has allowed satellite operators to put satellites in the sky every two degrees. If your dish is not two-degree compliant, you may receive interference from an adjacent satellite. To get enough signal for minimum fading, use a 3.2 meter or larger solid-core dish for AMC-8 reception. The SES-Americom website at www.ses-americom.com is an excellent resource for information to line up a dish, including a tool to determine azimuth and elevation based on a Zip code. AMC-8 is low on the horizon from the East Coast, so you must be clear of buildings or trees.

If a dish is placed on top of a building or in a higher location to obtain a clear line of sight, be aware of any terrestrial microwave paths that operate in the 4GHz range that could potentially interfere with reception. Conduct a frequency search to be sure. Comsearch is one company that can provide this service. Once you've cleared the downlink site, it is possible to file with the FCC to protect the downlink, in the event another applicant wants to install a terrestrial microwave path or uplink nearby, after the dish has been installed.

Think inside the box

Are you peaking your dish when the satellite is in the center of the box? Geostationary satellites fly in a figure-eight pattern in the sky. When aligning a dish, do so when the satellite is at the center of that figure eight. This is called center of the box, and the satellite owner's website lists when the satellite is at that point. If aligned when the satellite is at the far end of the figure eight, it is possible to get a significant drop in signal strength when it reaches the other side.

Don't use the receiver to align the dish. With the latest digital receivers, it can take 30 seconds or more for the receiver to acquire a signal. It is better to align a dish with a spectrum analyzer. If you don't own one, find someone at the local TV station or cable company who will let you borrow one. You can also rent one if necessary. Another option is to hire a local satellite installation company. Many carry accurate signal meters. If using a spectrum analyzer to line up the dish, contact the operator of the satellite for a printout of the satellite carrier pattern. They can tell you what pattern to look for.

One more option is to purchase a lower-cost test device. Similar to a spectrum analyzer but designed to operate in the 920MHz to 2,150MHz range. Emitor makes a unit called the Satlook Digital. This unit can download the carrier pattern for the satellite and alert you when the dish is aligned properly.

Specify an LNB that has a phase-locked loop (PLL). Older video LNBs will will pick up a signal, but the digital receiver will not lock and drop out every few seconds. A good LNB with low noise temperature will make a big difference in how well the receiver will work. Find the lowest noise temperature possible for best performance.

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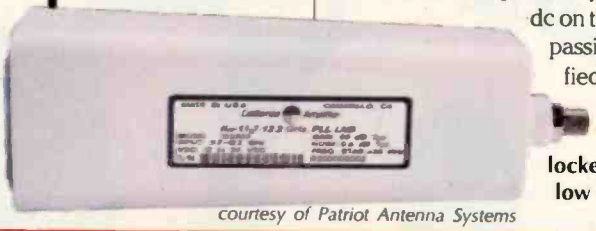
Most networks use Starguide receivers. Other receiver types include Comstream, Wegener,International Datacasting and ICP.

Westwood One transmits a Starguide II signal, which any Starguide II and many Starguide IIIs will receive. ABC, Premiere and Jones use Starguide III transmission, which can only be received by a Starguide III receiver. Because these receivers can only receive one network at a time, many radio stations have multiple receivers. It is not recommended to use one receiver to pick up multiple networks because the programming done at the network headend is lost each time the carrier or provider is changed.

When connecting more than one receiver to the dish, only one receiver should power the LNB. Splitters are available that will pass voltage on only one and block the dc on the others. Only use passive splitters. Amplified splitters can introduce phase distortion or possibly overload the receiver.



courtesy of Patriot Antenna Systems

Specify a phase-locked-loop LNB with a low noise temperature.

The downconverted L-band signal from the LNB can be connected via RG-6 for long runs or RG-59 for short runs. Avoid in-line booster amplifiers; they can overload the front end of the Starguide receiver and degrade the signal. Sometimes the receiver may see too much signal even without an amplifier,requiring an inline pad to be inserted before the receiver.

A great utility program written by Kirk Wesley to test a Starguide receiver is found on the *Radio* magazine website in the *Engineer's Notebook* section. The software was designed as a relay logger, but it will also display bit rate errors and signal strength.

The Starguide signal meter displays EB and AG values. EB, short for Eb/No,is a ratio of energy-per-bit to spectral-noise density; basically a signal-to-noise reading for a digital transmission system. Generally,the higher the EB the better the quality of the signal. AG is an abbreviation for automatic gain control. The better the AG,the lower this reading. You can only compare these readings between receivers using the same version of software. If the versions are different, the readings can vary due to different components used in later versions of the hardware. Don't worry about different signal readings from one receiver to the next. As long as the EB is above 4.5 and the AG is between 130-192, the receiver should work fine.

Trautmann is senior vice president of engineering for Westwood One Radio Networks, New York.

Syntrillium Cool Edit Pro 2.0

By Joshua Hall

Cool Edit Pro has two main parts: the waveform editor and the multi-track arranger. Use the waveform editor to load and record sounds. More than 20 file formats are supported, including .wav and MP3. More than 45 DSP effects can be applied to a sound file. In addition, mastering, analysis tools and audio restoration features are available.

Once an individual track has been edited, the user sends it to the multi-track arranger. There, real-time effects such as the QuickVerb, the Dynamic EQ or the Doppler Shifter—all of which are new to this version of Cool Edit Pro—can be applied to any of the tracks. Set the envelope volume and pan setting by clicking and dragging on the waveform. The sample can be split into several parts, and each piece can be resized by clicking on the left or right edge of the envelope.

Each of the DSP effects has easy-to-use presets. Individual adjustment of the preset parameters is also easy. In addition, there are settings for room size, correlation and reflection settings. The effects alone are impressive. Other possibilities include vocal-track elimination by using the channel mixer, a hard limiter for loud audio punch and an FFT filter for a telephone-style bandpass or hiss reduction. With 45 DSP effects, Cool Edit Pro has the options to create professional audio production.

The optional Red Rover provides a hardware transport controller through a USB interface.

Performance at a glance

- 24-bit/96kHz capability
- Scripting and batch processing
- Multiple file-format supprt
- Multiple presets for each effect
- Full undo capabilities
- Real-time effects
- Looping tools

Under the hood

The specifications to the audio performance are impressive. Its 32-bit internal processing and data rates up to 24-bit/192kHz and higher providing exceptional audio. Direct-X plug-in support, CD ripping, loop-based song creation including session tempo and key matching, and even video (.avi) soundtrack editing are all standard.

I experienced a few graphical errors, which were related to my sound card and not the software, and Syntrillium is working with the card manufacturer to resolve this. After a month of heavy, everyday use, it crashed once, but automatically restored all my work after a reboot.

Another available option is a hardware controller that provides transport controls. The Red Rover connects through a USB port and provides unlimited access to all 128 tracks of possible audio on Cool Edit Pro.

Personally, I found the Red Rover controller unnecessary, but new users may find its friendly button layout easier to use. The same functions can be done with a mouse, but the Red Rover helps it feel more like a traditional piece of production equipment.

Hall is writer, producer and co-host for the morning show at KMXV-FM, Kansas City.

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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.

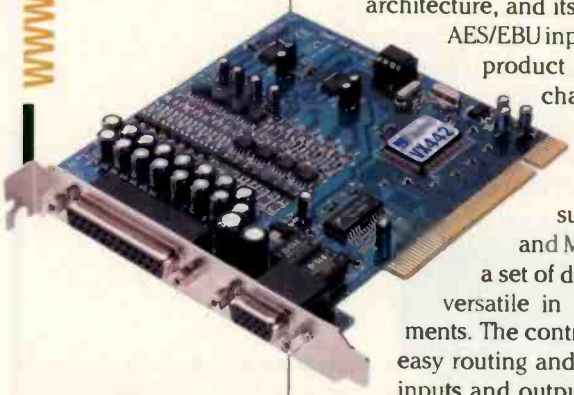
New Products

By Kari Taylor, associate editor

www.beradio.com

multichannel sound card
Digigram

VX442: Part of the VX series, this sound card is useful for pro audio production, as well as archiving and logging applications. With its 4/4 balanced line inputs and outputs, 96kHz 24-bit converters, its low latency architecture, and its additional stereo AES/EBU input and output, this product is a linear multichannel sound card with analog and AES/EBU inputs and outputs. It supports Windows and Mac platforms with a set of drivers that make it versatile in multiple environments. The control panel provides easy routing and digital mixing of inputs and outputs.



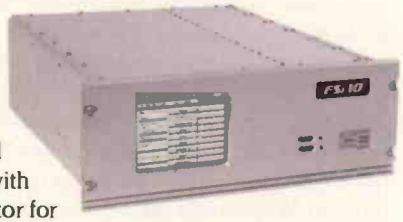
703-875-9100; fax 703-875-9161
www.digigram.com; input@digigram.com

Digital console
Wheatstone

D-4000: Based on the technical architecture of the D-5000, the modular D-4000 features a stainless-steel meter bridge and wrist rest, new work surface graphics and composite fused-finish end caps. The console features include: hot-swap design, four stereo mix buses, six true VU meters, any mix of digital and analog inputs, AES and balanced analog outputs, choice of master clock rates, as many as four mix-minus outputs and 24-bit analog-to-digital conversion on analog inputs. This console also provides A/B source switching with fully independent logic and machine control mode selection on stereo inputs, low profile drop-through counter design and multiple studio outputs with talkback interrupt.

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

AM/FM IBOC signal generator
Broadcast Electronics



FSi-10 and ASi-10: This third-generation IBOC signal generator takes advantage of the ability of the FXi60 to accept a direct digital input and provide an analog FM and FM IBOC signal. All operating parameters are programmable from the front-panel VGA touch screen. The generator accepts AES-3 input and provides all signal conditioning needed for use in a high- or low-level combined system. Its output directly feeds the FXi60 or FXi250 digital FM exciters, when fitted with the IBOC input option card. The AM version, the ASi-10, can also act as the digital signal generator for an AM IBOC system. The phase and amplitude output are fed directly into a solid-state AM transmitter, and with audio processing a station is ready to begin broadcasting digital AM.

217-224-9600; fax 217-224-9607; www.bdcast.com; bdcast@bdcast.com

Analog FM tuner/monitor
Fanfare

FT-1AP: This rack-mount FM tuner offers three audio outputs (hi-level and low-level unbalanced and XLR balanced), one composite output with level adjust and BNC antenna connection. It is useful for translator and repeater remotes, and offers a high level of RF sensitivity (30µv for 50dB quieting in stereo), and first- and second-adjacent rejection (25dB and 80dB respectively). Other features include eight presets with exclusive UNISET programming control, wide and narrow IF band switching for selectivity and a fluorescent green display. This tuner/monitor offers options such as carrier sense to detect low or no signal at a translator/repeater site (available 10/31/01), RS-232 Data I/O and full-function IR remote control. The battery-backed microprocessor returns tuning to the exact same settings that were in play at the time of a power failure. The power receptacle accepts an ISE modular power cord and is fused at 0.5A. All boards are directly replaceable and do not require in-service alignment.

716-683-5451; fax 716-683-5421
www.fanfare.com; infosite@fanfare.com

Large diaphragm microphone
DPA Microphones

4041-SP: This omnidirectional mic offers more flexibility in terms of preamplification options. With low self-noise and high sensitivity, the mic is useful for detailed work, such as vocals, strings and other acoustic instruments with large dynamics. This product offers a low self-noise of 8dB(A) and maximum 9dB(A), a THD less than 0.5 percent at 120dB SPL peak. The microphone is now available in three versions: a unique modular design enables the capsule to be unscrewed from the preamplifier, offering options of a 48V or 130V powered solid-state preamplifier and a 130V tube technology preamplifier. The solid state is chosen for the most transparent reproduction, whereas the tube system adds a slight musical coloration to the recording.

+45 4814 2828; fax +45 4814 2700
www.dpamicrophones.com; info@dpamicrophones.com

Audio adapter
AudioScience

ASI5111: The ASI5111 provides one stereo analog and digital input, one stereo analog and digital output, a microphone input, two record streams and four play streams. Audio formats include 8, 16 and 32-bit PCM. Analog and digital interfaces are standard on the adapter. The analog interface is balanced and uses 24-bit over sampling converters to deliver more than 100dB of dynamic range with THD+N better than 0.0025% at sample rates from 32kHz to 96kHz. The digital interface can be software configured for AES/EBU or S/PDIF operation. The balanced microphone input works with professional studio microphones requiring +48V phantom power. Gain is adjustable via software up to 60dB. Processing effects

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Contributor Pro-file

Meet the professionals who write for *Radio*. This month: Satellite Technology, page 36.

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Gorman-Redlich Mfg. Co.	45	740-593-3150	www.gorman-redlich.com
Harris Corp. Broadcast Div.	3	800-622-0022	www.broadcast.harris.com
Lightner Electronics	50	866-239-3888	www.LightnerElectronics.com
Mager Systems	15, 34	623-780-0045	www.magersystems.com
Medietouch	21	888-665-0501	www.emt.net
Moseretronix	48	800-300-0733	www.moseretronix.com
Moseley Associates	11	805-968-9621	www.moseleysb.com
Mouser Electronics	49	800-346-6873	www.mouser.com
NAB Broadcasters	39	202-429-5336	www.nab.org/conventions/nab2003
Neumann Microphones	27	860-434-5220	www.neumannusa.com/103BER
Nexus Broadcast	50, 51	800-219-7461	www.nexusbroadcast.com
NPR Satellite Services	13	202-513-2626	www.nprss.org/be
Old Stone, Inc	50	800-538-4977	www.antennamast.com
OMB America	17	305-477-0973	www.omb.com
Propagation Systems	47	814-472-5548	www.psibroadcast.com
Radio Systems	29	856-467-8000	www.radiosystems.com
RAM Broadcast Systems	31, 46	847-487-7575	www.ramsyscom.com
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Samco Antennas, Inc.	50	817-336-4351	www.samcoantennas.com
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The Radio Foundation, Inc	51	212-595-1837	www.radioart.org/studio
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Valcom	25	519-824-3220	www.valcom-guelph.com
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Wheatstone	2, 55, 56	252-638-7000	www.wheatstone.com
Wireworks	46	800-642-9473	www.wireworks.com

www.beradio.com

Shaping radio today and tomorrow

By Kari Taylor, associate editor

Do you remember?

This console debuted at the 74th AES Convention in New York, Oct 8-12, 1983.

The A-300 broadcast console was designed to set new standards in on-air consoles for performance, function and design. Features included total logic control, three-bank lighted source selector and Program and Audition output assign switches, long-throw conductive plastic faders, electronic or transformer-balanced inputs and outputs, and total modular construction in any size mainframe you require.

Station engineers were said to appreciate the Hall Effect on/off switches, easy installation interface and serviceability, gold contact connectors and rock-solid construction. Announcers liked the smooth feeling controls, lighted switches and automatic logic control system, and management loved the A-300's lasting quality and price.

The Wheatstone A-300 broadcast console was introduced in the Fall of 1983 and debuted at the 74th AES Convention in New York, Oct. 8-12, 1983. The original literature stated that the console was designed "to set new standards in on-air consoles for performance, function and design." Its features included total logic control, three-bank lighted source selector and Program and Audition output assign switches, long-throw conductive plastic faders and electronic or transformer-balanced inputs and outputs. The console was completely modular in construction, and it was available any size mainframe.

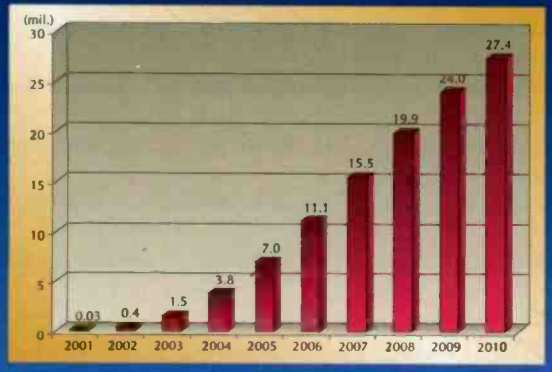
Electronically, the A-300 featured Hall Effect on/off switches, gold contact connectors, lighted switches and automatic logic control system.

The A-300 was succeeded by the A-500.

Sample and Hold

A look at the technology shaping radio

Satellite Radio Subscriber Projections



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That was then

In the January 1994 issue of *Radio* magazine we reported that Amati and AT&T successfully tested their in-band on-channel DAB format over the air at WPRB-FM in Princeton, NJ. The system performed well despite crowded spectrum conditions and ice storms during the test period. WPRB was chosen for its proximity to AT&T's development facility in Murray Hill, NJ, and its worst-case spectrum position, with relatively strong signals in both of its first-adjacent channels.

Similar to previous IBOC-FM tests, a separate low-power, linear RF amplifier was used as a transmitter for the digital signal. Its high level combined with WPRB's existing analog FM transmitter's output and fed to a common antenna. However, these tests also noted surprisingly successful results when the station's FM transmitter was used for the analog FM and digital signals in a low-level combined operation. Successful reception was possible in this mode with the FM transmitter running up to about half its rated power. The grounded-grid design of the 10kW FM transmitter used at WPRB may have contributed to this unexpected result, according to Amati engineers.

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