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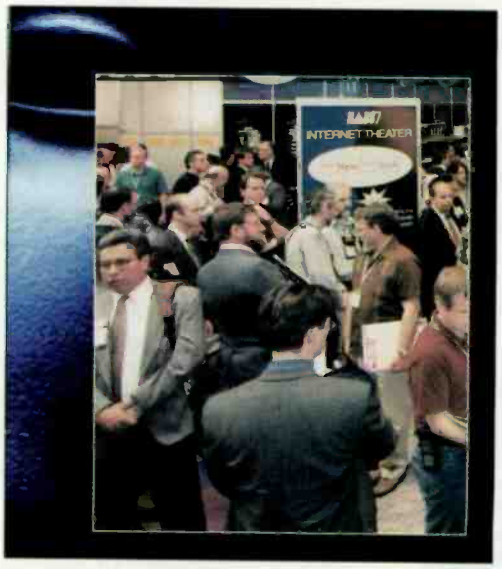

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ON THE COVER: The technology presented at the NAB98 sessions can be thought provoking and provide fodder for conversations off the show floor. Cover design by Michael J. Knust.

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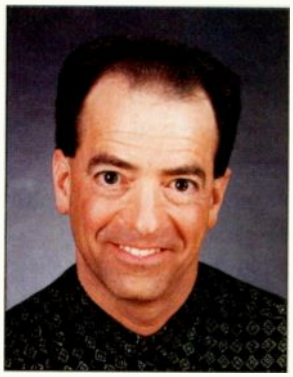
Editorial

The crystal and the flame

I had known the work of author Italo Calvino, but had not read his *Six Memos for the Next Millennium* (Harvard University Press, 1988) until it was given to me recently by a colleague. She recommended it on two counts — for its intended purpose as a commentary on literature, but also as an unexpected guide to approaching new media.

With that curious endorsement, I launched into the short book, and soon understood. *Six Memos...* is a collection of essays originally intended as lectures for the Charles Eliot Norton series at Harvard University. Each lecture deals with a specific element that Calvino finds critical to literary expression, but it also provides good advice for professionals in any field of communications.



The essays are each titled by a single word, and a listing of them creates a mantra for excellence in today's telecommunications environment: *Lightness, Quickness, Exactitude, Visibility, Multiplicity* and *Consistency.*

Some illumination on Calvino's intent drives the essays home: In *Lightness* he refers to the attribute of nimbleness or "unheaviness," by which he recommends divesting oneself of unnecessary inertia and encumbrances. The close corollary of *Quickness* adds agility and strength. This provides the speed and reflexive motion necessary to adapt to today's fast-changing media milieu. *Exactitude* tempers the pure speed with requisite accuracy.

Visibility is more aptly titled "visualization" in today's context. It is commonplace terminology for seeing something real in one's mind as a precursor to making it happen, and Calvino recommended it long before TV ads or bumper stickers did.

Multiplicity concerns the ability to be comfortable in two or more distinct environments simultaneously — a form of mental multitasking that is valuable to broadcasters today as they contemplate coexistence in multiple media marketplaces (e.g., on-air and on-line).

Consistency is self-explanatory. Doing something well on an ongoing basis is essential to success. But we are left to guess how Calvino would connote the term, for this last lecture was never written. On the eve of his departure from Italy for Cambridge to begin the lecture series, Calvino died suddenly. The lectures were never presented, and their only legacy is this posthumously published book.

"The answers you get from literature depend upon the questions you pose."

— Margaret Atwood

Such brutal condensation of his work, and its appropriation to another science are an affront to the mastery of the original lectures, so I recommend *Six Memos...* to you in its entirety, as my friend did to me. Here's an example of what you'll encounter:

In *Exactitude*, Calvino contrasts the ultimate structure and slow, controlled growth of the crystal with the wild variation and rapid consumption of the flame. He presents them as two opposing models of development and change. Each expends the matter surrounding it to create vastly different products of "perfect beauty."

Provocative notions come quickly when reading such a rich text, empowering new and unconventional thinking. A little aesthetic recharge is good for the technology-ridden soul now and then. In this case, some valuable lessons are included.

Skip Pizzi, editor-in-chief

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Viewpoint

Real radio

Just for a moment, let's think about radio broadcasting. Every day we're surrounded with ideas and issues that affect our jobs and lives. When you go through the day and phrases like consolidation, DAB, the Internet, computer network and time management pop up, it's easy to lose sight of what you're doing.

Most radio engineers don't get into broadcasting because they want to get rich. Most don't get into it for fame. All the radio engineers I know, myself included, became radio engineers because they enjoy the challenge of the job. For the most part, this challenge has always been an audio path (from microphone to on-air processing) and an RF path (STL and transmitter). The stuff that real radio is made of.

I remember working on an AM transmitter with a three-tower directional array one weekend with three other people. Two of them were co-workers, the other was a friend from another station (who was there voluntarily because of his passion for radio). We were taking the weekend to clean and tune-up the main transmitter. It was not an emergency situation, and we had a rare opportunity to go through the system with a fine-toothed comb, get the dust and bugs out, and investigate some of the little problems the station was having.

As the work progressed, we got deeper and deeper into the machinery. What started out on Friday night as a planned three-hour outage became a thorough investigation and repair project that continured on to Saturday and Sunday nights. We split the team up and one group worked on the transmitter while the other group went out to the ATU doghouses and cleaned out five years of dirt, dust, insects and all the other fun things that showed up when the previous owner had neglected the site.

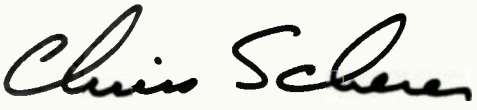
We worked through the next two nights and put it all back together for an early morning sign-on the next day. When early Monday morning rolled around and we had finished the final adjustments on the phasor, we stepped back and admired our work. All the readings were exactly where they were supposed to be. The transmitter sounded better than ever. We had our little pile of defective components that were going to be a show-and-tell for the general manager later (before being used as a reference for a replacement spare parts order). We were all dirty from climbing in, out and around the transmitter and doghouses. There were a few minor scrapes on our hands and knees from the acrobatics. Another of my co-workers (and also a good friend) looked at us and our accomplishment and remarked, "This is radio. This is *real* radio." We all smiled and agreed.

Everything we used was analog test equipment. Rags, now blackened from dirt, filled the trash can. The soldering iron was still smoldering. There was no digital here. There was no computer control. We did not have to establish a protocol or load a driver. It was real radio.

The job of the radio broadcast engineer changes every day. The responsibilities of a chief engineer today compared to those of five, 10 or 20 years ago have obviously changed — in technology and staff.

The challenge of our jobs changes every day, and we must change to keep up with it. There are still some basic elements that remain constant: the tools we use every day. Electronic fundamentals and troubleshooting procedures are the same today as when they were invented.

The opening session at the Broadcast Engineering Conference — Radio Boot Camp — brought many of these ideas to mind. Working on transmitters and basic audio concepts are areas that are always a part of the job and always will be. Many of us wonder where the next generation of radio engineers will come from. Whoever it is, they will start from the same basic building blocks we did and move up to the complex structures and digital protocols that are shaping radio for tomorrow.



Chriss Scherer, editor

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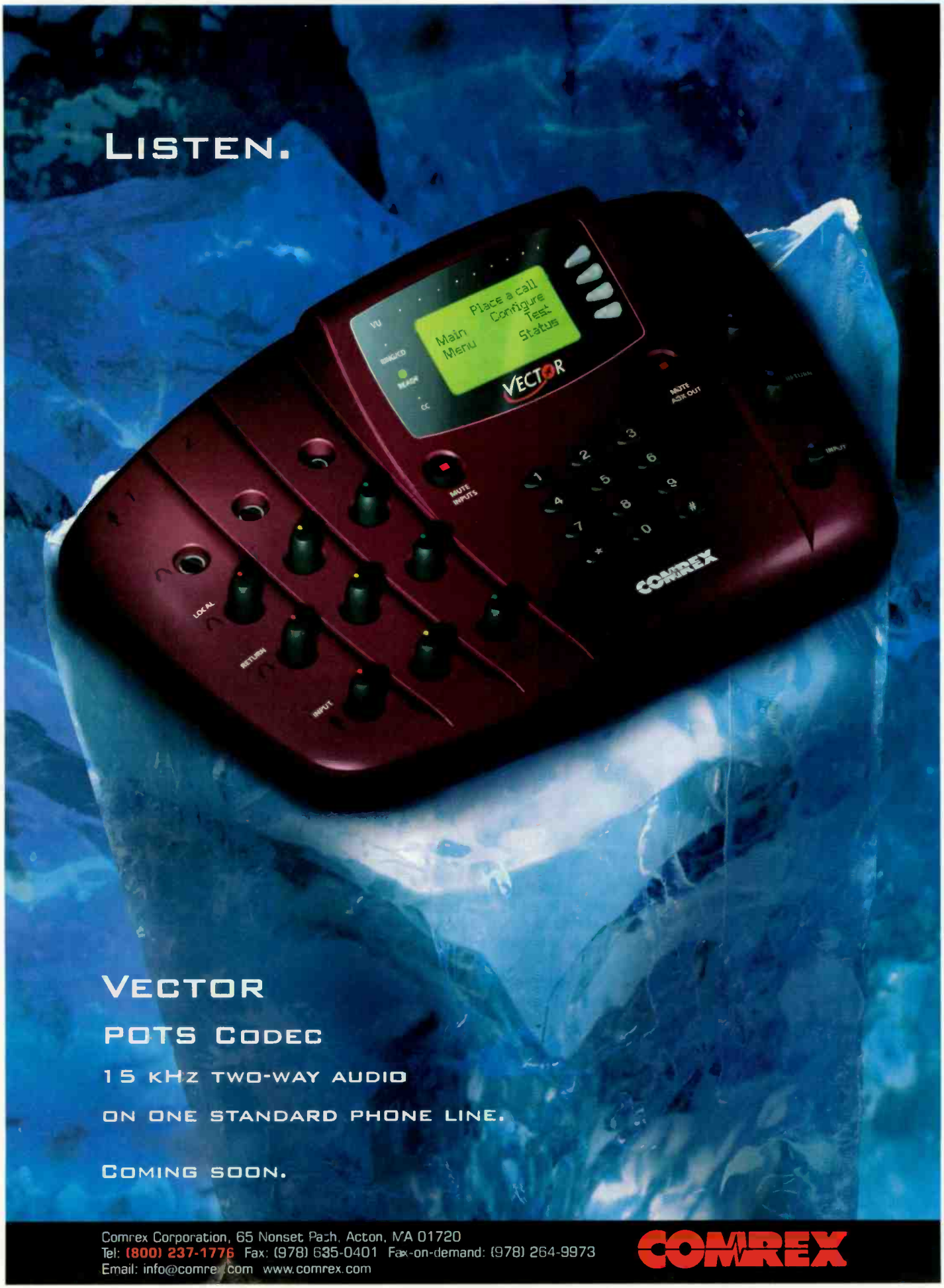

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Computer integration, part 1

By Kevin McNamara, CNE

Consolidation in this industry is finally solidifying and the realization that advertising revenues do not necessarily increase proportionally with the number of stations owned is sinking in. Station owners are now looking for solutions to increase efficiency and reduce the cost of operating these "clusters." The price to implement technological solutions has come down to a point where the return on investment in many cases can be measured within months.

Consider that an engineer can assemble a PC with a "pro" quality audio card and the appropriate software to create a fully functional, eight-track digital audio workstation for less money than the cost of a professional two-track quarter-inch reel-to-reel tape machine. Does it make sense to build (or rebuild) a facility based on analog technology? Probably not. Chances are that you have already integrated computer technology into your facility. If you are planning to rebuild, or even thinking about it, keep reading for some basic information on how to integrate computer technology.

Consolidating the traffic and music scheduling systems can cut down on time and paper. Here, a bridge has been established between an AS-400 and Novell/Win95 network.

Generally speaking, the amount of money allocated for technical projects is usually only sufficient to cover specific items (i.e. a new digital audio storage system, or a new processor). This has the net effect of creating piecemeal technology deployment throughout your facility. The more important issue is that the infrastructure used to connect these items tends to be built around those devices. In the analog world, that infrastructure probably consists of one or more runs of a shielded twisted-pair cable.

However, in the digital domain, you have a lot more to think about — standards, data speed, data protocols, transmission media, etc. Manufacturers using proprietary data communications and file format standards can further aggravate this problem. There is a lot to think about, but the good news is that a properly designed data communications infrastructure will most likely endure many of these problems now and in the future.

Establishing needs

Step back from your day-to-day routine and take a close look at how your total facility functions. Analyze how information flows to and from each department; then consider the type of information. Next, answer some essential questions:

- Is a PC generally required to create the information? Who uses it? Who needs it? How is it dispersed (i.e. written, disk, network, e-mail)?
- Does any employee need shared resources (i.e. printers, modems)? How PC literate is the employee?
- Is a computer-based network in place? Is the network available at all necessary desk positions?
- What software is in place? Is the software standardized throughout the facility? Are versions current?
- What hardware is in place? Is it adequate for the application?
- Will outside access be required (i.e. Internet, e-mail, fax or remote dial-in)?
- How "mission critical" is this information (i.e. traffic, accounting or on-air storage/playback)?
- Will information be routinely shared with a corporate office or other stations (i.e. e-mail, financial data, audio/video, telephone)?

Once this exercise has been completed, you should have an excellent idea of your present situation. Then you can create a needs analysis that will form the basis of your computer integration plans. Assuming you have the approvals to implement your plan, let's plan the system.

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The infrastructure

Although most stations have at least some PC-based network in place, let's assume you are designing/rebuilding a facility that has only minimal PC-based resources available. The first step is to design a network infrastructure. The infrastructure is fundamentally defined by your choice of networking protocols; however, in "real world" terms, the infrastructure determines the type of physical hardware and cabling you will ultimately need to purchase, install and configure. The type of data and the speed at which it passes through your network will ultimately determine this choice.

Network operating systems

You will need to determine the network operating system(s) necessary to operate the applications. There are two types of networks: peer-to-peer and dedicated server. Peer-to-peer networks consist of two or more computers connected together over a network. In a properly configured peer-to-peer, each computer will be able to share the files and resources of another computer that is also connected to the network. Dedicated server type networks use one or more computers dedicated to handling specific tasks, like hosting the network operating system, storing files or communicating with other resources.

Operating systems like as Lantastic, Windows for Workgroups and Windows 95 can be configured to operate as peer-to-peer networks. As peer-to-peer networks are easy to manage, relatively low in cost, or already included in your existing operating system, you should consider them for workgroups of about six users or less. Dedicated server network operating systems are more expensive, typically priced by the total users needing to access the network at once. Dedicated systems offer increased speed, flexibility, redundancy and — perhaps most importantly — security. Novell and Windows NT servers are the two most popular dedicated network operating systems. Your choice in some cases will be determined by your specific application (i.e. a digital audio storage system), though it is not unusual to use more than one server implementing different operating systems.

How many servers?

Another important consideration in designing the network is how you will deal with different departmental needs within the scope of your integration project. Of course, one approach is using a single server on your network. In most cases this will give you what is needed in terms of having the appropriate information available to the various users in the facility. A better approach is to add a file server for each key business function — traffic, business, programming, promotion and/or technical. A well-designed multiple-server approach has some benefits. First, an essentially separate Ethernet network can be established for separate departments, eliminating poten-

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tial crashes that will take down the entire network. Second, an enhanced level of security can be attained by denying total access to critical servers on the network. Third, data traffic on the network "backbone" can be decreased by routing only data that is intended for another server. This nets a huge increase in total network throughput, particularly important if your network carries streaming data that can tie up network traffic.

Networking data communications primer

Data that is intended to be transmitted over a network is broken into "packets." These packets are packaged between several bytes of new data called the *header*. The header contains information about the routing of each packet of data in order for it to be passed to the appropriate destination. There are generally two types of network protocols, Ethernet and token-passing.

Ethernet networks are by far the most popular and will most likely end up as your choice; however, you could have both Ethernet and token-passing networks working together.

How much speed

You will need to determine the speed at which your network will operate. While 10Mb/s was the popular choice for Ethernet networks in the past, standards now exist for 100Mb/s. In fact, a new standard called *Gigabit Ethernet* is emerging that will operate at one gigabit per second. Chances are you won't be building a Gigabit Ethernet network, but the effect of its introduction is that the price of 100Mb/s network hardware is falling.

Cabling issues

Most currently designed Ethernet networks operate over a cable made up of four individually twisted pair wires. Also called *category five* or CAT 5 cable, these are tested and certified to pass data at speeds of at least 10Mb/s at distances of up to 328 feet. There are new specifications called *extended category five*, which allow data speeds beyond 100Mb/s up to Gigabit Ethernet. The point here is to purchase cabling that is rated for as much data bandwidth as possible. Token passing networks require two signal paths: signal in and signal out. For this reason, either a special coaxial cable using two inner conductors — called *Twinax* — or dual fiber optic media are used. In any case, you need to exercise care in deploying the cables, as there are total length limits for runs of cables that depend on the network topology selected.

Next month, we'll expand on these points and expand our efforts by discussing the options available for connecting your facility to the outside world.

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

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Coping with Moore's Law

By Skip Pizzi, editor-in-chief

As radio's operations migrate to computer-based systems, one of management's greatest challenges comes from the relatively fast capital-equipment replacement cycles common to the PC environment. Moore's Law tells us that CPUs double in capability about every 18 months, and many leading-edge users replace or upgrade their hardware after every one or two of these cycles.

Broadcast facilities are certainly not used to replacing any equipment with such frequency, so some compromises are clearly required. What follows are a few tips and techniques for broadcasters in dealing with this dilemma.

Separating audio from administration

The ultimate goal of a computer-based radio station is complete integration of the administrative and the audio operations on a common computer-based system. But hardware replacement/upgrade cycles may not necessarily be in complete synchrony across the business and production processes. There may be times when administrative platforms require upgrades but audio operations remain adequate, or vice versa.

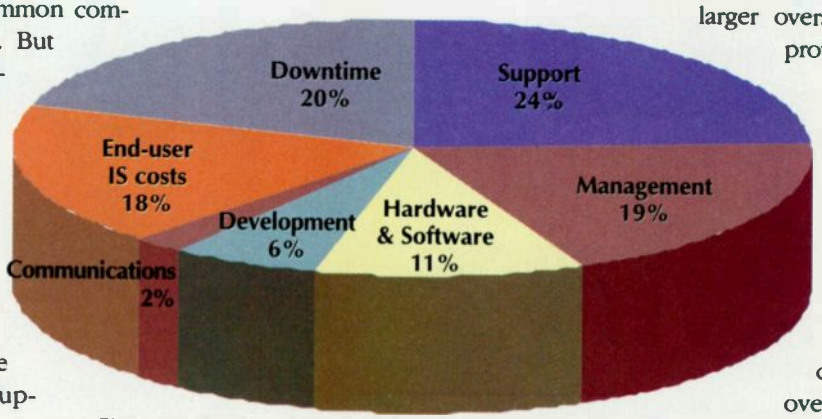

Figure 1. Total cost of operations (TCO) analysis for Windows-based systems, as reported in a recent study. Note that only 11% of costs come from hardware and software purchases. (Source: Interpose, Inc., and Microsoft Corp.)

High-quality audio operations are far more CPU-intensive than most corporate operations. Keep these replacement-cycle distinctions in mind as you establish capital equipment budgets.

Viewing the big picture

While capital purchases may happen at a greater-than-traditional rate in the computer-based radio facility, the average cost of each item is less. In the past, a major hardware upgrade for a production studio could easily run into the high five figures, but it was rarely performed more than once or twice a decade.

So although hardware purchases will happen more frequently, the total capital dollars spent across that hypothetical decade (for a well-designed system) will probably not differ substantially from past practice. The processing power increase that comes from each computer-based upgrade will likely be greater than with traditional systems, as well, resulting in a higher "dB-per-dollar" ratio (the mythical term used by some engineers to impute the performance value of a particular purchase).

The distributed nature of work that computer-based audio allows also factors into cost-effectiveness, both positively and negatively. More spaces can be productive, so "parallel" production can take place (as opposed to the "serial" queuing up for studio time in a single production room). But this may require more expensive environmental treatment in a greater number of rooms or a larger overall area. These improvements include quieter air-conditioning and cleaner/more reliable power throughout the facility. Nevertheless, such infrastructure costs are generally one-time expenses, and can be amortized over the long term.

Another big-picture issue involves maintenance costs. Moving to computer-based operations probably won't save you much in maintenance staff costs. Your mileage may vary, but it's likely that you'll probably just be trading expertise in audio engineering for expertise in computer maintenance, so it will probably be a wash. (Ideally, you'll keep some of each.) Unfortunately, Moore's Law does *not* apply to support personnel. If anything, the same support levels cost *more* rather than less over time. Good computer support staff are highly prized, and hanging on to your best people can get rather expensive. The more they know, the more valuable they become — to you and to everyone else looking for competent support staff. Like almost everything else in broadcasting, human resources

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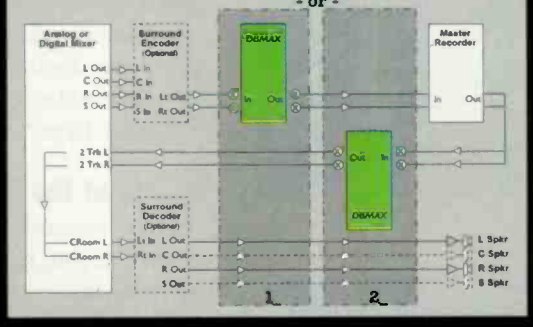

TV or Radio Production & Transmission Emulation

Example of production for DAB, Digital TV and FM

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2) TX Emulation: DBMAX inserted post-master for transmission emulation

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are the most pivotal elements in any operation's success, and you get what you pay for.

One area where the change *will* have a positive impact is in your spare parts stock, however. Converting to computer operations should result in a significant net reduction for this line item.

Platform trickle-down

As your conversion progresses, you'll identify operational areas where higher-performance computer hardware is the most beneficial. These are the places where the best new computers should go first. Any older hardware being replaced can then "trickle down" to the next most needy area, and the computers replaced *there* can in turn be ceded to the next most critical operation, and so on. Computers replaced at the bottom of the food chain can be donated to a needy cause or sold on the used market.

This allows several (if not all) departments to benefit when only a few new high-end machines are purchased. Each affected group takes a step forward in computing power even though the company only purchases new hardware for the most CPU-intensive applications.

Of course, there is a downside to this process. Every workstation receiving a new or trickled-down platform must be reconfigured for its new use and user, incurring labor costs and user downtime. This trauma is likely to continue to some extent for the first week or two after the new platform is up and running, as well, which can cause a substantial ripple in productivity throughout the operation.

The trickle-down process also implies that the only new purchases made will be high-end products, which are still relatively expensive. But, if these platforms truly do make their way through the facility, you'll maximize value over the life of the hardware.

Perhaps the toughest part of the trickle-down process is the judgment required in deciding when it's time to make an upgrade, who inherits what down the line, and when it's time to send an older item to the big legacy-LAN in the sky. Having some hard depreciation rules for computer equipment can help here, but again be careful not to force administrative computing rules on audio production equipment.

CPU vs. peripheral processing

Another helpful strategy has been adopted by some computer-based audio manufacturers. It offloads more of the audio-specific operations from the platform's CPU to peripheral hardware (i.e., plug-in cards supplied by the vendor). This can extend the platform's useful lifespan because it only needs to be fast enough to serve as an effective host for the peripheral. The peripheral can be upgraded independently (replacing relatively inexpensive hardware or firmware) while keeping the same PC in place.

Eventually, however, the peripheral hardware will outgrow its host computer (in terms of bus speed or interface requirements, for example), so this probably will only buy you one or two extra "Moore cycles."

Of course, if taken to its logical extreme, this concept may be self-defeating. The more you move away from the general-purpose platform for your audio-specific operations, the less economy of scale you gain from computer-based operations, which was the original point (wasn't it?). The pendulum could eventually swing to a place where computer-based vendors are selling the virtues of "dedicated audio hardware appliances." What a concept.

It's unlikely that this will occur, however, if only because CPUs continue to excel at a fast enough rate. The fact that PCs are now chasing full-motion *video* operation means that radio's need for audio-only processes should remain well within the capabilities of native hardware. New bus standards and related advances will also help (see "The Last Byte," p. 80, and "The Last Byte," March, 1998).

The tip of the iceberg

Finally, remember that as much as computer users are concerned with hardware replacement costs, most of the expenses in computer operation come from other quarters (see Figure 1). Keeping the platforms current can actually *reduce* costs in the other more influential areas of support costs and user downtime.

It will take some getting used to by broadcasters, but the computer cost beast *can* be tamed. In the end, computer-based broadcast operations are likely to become far more cost effective than traditional systems.

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Tube life

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

It is amazing how many engineers are scared by the word "tube." In at least two cases where I was trying to find an engineer, mention of the fact that the transmitter contained tubes in the final was enough to elicit "no thanks" from people whom I considered to be good candidates. I'm sure that there are just as many old timers who are as dubious of specks of contaminated rare metals mounted on bits of plastic with strange names.

Modern power tubes

Final tubes can easily cost many thousands of dollars. Some transmitters still use tubes costing around $90 for a 250-watt power tube. In these days of tight operating budgets, it behooves the chief to keep his tube usage low and get every possible electron out of every tube.

Over the years, tube design has improved and changed in appearance. The tubes shown in Figure 1 are simply seated firmly with a downward force and contact is made with *fingerstock,* or inserted and twisted to make contact. Others have separate filament leads emerging which are clamped to the filament supply, like the 3CX10000H3.

Figure 1. Good electrical contact is important for getting the most life from a tube. Pictured here are the 4CX15000A (left) and the 5CX1500B (right).

Some of the trouble experienced is due to mechanical faults caused by careless tube insertion. Over time, the fingerstock becomes brittle, especially through heat developed locally by dirty or faulty contacts. Before installing a tube, be sure the socket is clear of debris. Bits of broken fingerstock can not only result in intermittent contacts, but they can also produce shorts in the socket itself, with subsequent burning of the socket and burnt tube contacts.

Large areas of missing contact fingers can result in instability, incorrect or unstable tuning, and early tube failure. Most sockets of this type can be repaired. If a socket has more than about 20% stock missing, replace it. If there is a tension spring around the fingers, check to see if it is in good condition and also replace it if necessary.

When replacing a tube, note if there are signs of burning or scorching anywhere, and act accordingly. Look at the scratch marks made by the socket contacts on the old tube. One way to check for correct insertion is to insert the new one firmly in place, then carefully take it out and look at the scratches on the new tube rings. They should be at about the same place as on the old tube.

Never write on ceramic tubes. Even placing tape on glass tubes for record keeping is not a good idea. Any residue on the tube body can cause problems with arcing or deterioration of the ceramic.

Tube gassing

Before manufacturers achieved today's reliability, it was the practice to place spare tubes into service regularly to prevent shelf gassing. This is not necessary today. In fact, it is frowned on by tube builders because it increases the risk of breaking the tube or the socket.

An exception to this rule is glass envelope tubes. The glass is not porous, but the Kovar alloy that seals the glass and metal can allow very slow gas leakage. Because Kovar can rust, such tubes should be kept in sealed plastic bags and rotated in the transmitter every twelve months.

Although tubes rely on heat for proper operation, heat is also an enemy. Squirrel cage blowers can collect quite a lot of dirt on their blades. This will drastically reduce air flow and cause overheating. Cooling fins on tubes must also be checked for similar plugging up by insects and dirt.

Altitude should not be overlooked. Thinner air on mountain tops gives less cooling effect for the same volume at sea level. It is a good idea to use a thermometer to check for operating temperatures that meet tube designer specs. Lower air dielectric values at altitude may also result in external arcing.

Placing into service

After checking the tube for mechanical defects it is best to make a VOM test for filament continuity and freedom from internal electrode shorts with the tube on its side to detect any electrode sag.

Initial and continued filament voltage has the greatest effect on tube life. Don't rely on the transmitter manufac-

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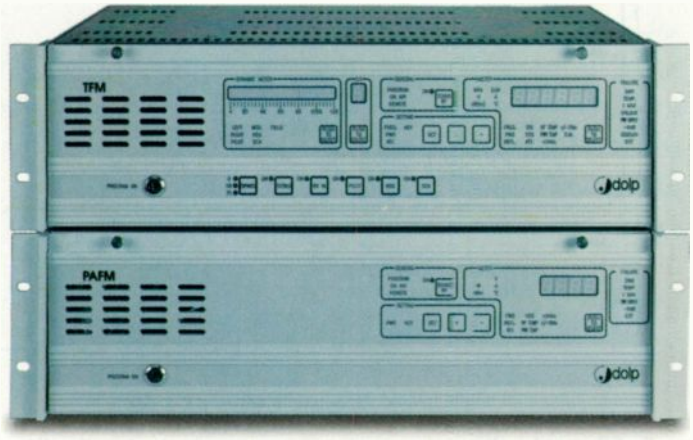

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turer's metering. Verify the meter's accuracy with a calibrated VOM connected directly to the actual tube terminals. Voltage drop in the filament leads from the transformer is often greater than realized and transformer terminal voltages are not the same as tube filament terminal voltages.

Filament voltage management

After installing a new tube, run it at rated filament voltage for about 150 hours. Be sure the transmitter is tuned to peak operation, and then adjust the filament voltage for optimum life.

Slowly reduce the filament voltage until you see a decrease in output, then raise the voltage very slowly by one or two tenths of a volt until normal operation has resumed. You have discovered the emission limited voltage. By running slightly above this point, the life of the tube may be increased up to 50% longer than a tube running continuously at its rated voltage. Figure 2 shows the effect of precise voltage control.

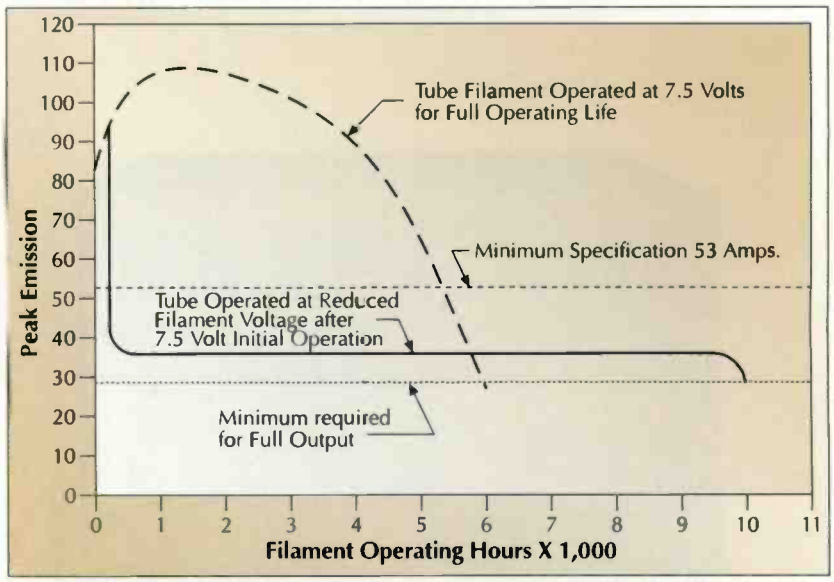

Figure 2. Filament voltage management can nearly double the life of a tube. (Courtesy of Econco.)

If a tube thus calibrated is removed for any reason and then replaced, it is only necessary to run at rated voltage to retune the transmitter; then go back to its original calibrated operating voltage.

Problems

Tube problems fall into two groups: mechanical and performance. Mechanical includes catastrophic failures in which tube elements short to each other or to adjacent chassis components. Occasionally an envelope will puncture, allow air to enter, and produce internal arcing or filament burn-up.

Sometimes intermittent internal shorts occur when the grid or filament warps and touches another element due to heating. This type of fault can clear and not show up on a VOM when the tube cools.

When output can't be obtained with normal operating voltages and other things look normal, consider low emission. This kind of fault is very seldom sudden. It seems to happen slowly, then one day you find there just isn't full power.

If raising filament voltage a few tenths of a volt returns output to normal it is a sign that the emission is beginning to fall off slowly. Increasing voltage to rating or a few tenths of a volt lighter can be done while new tubes are obtained. This is OK for a short time, but there is a risk of mesh or spiral filaments shorting.

Several companies offer tube rebuilding services, and most duds can be repaired. Some of the material in this article can be found in Econco's handbook, *Tube Topics*, available free from Econco.

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DAB Update

By Chriss Scherer, editor

At NAB98 there was a lot of talk about the status of domestic and international DAB. As you may already know, most other countries are working on or implementing DAB systems using the Eureka 147 format in the L-band frequency range. Right across our northern border, DAB on-air broadcasts have begun from Toronto and are scheduled to begin soon in Montreal and Vancouver.

In the U.S., there are two areas of development: Satellite delivered (S-band) and In-Band, On-Channel (IBOC).

Satellite development, commonly referred to as Satellite Digital Audio Radio Service (S-DARS) is moving ahead after the FCC auctioned two licenses last April. Both of the license awardees (CD Radio and American Mobile Radio Corporation) have been fairly quiet so far, but are on similar time schedules — at least within a few months of each other. CD Radio began constructing three satellites last year — two for launch and one as a back-up. The satellites will be launched later this year — one in August and one in October. They will assume orbital positions at 80°W and 110°W.

Meanwhile, AMRC is "on target" for a complete system rollout in 2000. They too will be launching two satellites soon. With two separate services available, the question of receiver hardware requirements becomes a consideration. CD Radio and AMRC have held discussions over this issue and are making efforts to have a single receiver capable of receiving either system.

The Digital Radio Express prototype receiver board measures six by eight inches.

The IBOC story

Broadcasters in the U.S. showed an interest in creating an IBOC system, thereby using existing spectrum instead of finding a new frequency band in which to operate. This would allow current licensees to retain their spectrum allocations and broadcast a digital signal. Another consideration is the unavailability of L-band spectrum in the U.S. for Eureka systems.

After several proposals for new band or In-Band, Adjacent-Channel (IBAC) systems were tested, many of their proponents either abandoned their efforts or joined together on the IBOC ideas.

USA Digital Radio (USADR), thought of as a sort of grand alliance for IBOC, is currently planning lab tests of its AM and FM systems and is talking about some field tests in the Baltimore/Washington D.C. area. Until recently, all the active IBOC work was being done by USADR, a joint effort of Westinghouse Wireless, CBS, Gannett and Lucent Technologies. USADR participated in the initial lab tests conducted by the NRSC, but those tests were conducted before the alliance with Lucent Technologies.

A new IBOC voice

Digital Radio Express (DRE), a California-based company, has entered the IBOC arena with its own IBOC system proposal. While USA Digital Radio has been working on an IBOC system for most of this decade, DRE has been working behind closed doors for only about two years while determining if its system would be a viable one. Apparently, they feel it is.

In February of this year, DRE held a demonstration for the NRSC DAB subcommittee to begin the process of raising awareness of its system. Following these demonstrations, the DAB subcommittee was reactivated to take a further look at the IBOC systems.

One of the design goals for the DRE system is that it be integrated in physical size. The company didn't feel that a large system occupying several racks of equipment was the proper place to begin testing. By working on a system that is a practical size to begin with, the hope is that final

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development and production of hardware will be simpler and quicker if the system is adopted as a standard. The idea is to take a small printed circuit board and convert it into a chipset — as opposed to reducing a rack full of gear into a chip.

The demonstration system currently in use occupies a few rack spaces for the transmission side, with the receiver prototype mounted on a single printed circuit board measuring about six by eight inches. This compares favorably to some of the early receiver models that occupied racks of equipment.

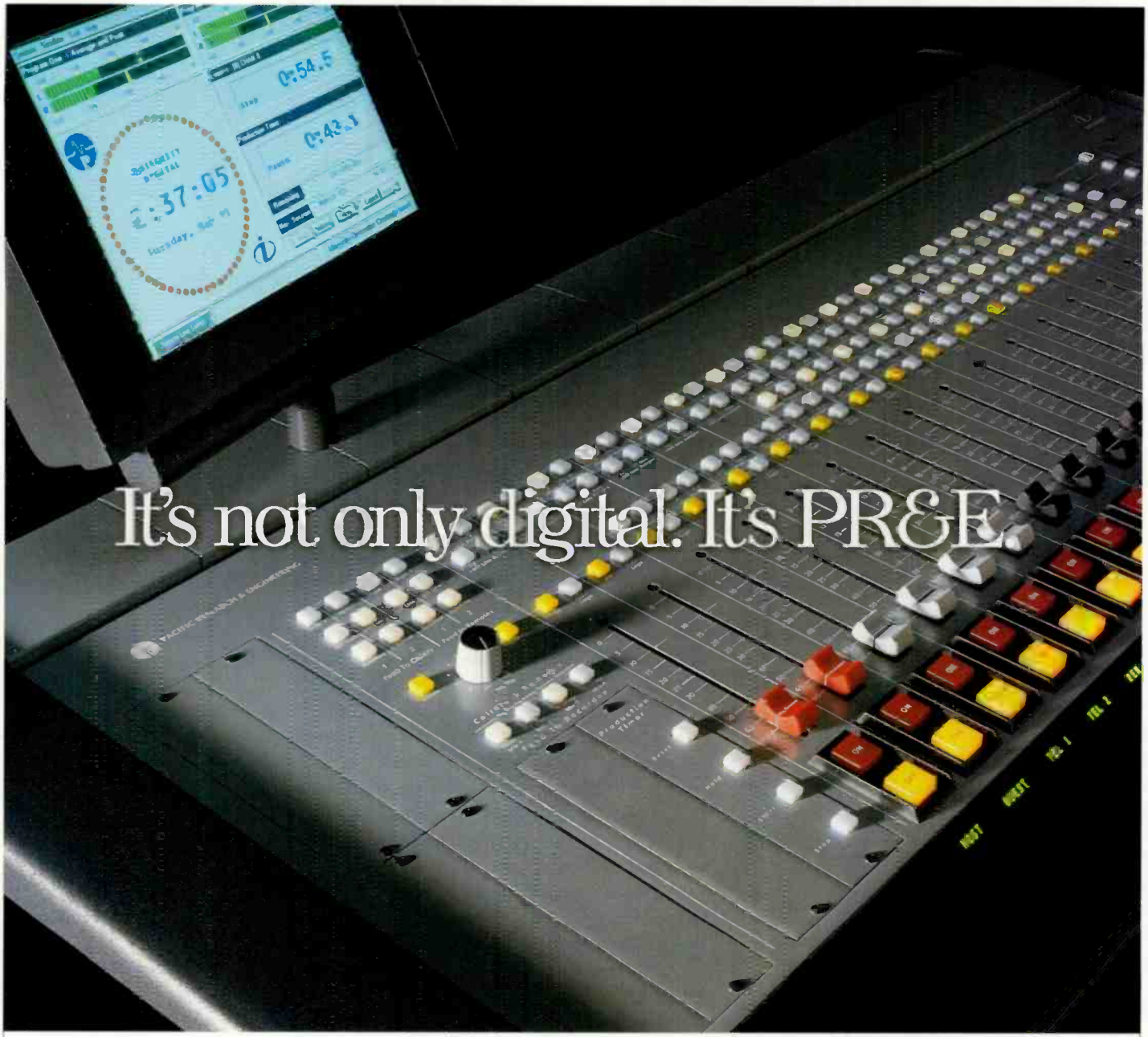
What do you think?

Take the *BE Radio* online survey on DAB. Turn your browser to **www.beradio.com** and speak your voice. The results of the April survey will be printed in the May/June issue of *BE Radio*.

Technical details

The DRE system was designed under the direction of Derek Kumar, vice president of engineering for DRE. Kumar previously worked for Electronic Decisions, Inc. (EDI), which had been subcontracted by USADR. USADR later purchased the intellectual property of EDI and then abandoned the system Kumar designed.

Information on the workings of the DRE system state that it uses a trellis-coded multiple-carrier modulation with time and frequency diversity, fault-tolerant multipath equalization, fully independent and redundant sideband processing, hierarchical forward and error protection, and advanced post-detection diversity combining. With data rates up to 128kb/s for FM, DRE plans to apply the same principles to an AM system with data rates of up to 48kb/s. Because of the proprietary nature of the systems being used, some of the explicit details are not yet being made available.



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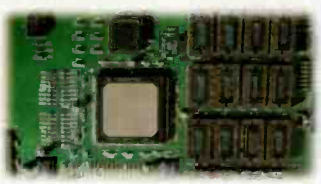

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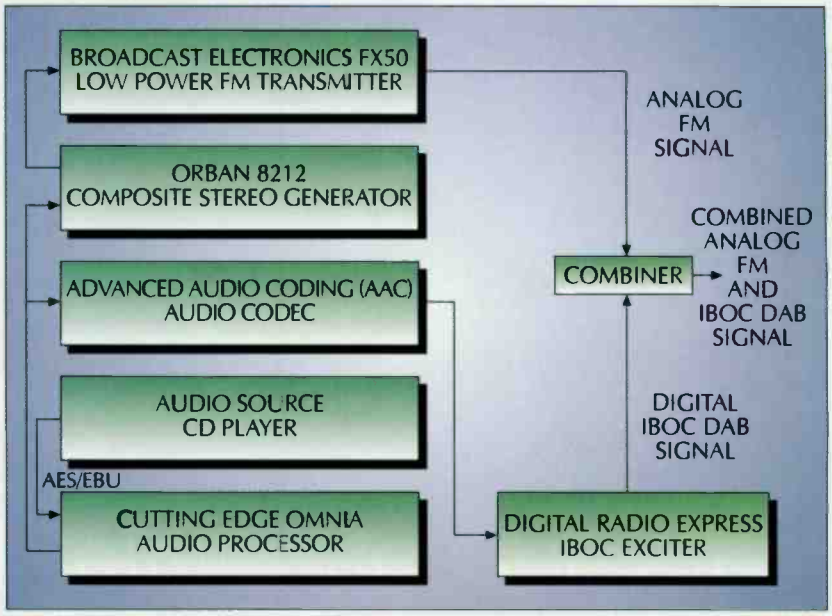

Figure 1. The DRE hybrid analog/digital transmission system being demonstrated.

In addition to the main channel, DRE also expects to be able to transmit subcarrier data, with capacities up to 64kb/s.

DRE has conducted demonstrations of their FM system with the setup shown in Figure 1. The demonstrations conducted up to now used a Layer III codec, but they have since switched to a newer encoding algorithm called Advanced Audio Coding, or AAC. AAC was the algorithm used in the demonstrations at NAB98.

To implement an IBOC system, the RF power amp must be linear in its function. DRE believes that most modern transmitters would be able to accommodate the digital stream with only minor modifications, saving broadcasters from having to buy a completely new transmitter. On the receiver side, the hybrid analog/digital system also allows a transition period for the consumer. Most analog receivers should have filters narrow enough to remove the digital data in the sidebands without any audible effects.

The schedule for DRE involves continued demonstrations of their FM systems now, with field tests commencing in the second quarter of 1998. DRE has already been in contact with a station in the San Francisco area to conduct the on-air tests. The station's identity will be announced later, pending the final agreements and arrangements. DRE plans to demonstrate an AM system in the third quarter of 1998.

DRE has also formed alliances with TriTech Microelectronics and Telos Systems. TriTech, a subsidiary of Singapore Technologies Semiconductors, is based in Singapore, with offices in the U.S., U.K., Taiwan, Korea and Japan. TriTech will convert the DRE receiver design into an IBOC chipset. TriTech is also a major investor in DRE and is its technology licensing partner.

Telos, already known for its work in audio transmission and digital encoding, has agreed to manufacture the encoding and transmission hardware if the DRE system is adopted.

DAB in the U.S. is moving along. Both the S-DARS and IBOC proponents are looking at the year 2000 as their service launch dates. At this point, the S-DARS systems should be running before an IBOC standard is decided upon. The progress continues, albeit slowly.

Related websites

- TriTech Microelectronics
  www.tritechmicro.com
- Telos Systems
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FCC Update

FCC considering microradio proposal

By Harry Martin

The FCC set April 27 as the comment date on a petition for rulemaking which proposes the establishment and licensing of low power "microradio" stations. The petitioners, individuals living in Virginia and Connecticut, have proposed that the FCC dedicate one AM and one FM channel to the service and that the assigned frequencies be shared among licensed microradio stations that would each serve one or several square miles.

The petition has received at least tentative support from Commissioners Powell and Ness, and from Chairman Bill Kennard. Ness sees the establishment of a microradio service as a way to solve the problem of pirate broadcasting, while Powell and Kennard view the proposal as affording opportunities for diversity, particularly in the establishment of community-oriented and minority-owned facilities. (The consolidation of the radio industry since the passage of the Telecommunications Act of 1996 has limited opportunities for the development of locally oriented outlets.) Broadcasters and the NAB have strongly opposed microradio, citing not only clutter, but technical interference and economic competition.

After comments on the pending petition are reviewed, the Commission will decide whether to propose rules which would institutionalize the microradio service, dedicate spectrum to it and establish application processing procedures. Should the matter develop into a rulemaking proceeding — which may be unlikely in light of the controversy the plan has already caused — existing radio stations will be given another opportunity to air their views.

Ads for casino gambling legal in more states

The U.S. Supreme Court has declined to overturn a ruling stating that the ban on advertisements for casino gambling and lotteries that are legal within a state is unconstitutional. The U.S. Court of Appeals for the Ninth Circuit last year found that banning gaming ads under these circumstances is a violation of commercial free speech. The Supreme Court has now declined to hear the appeal of the Ninth Circuit's ruling, thus allowing that ruling to stand.

Meanwhile, a U.S. District Court in New Jersey also has concluded that the prohibition on broadcasts of gambling ads is unconstitutional. Additionally, the plaintiffs in the New Jersey case, which include the National Association of Broadcasters and Players International, have filed a petition with the District Court there urging that the federal ban be eliminated nationwide. The U.S. Department of Justice has opposed this petition, and a decision remains pending.

However, a potential conflict among circuits is brewing. In New Orleans, the U.S. Court of Appeals for the Fifth Circuit has a pending case which addresses the same issue. In that case, the Greater New Orleans Broadcasters Association seeks to air ads for riverboat gambling which now is legal in New Orleans. The Fifth Circuit initially issued a decision against the broadcasters, but that decision was sent back to the Fifth Circuit in light of a landmark 1996 Supreme Court decision protecting commercial free speech. It remains to be seen how the Fifth Circuit will rule now that the Supreme Court has declined to hear the appeal of the Ninth Circuit case.

In the wake of the various court rulings, the FCC has announced that it will not enforce the rules against gambling advertisements in the nine Western states that make up the Ninth Circuit (California, Arizona, Nevada, Idaho, Oregon, Washington, Montana, Hawaii and Alaska) or in New Jersey. However, the court decisions do not affect any other states. The Commission's rules remain in full force in all states outside of the Ninth Circuit and New Jersey. Furthermore, the federal cases do not have any impact on state laws governing lottery and gaming ads. Those laws currently remain fully in effect.

A growing tide nonetheless appears to be developing against the advertising ban. The plaintiffs in the Fifth Circuit case are hopeful that the Supreme Court's decision not to hear the appeal of the Ninth Circuit case will encourage the Fifth Circuit to reverse its initial ruling and find in favor of the broadcasters.

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

dateline

Commercial radio stations in the following locations must file their annual ownership reports on or before June 1, 1998: District of Columbia, Maryland, Virginia, West Virginia, Michigan, Ohio, Arizona, Idaho, Nevada, New Mexico, Utah and Wyoming.

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Shared Knowledge

Technology • Trends • Tricks

By Skip Pizzi, editor-in-chief, and Chriss Scherer, editor

The conference sessions at NAB98 once again proved to be a valuable source of information.

The variety of information presented at the NAB conferences covers a myriad of topics. With areas of interest for management, sales, programming, production, promotions and engineering, there was something for everyone.

Many topics presented became the source of discussions — sometimes heated ones – later in the day and evening. Even with all the noise and activity of Las Vegas, people gather and discuss the days' activities, trading stories and opinions of industry technology, trends and tips.

Broadcast Engineering Conference

One of the more popular conferences at the NAB convention is the *Broadcast Engineering Conference*. This conference, co-sponsored by The Society of Broadcast Engineers and the NAB, presented a wide variety of topics that covered not only radio and traditional broadcast topics, but looked even further into some of the future technologies as well. As you can imagine, the Internet was explored, as were areas of datacasting, interactivity, tower space and more.

Cover the basics

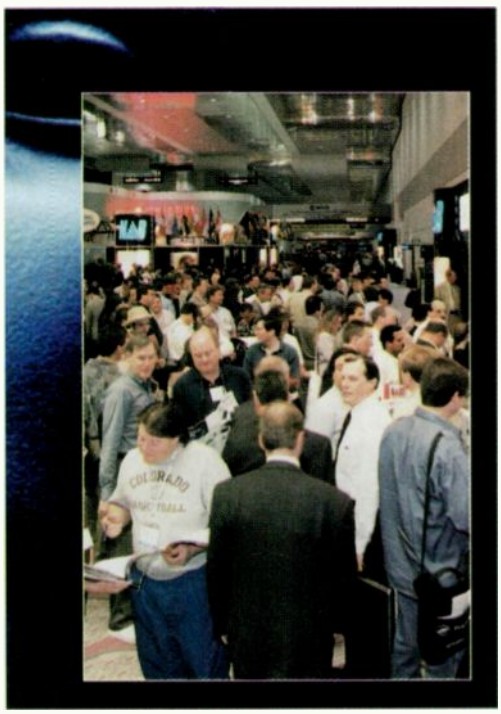
The first day of presentations started off with an overview of the basics: Radio Boot Camp. These presentations covered some of the nuts and bolts ideas often taken for granted, but which are the basic building blocks in any facility. It is important for newer engineers to take advantage of sessions like this to add a few tools to their belts, and even the most seasoned engineers sometimes overlook the basic principles of radio engineering. Many of us perform them every day without a second thought.

Consolidation is an oft-used term these days. It's full meaning is still being defined as proposed mergers come together and stations that were once fierce competitors transition into friendly neighbors. The role of the manager in these newly created positions continues to change — whether you are a station manager or engineering manager — and being successful in a multi-station facility requires you to look at the individual needs of the stations as well as the overall view of the facility. There are many ways to share common resources to reduce inventory or wasted manpower. Scheduling maintenance, hiring personnel, equipment compatibility, and integration and asset purchasing are just some of the areas that are affected by the changes of consolidation.

With these kinds of changes taking place, the return to basics approach of Radio Boot Camp revisited some standard topics of RF and audio that will never change, regardless of the terms being used to describe how the business operates.

Digital, digital, digital

It's no surprise that there were several sessions dealing with digital audio and radio in varying forms. While television is facing concerns of its own with the implementation of digital signals, radio is just starting to delve into it. Different parts of the globe are involved in various stages of DAB application or development. (See *Next Wave*, p. 24 for what is happening in the U.S.) The DAB session detailed progress on the various fronts.



Eureka 147 is being implemented around the world, and some satellite delivery systems are gearing up to go online. The expectations and obstacles of many of these technologies were discussed in the sessions and became a source for further discussions outside the show hours. The fact that the U.S. is not going to be part of the near-global Eureka standard alone triggered many conversations.

Further digital topics covered the application of fully digital air chains and broadcast paths. There are systems currently available that make this once fabled feat a reality. Computer-delivered audio and CDs feeding a digital console and audio router take care of the studio. Soon enough, the only analog devices in the control room could be the microphone and monitor speakers. A variety of digital STL options exist, and the installation of a digital exciter and audio processing completes the route. Taking these steps now can prepare your facility for the DAB plunge later.

Subcarriers are nothing new to broadcasting, but utilizing high-speed data transmissions is. The NRSC High-speed FM Subcarrier Subcommittee last year conducted tests on three systems, and reports on these tests and applications shed some light on new revenue sources for broadcasters.

Bits

Computers and the Internet continue to take on more importance in every aspect of the station operation, and the sessions covering these technologies were no exception.

As broadcast engineers add 'computer engineer' to their duties, managing the hardware, software and infrastructure of the computer network becomes a desirable skill. Developing cost-effective systems can be a confusing area, but the information provided at the *Computer Network* session helped quell concerns and gave attendees tools that they can use to smooth the facility operation.

Using the Internet in any business is becoming a common practice. Radio has some unique features that make it a natural alliance. With some 3000 stations already webcasting, establishing an Internet presence has become necessary to stay competitive.

NAB98 Shared Knowledge

With more emerging technologies on the way, the webcaster will enjoy even more possibilities.

The session on tower management brought up some interesting points, especially in the face of the DTV transition. Many FM stations are tenants on TV towers and may be facing some changes to their lease as modifications are made for the tower owner's upgrade. For tower owners, some new possibilities are being opened as well.

As always, the engineering sessions covered a wide range of topics that every broadcast engineer is involved with. The diversity of material showed clearly that today's broadcast engineer is required to be some thing of a jack-of-all-trades to keep a facility running at top performance.

Broadcasters' Law and Regulation Conference

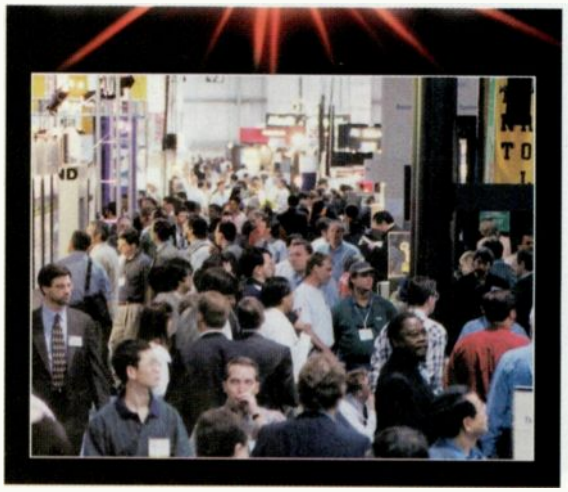
Staying up with the latest rules and regulations can be a full time job in itself sometimes. The *Law and Regulation Conference* was a chance to learn more about recent rulemakings and proposals and how they will affect station operation.

As consolidation becomes the standard for many, the need to fully understand its legal implications becomes important. While the consolidation process is underway, steps must be taken to ensure compliance with the rules. It's easy for things to slip between the cracks. Other points of concern are the antitrust issues that can pop up after a megamerger.

While many of these issues are inevitably handled by the station's lawyers and owners, the chief operator can also keep an eye out for some of the pitfalls that may arise. While antitrust concerns may be out of your hands, compliance with the rules certainly is not. By staying on top of things — keeping the records straight, verifying operating parameters, proper logging requirements — many problems can be avoided.

The session on avoiding FCC fines was helpful in shedding some light on problems commonly found by inspectors in the field. Although field inspections are becoming less common because of the FCC cutbacks, compliance with the rules is still a very important subject. Take advantage of someone else's misfortune — if they received a fine, make sure that you are not in the same situation. If you are, correct the problem before it costs you.

The station's chief operator is usually the chief engineer. Because of this, engineers are often called upon as the in-house rules expert. Last year, EAS was a hot topic for compliance. This year, the concerns were more varied, but the effects of consolidation, most notably the additional record keeping, were a concern for attendees.



A technical facilities upgrade is something that can be brought up from time to time. While the engineering sessions cover this topic from a nuts and bolts standpoint, the regulatory issues surrounding it make it almost a companion session for the station managers and owners. Changing the city of license, adding a booster, moving the studio or transmitter facilities (especially with consolidation), are all issues that were addressed during the managers' track.

The broadcast auxiliary services are constantly being congested with more and more traffic from stations. Some recent FCC petitions and actions threatened the spectrum with proposed uses by non-broadcast bodies. This topic raised just as many questions as it answered as we look ahead toward greater requirements for the auxiliary spectrum to support so many digital signals.

Internet issues were discussed everywhere, but with any emerging technology comes emerging legislation. One area of concern is webcasting. If music licensing fees are paid for radio airplay, what happens when you send your signals over the Internet? Many syndicated program providers already refuse to give affiliates permission to stream their show. Some of the other concerns deal with straight-forward online content. Posting graphics and links may be considered a convenience to your website visitor, but the owner of the other site may not want his product being brandished in an outside environment.

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of libel and defamation must be considered for any online content. Just like anything put out over the air, online content must also follow some set guidelines.

Pirate broadcasting was the topic of one session, and a major point of debate among attendees. It is difficult to know how many unlicensed operators there are in the U.S., but the problem continues to grow. The rules state that it is an illegal practice, but they continue to operate — sometimes under the nose of the FCC — without being shut down. Concern for a solution to the problem was evident among broadcasters. FCC petitions suggest that limits be set for micropower broadcasters. Meanwhile, broadcasters continue to oppose pirate operation and the proposed legislation altogether. This is an issue that will take some time to either be settled with legislation, or ended with the shutdown of these pirates.

NAB Multimedia World

The NAB's *MultiMedia World Conference* is well on its way to becoming a bona-fide "important" computer industry trade show. Situated in the same convention centers and falling chronologically between CES and COMDEX each year, it is establishing itself as the predominant show for the content-provider or "media" side of the computer business. Keynote and luncheon presenters read like a who's who of the computer industry.

This is a smart strategic move for NAB — and for the broadcast industry as a whole if it takes the hint from its trade association. Consider that broadcasters are among the kings of the content hill, and this content can serve *both* the "appliance" world of CES and the "platform" world of COMDEX — an enviable position. This is what convergence may be all about. While the consumer may never truly use a single multimedia device to access all media, the content provider can maximize the delivery potential of its media to have these assets hit as many receivers as possible.

The emergence of more media-capable PCs and other new wireless delivery technologies over the next two years almost guarantees considerable upheaval in the media production and distribution industry, in which broadcasters play a major role. For those who read between the lines, that message was spread throughout NAB98, but it was most overtly pre-

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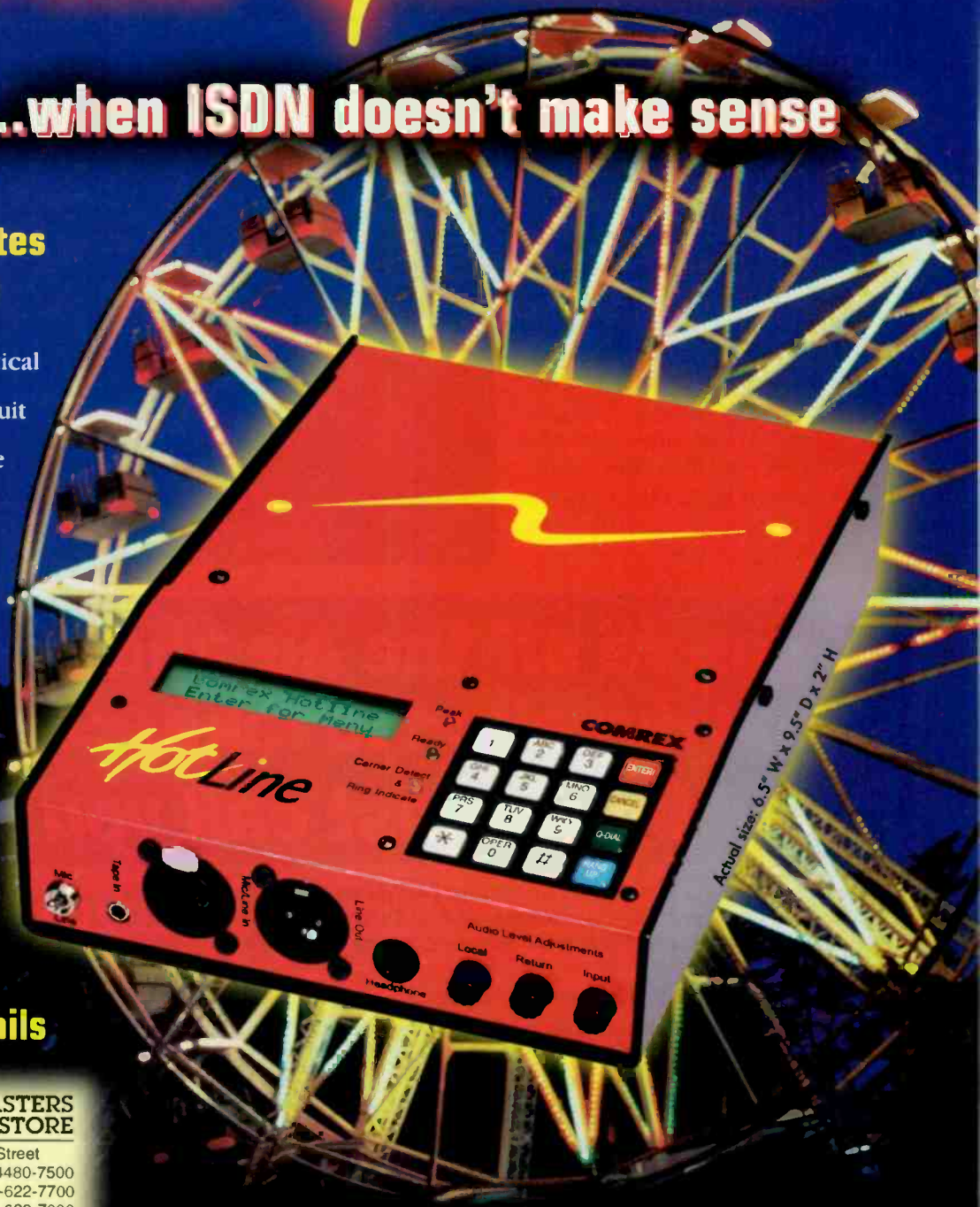

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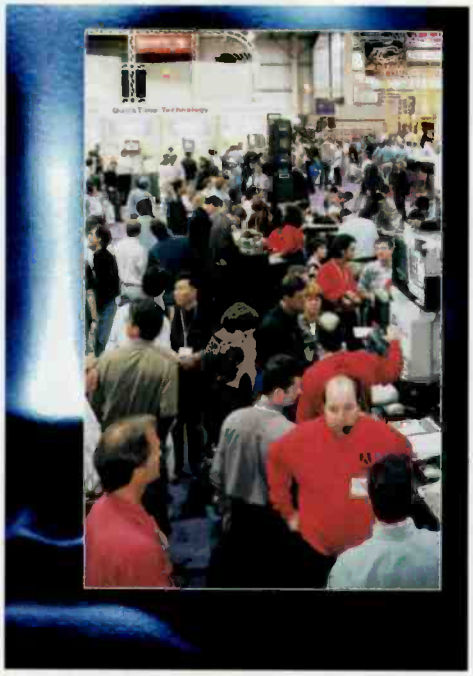
sented in the two NAB *MultiMedia World* tracks: the *Internet Technologies and Applications Conference* and the *New Media Professionals Conference*.

Sessions considered the Internet from a variety of angles, and presentations ranged from superficial to deeply detailed. Topics included legal and copyright issues on the Internet, programming and "branding" strategies, global expansion via the Internet and making on-line services profitable. Also on the program was an interesting technical trend that's completely nonexistent today, but which may become hugely important in the near future: Internet connectivity via low-earth orbit (LEO) satellites. The mobile nature of this technology makes it particularly important to radio broadcasters.

From a technical perspective, on-line radio presentations considered a range of issues from maximizing the impact of current website offerings to



considering near-future possibilities, including the incorporation of "e-commerce" for on-line purchasing from broadcasters' websites. A number of exemplary existing sites were visited "live" from the conference sessions and from booths on the exhibition floor.

This stimulated much discussion of how inappropriate the traditional broadcast business model may be for the on-line environment, and why development of a new and substantially different strategy may be in order. As you might expect, this kind of radical departure was not easily accepted. Making matters worse, while broadcasters made up a lot of the audiences, few were included among these sessions' presenters. This didn't make such a bitter pill any easier to swallow. Nevertheless, most broadcasters at *MultiMedia World* did seem to get the message that change is in the wind.

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NAB98 **Shared Knowledge**

NAB Communications and Connectivity

As NAB *MultiMedia World* considered the convergence of broadcasting and computing, NAB *Communications and Connectivity* looked at the more "traditional" linkage between telcos and broadcast. But most of the topics covered in this conference were anything but traditional.

This conference also included two tracks: the *Telecommunications Strategies Conference* (focusing on terrestrial connectivity) and *Uplink 98: Satellite Operators and Users Conference* (looking at satellite issues).

Subjects of technical interest considered interconnection techniques for station groups, the increasing value of fiber optics (both within and between facilities), the changing satellite-distribution environment and synergies between two-way wireless and broadcast technologies.

An international panel presented their views on what were the most important emerging global telecommunications issues, while other panels considered the specifics of high quality intra- and interfacility signal transport.

Crowds at the *Communications and Connectivity* sessions seemed a more staid and subdued lot than the rather mercurial group at *MultiMedia World*. Discussion was more practical and less speculative here, but still quite forward thinking.

Throughout NAB98, there seemed to be an overwhelming air of arrival and realness for many telecommunications services previously considered futuristic. The shifting of paradigms was almost palpable at the show. To the dismay of many radio broadcasters, however, the only issue that still seemed *not* to be getting any closer to reality was DAB.

Battison receives NAB engineering award

John Battison, *BE Radio*'s technical editor, RF, was chosen to receive the 1998 Radio Engineering Achievement award from the National Association of Broadcasters (NAB). Battison, a 52-year veteran of broadcast engineering, is one of the founders of the Society of Broadcast Engineers (SBE), and is a recognized authority on directional antennas. During his career he has served as director of engineering for the Telecommunications Department at Ohio State University, has taught at American University and New York University, and has presented papers at conferences all over the world. Since retiring, John has focused his energies toward his consulting business and his monthly column in *BE Radio*, RF Engineering.

"I'm absolutely thrilled," Battison says of the honor. "I just retired this year and this is about 1000dB better than getting a gold watch, that's for sure."

When asked to look back over his career and pick his proudest achievement, Battison says without a pause, "The formation of the SBE. That was probably the best."

The Award, presented annually to one TV and one radio engineer, was presented to John at the Technology Luncheon at NAB98 in Las Vegas on April 8.

We at *BE Radio* congratulate John on his well-deserved award and applaud the NAB for his recognition.

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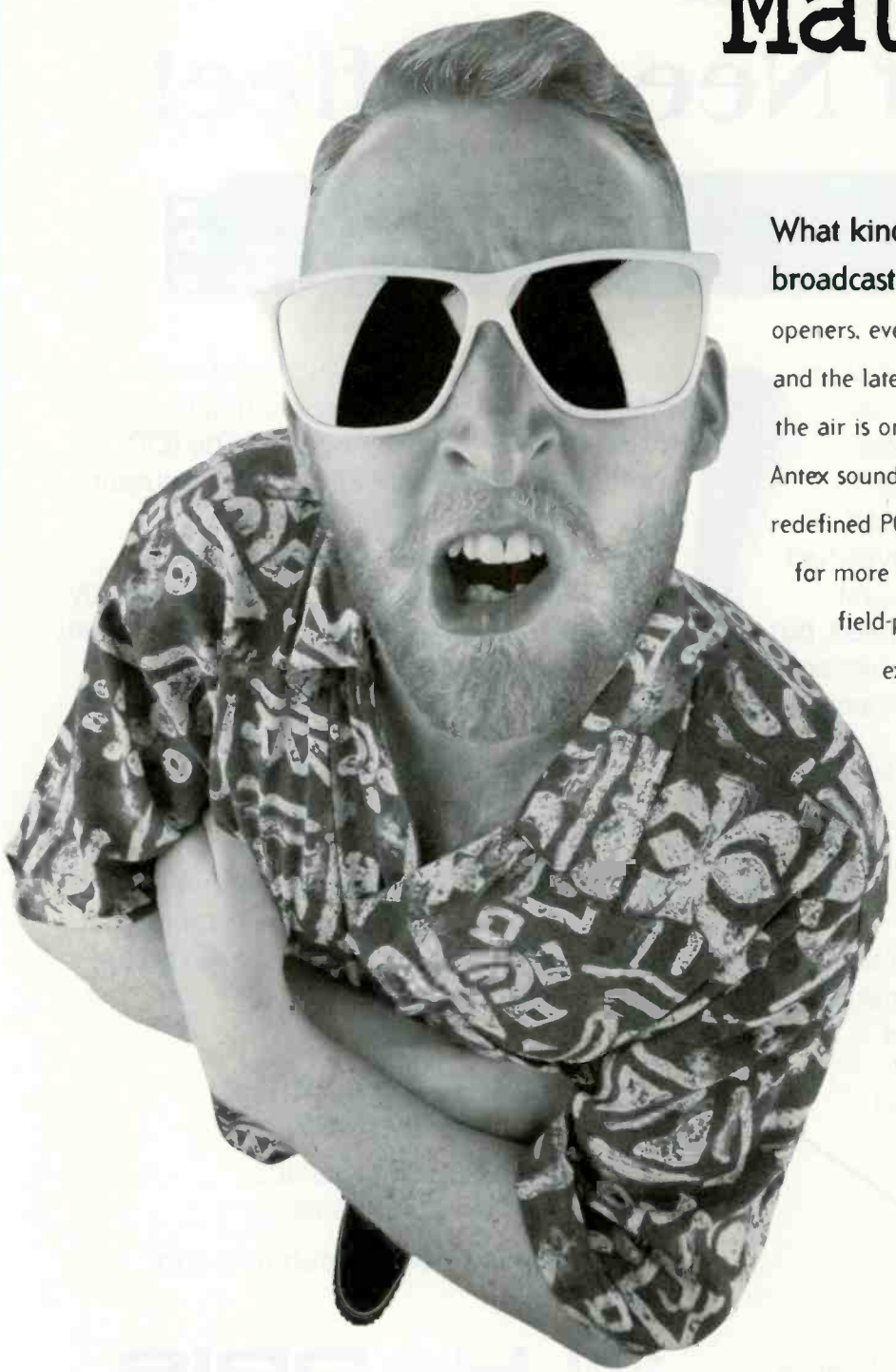

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Architectural Acoustics:

A primer for radio studios

By Richard Schrag

The basic elements of acoustical design become essential concepts when they apply to spaces where radio is made.

The technical spaces in a radio station have unique requirements for sound isolation, noise control and interior acoustics. (WBUR, Boston)

There are always hot topics in the world of radio engineering. Often they center around electronic technology, whether it be the latest digital console, the most clever use of RBDS, or the slickest new audio editing/storage system. But let's face it, they almost never have anything to do with the physical space that comprises the radio station.

As new technologies come and go, and sometimes radically change the way we do our work, radio studios — the rooms in which this work is created — have fundamentally invariant needs: audio program is generated (by musicians, people speaking, a CD player, a satellite feed or some other source) and one or more human beings manipulate an elaborate assemblage of electronic equipment in such a way that this signal can be transmitted (with any luck) to a listening audience. Basically, no matter what new toys you put into them, these rooms always work in more or less the same way.

Still, radio studios are unique spaces. In most kinds of architecture, the interior environment is constructed for a specific activity, and giving it a place to happen. Radio studios take it a step further in that the rooms themselves become part of that activity, an integral part of the broadcast signal.

Specialized construction components are required to provide adequate sound isolation between rooms (doors and windows), and appropriate interior acoustics (absorptive wall and ceiling finishes). (NPR, Washington, D.C.)

In radio, the room around you is just as much a tool as is a microphone, a console or a piece of processing equipment. Just as the quality of light in a painter's studio or a museum is crucial to creating or viewing a work of art, the quality of acoustics in a radio studio dramatically affects the capture and manipulation of an aural experience.

So even if the same old issues of architectural acoustics are sometimes overshadowed by much sexier current topics, it's still important to understand the basics. That way, at least you'll know what's involved in making sure you have a room that's sonically worthy to house that new digital audio workstation or the latest near-field speaker.

The big three

The subject of architectural acoustics is generally considered to cover three primary areas: sound isolation; noise and vibration control; and room acoustics.

Essentially, one involves keeping sound where it belongs, one involves getting rid of sound you don't want, and one involves making the sound you do want behave itself.

Sound isolation

The first concept has to do with making sure that sound energy from one activity doesn't disturb another activity. Every aspect of a room's construction — walls, ceiling, floor, doors, windows, ductwork, piping and many others — plays a part in determining how well that room is isolated from its surroundings.

Most of the time sound isolation is a matter of keeping out unwanted sound, be it people talking in the hall just outside the door or an airplane flying over on final approach. When a room must have a background noise level quiet enough to enable critical recording or listening, a whole host of noise sources (constant or transient, transmitted through the air or through the structure, originating from inside or outside the building) can potentially disturb those activities to the point that the room is unusable. At the same time, particularly in a radio studio where multiple rooms often operate simultaneously, the noise a room generates when it's working must be contained so that other nearby functions are similarly undisturbed.

While sound isolation properties are governed by rather well-behaved principles of acoustical phys-

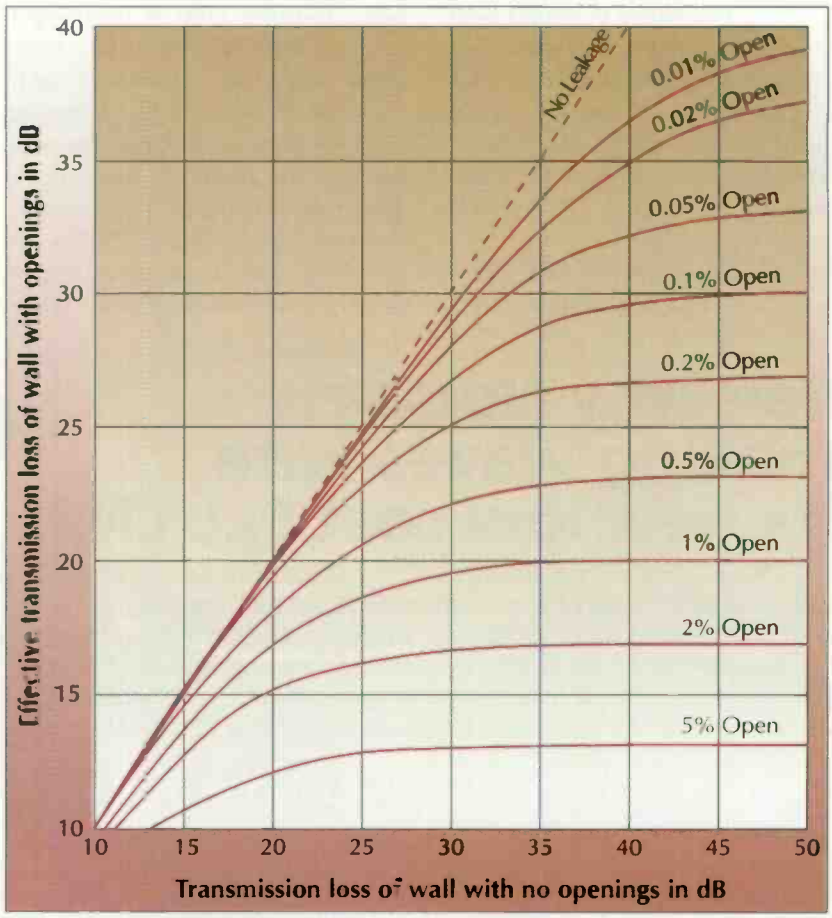

Figure 1. In sound isolation construction, every penetration is critical. Even minor leaks can significantly degrade acoustical performance.

Architectural Acoustics:

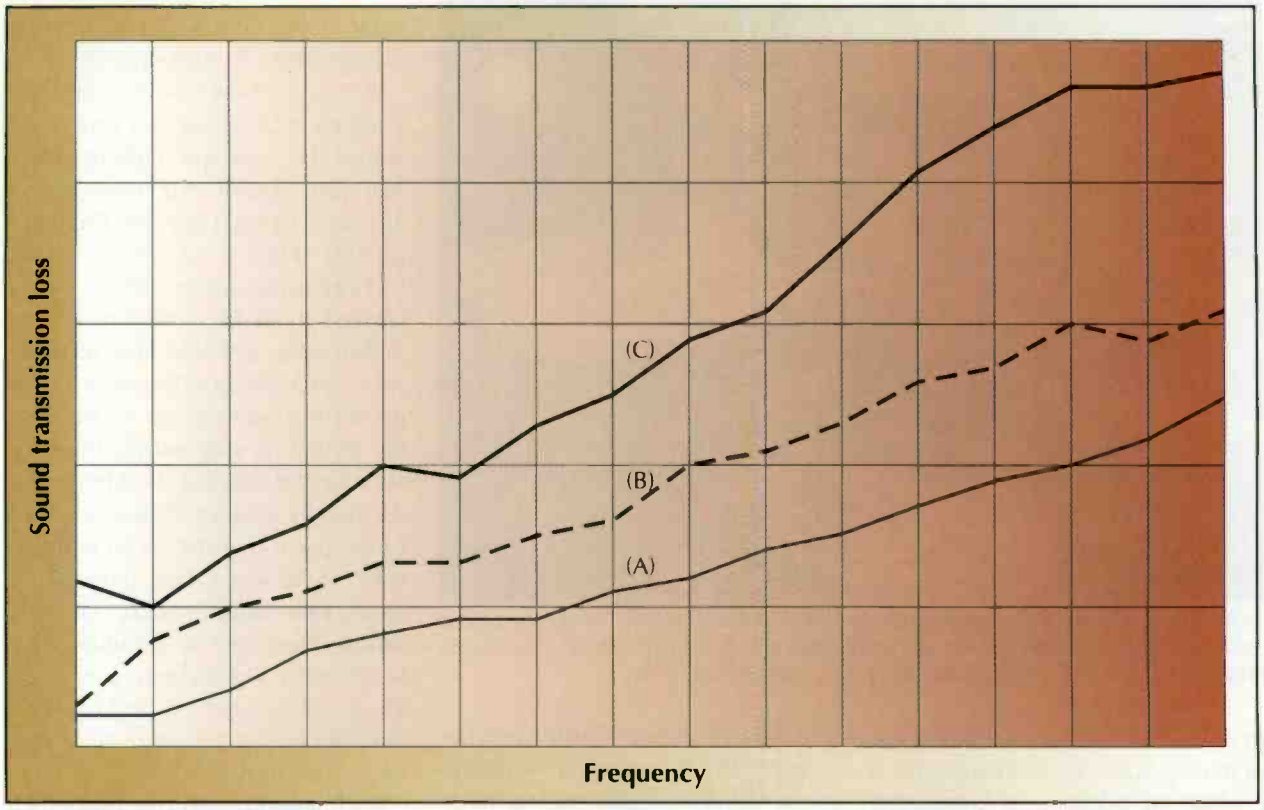

Figure 2. Adding airspace to a partition can improve sound transmission loss even more than doubling the surface weight. (a) 6" partition at 30lb/ft²; (b) 12" partition at 60lb/ft²; (c) 12" partition with an airspace between two 15lb/ft² layers.

ics (see "The basics of sound isolation," p. 50), the myriad paths sound can take in getting from one place to another makes this one of the most treacherous, but nonetheless crucial, aspects of broadcast studio design.

Noise and vibration control

Just as maintaining a high enough signal-to-noise ratio is paramount goal throughout the audio electronic chain, the acoustical environment for recording or listening must be quiet enough that the subtleties of the audio program can be clearly differentiated from the ambient background noise. While appropriate sound isolation measures keep out unwanted sound, noise and vibration control usually refers to managing the systems that are essential to the operation of the room or the facility, but which might cause a disturbance at the same time.

In many cases, the most prevalent source of noise and vibration is all too obvious: the heating, ventilating, and air conditioning (HVAC) sys-

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tems. Broadcast equipment creates extensive heat loads with stringent cooling requirements, so mechanical engineers dutifully design systems that can provide a high volume of air to keep the occupants and the equipment happy. All that air must be churned out by a fan, rushing through the ducts above the ceiling to where it blows out of the diffusers above our heads. Unless special precautions are taken, it is likely to create turbulence along the way, carrying with it the resulting rumble, roar, whistle or hiss. If they're going to be sufficiently quiet, HVAC systems must have airflow that is smooth, low-velocity and free from abrupt changes in direction or speed.

Another source of noise and vibration within acoustically sensitive radio spaces is the electronic equipment itself. With the proliferation of memory-intensive processing gear, there is a greater need than ever

The basics of sound isolation

The physics of sound isolation can be fairly complex, but they stem from a few fundamental principles. The following concepts refer to a simple partition, such as a wall between rooms, and can be extended to similar conditions such as roof/ceiling assemblies.

- **Mass:** Far and away the dominant parameter in stopping sound transmission through a partition is mass. Increase the mass and you will increase the amount of sound attenuation by the partition. For the most part, it doesn't much matter what materials you use (although stiffness and damping do play secondary roles), so an inch of concrete at 120lbs/ft^3 (10lbs/ft^2 total) is roughly equivalent to four layers of 5/8" drywall at 2.5lbs/ft^2 each.
- **Airspace:** With mass alone, transmission loss increases only six dB per doubling, so you quickly reach a point of diminishing returns. To achieve significantly better sound isolation properties, two layers with some separation between them is required. A mass-airspace-mass configuration is the most effective assembly for broadband attenuation. [See Figure 2] Additionally, sound absorption in the cavity assists in maximizing attenuation.
- **Decoupling:** The way in which the two faces of the partition are attached is critical to the overall sound transmission loss performance. If both are screwed to common metal stud framing, some of the incident sound will be transmitted directly through the supporting structure to the other side. Making the two sides independent from each other gives far superior results, since the intervening airspace is much less efficient than rigid metal at transferring sound energy to the opposite face.
- **Penetrations:** It is essential that a partition be completely sealed at all penetrations. Even a minor leak comprising 0.1% of the total surface area can reduce a transmission loss of 50dB wall by more than 20dB. [See Figure 1]
- **Flanking paths:** The best partition in the world can't provide adequate acoustical isolation if sound can travel through a common floor slab from one room to the next, if there is ductwork directly connecting them, or if the wall extends only six inches above the ceiling. All paths by which sound or vibration can travel from one space to another must be addressed to ensure that the desired overall performance is maintained.
- **Balance:** A partition is only as good as its weakest component, so there's no benefit to building a superior wall if there's a door or window in it that doesn't have an airtight seal. The sound isolation of a room depends on the combined performance of the walls, ceiling, floor, doors and windows, ductwork and all other building components, so each of them should be designed to contribute a comparable degree of sound isolation.

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GP-4	4	6,000W	3.4	$2,600
GP-5	5	6,000W	4.3	$3,150
GP-6	6	6,000W	5.5	$3,700

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SGP-3	3	10,000W	1.4	$3,595
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before to get the CPUs, hard drives, and most fan-cooled equipment out of the critical rooms.

While the HVAC systems and the broadcast equipment are an almost universal concern, other sources of noise and vibration shouldn't be overlooked. Transformers and other electrical switchgear can contribute significant structure-borne energy, and plumbing noise can be equally pervasive. Elevators, exhaust systems, and other building infrastructure equipment must be considered as well.

Room acoustics

The third basic aspect of architectural acoustics has to do with how sound behaves within an enclosed space. For a radio studio, we're interested in creating an appropriate acoustical environment for recording, evaluating, manipulating, or even listening to audio program.

As sound is generated by a "live" source or a monitor loudspeaker and subsequently bounces around the room at 1130 feet per second, each time the sound hits some surface within the room the energy will be to a greater or lesser degree reflected or absorbed, depending on the surface material and its orientation to the incident sound. Additionally, the portion that is reflected can be specular (that is, directed from the surface at an angle that mirrors the angle of incidence), diffuse (spread out in many different directions) or anything in between. Add to this the directivity of the source, air absorption, the fact that every parameter of acoustical behavior varies with frequency, and the geometrical implications of a three-dimensional space, and it's not hard to understand why the sound that eventually finds its way to a microphone or someone's ears is exceedingly complex. Nonetheless, by carefully selecting the amount and location of the room's construction materials and finishes, it's possible to give the room an acoustical character that is tailored to what goes on inside.

Nonetheless, by carefully selecting the amount and location of the room's construction materials and finishes, it's possible to give the room an acoustical character that is tailored to what goes on inside.

On the one hand, creating a good acoustical environment means avoiding specific types of problems, such as flutter echo (repeated reflections set up between opposite parallel planar surfaces), pronounced resonances, or frequency convolutions resulting from combinations of reflections. On the other hand, good acoustics means enhancing positive characteristics, such as the evenness of the frequency response, the

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uniformity of the spatial response, and the quality of the temporal response.

So, what's so special about radio?

So far, these acoustical fundamentals apply to any space — office, concert hall, or bus terminal. However, radio studios are an exceptional case. They contain several different kinds of spaces that each have exacting requirements in all areas of architectural acoustics.

Terminology is far from standard in this industry. For one station the term "studio" might refer to the entire physical plant; for another it might mean the room with a console and an operator; and for a third it's any space that has live microphones and voice talent or musicians. We'll employ the latter definition here, recognizing that these are the rooms with arguably the most stringent acoustical demands of any in a broadcast facility.

- **Studios:** Spaces with live microphones naturally require excellent sound isolation and noise/vibration control, especially when the source is distant from the microphone or has wide dynamic range.

In addition, studios demand an interior acoustical environment that is well suited to the type of sound to be recorded or broadcast. For music, this ranges from a performance with mostly MIDI and direct instruments to one with multiple acoustic instruments or singers. For voice, a news broadcast or call-in show with a single host is quite different from a talk show with multiple hosts and guests. For both musical and voice applications, the need for low background noise levels and proper room acoustics becomes more critical as the number of sources and/or live microphones increases.

As you add stereo requirements, then surround, then additional persons (a director or producer) who need to hear an accurate representation of the broadcast signal, the configuration of this room becomes a significant acoustical challenge.

- **Control Rooms:** Acoustically, a control room is primarily a space for monitoring audio program for broadcast. At its simplest, this involves a single operator with control surfaces and audio monitoring equipment. However, as you add stereo requirements, then surround, then additional persons (a director or producer) who need to hear an accurate representation of the broadcast signal, the configuration of this room becomes a significant acoustical challenge. (See "Perils of the monitoring environment," p. 56.)

Beyond that, control room activities may entail live microphones for combo-style operation, interviews or even musical performance. If so, the noise levels and room acoustics may be just

as critical as in a studio, except that in the control room you've also got to contend with the equipment: its physical size, acoustically reflective surfaces, and the noise it creates.

• **Production and editing rooms:** Production rooms are similar to broadcast control rooms, except that they may rarely be called upon for live broadcast. The good news is that some of the equipment, control surfaces and ergonomic relationships are less constrained than in an on-air room, so generally a few more concessions can be made to accurate audio monitoring. At the same time, unless the room will be used for only the most rudimentary editing, a more pristine acoustical environment is warranted. "Do I have signal?" may be the primary concern in a broadcast control room, but production rooms suggest an environment where more exacting sonic judgments will be made.

• **Equipment rooms:** As seemingly every type of audio equipment takes on more and more processing power, it becomes that much noisier. As a result, it is increasingly important to get the brains of the equipment (CPUs and hard drives) out of the critical monitoring and recording spaces, leaving only the control surfaces (keyboards and monitors) behind with the operators. This allows the most finicky equipment to reside in a cleaner environment with more stable air conditioning. However, it also means that the studio layout must carefully address the relationship of the equipment rooms to the rest of the technical spaces.

Careful room shaping can allow good sightlines between a control room and studio while still maintaining an optimum monitoring environment. (NPR, Washington, D.C.)

Design issues

When the various principles of architectural acoustics are applied to the special requirements of the different types of technical spaces within a radio station, the resulting design issues can be very complex. If these rooms are to be architecturally, ergonomically and acoustically successful, a great many factors must be addressed, starting with the basic configuration of the enclosed space.

• **Size:** If, according to a popular maxim, the three most important things in real estate are "location, location and location," then the three most important things in room acoustics may very well be "volume, volume and volume." No amount of acoustical finishes can overcome the sonic limitations of a room that is too small.

In the case of a monitoring environment, insufficient volume limits the ability to accurately reproduce low-frequency information. The loudspeakers can generate the energy, but if the room can't handle well-behaved propagation of that energy because the boundaries are too close

Architectural Acoustics:

to the source or the listeners, the apparent spectral balance will be unreliable and the uniformity of the room's response for persons at different locations will be lost.

For a recording space, unless low-frequency energy has sufficient volume in which to develop, it can easily overwhelm the room. In addition, the cues by which we identify a room's size, shape and character are all tied to subtle reflections of sound. It's very difficult to successfully conceal the size of a too-small studio.

- **Dimensions:** A popular misconception is that by selecting the right dimensions, you can eliminate room modes. In reality, any time you enclose a volume of air, the dimensions of that room correspond to some set of "modes" which support standing waves at various frequencies. What you can do by choosing appropriate room dimensions is to

Perils of the monitoring environment

It seems easy enough: you play an audio signal through a loudspeaker, and listen to it. No, wait, this is stereo, so it's a pair of loudspeakers, and now you and both speakers need to be essentially equidistant from each other. (Surround, of course, is another can of worms entirely.) Plus, in order to maintain accurate sound reproduction and stereo image, the loudspeakers should be slightly up from the horizon, but no more than about 15 degrees up. (In other words, monitors hanging way up next to the ceiling are a bad idea.)

Presumably you're not in the middle of a cornfield, so you also have to consider what the room boundaries do to the sound from your loudspeakers. Bilateral (left-right) symmetry is essential for stereo or surround monitoring, and applies to everything from the room geometry to the location and extent of finish materials to the placement of the doors and windows. In addition, the relationship of the monitor loudspeakers to the room's walls and your distance from them (i.e. soffit-mounted vs. mid-field vs. near-field speakers) greatly affects the way they energize the room and interact with the nearby surfaces. In an ideal situation, you can optimize the room geometry to direct all primary sound reflections away from the listening areas, so that the monitor sound can be heard in a reasonably unadulterated form. And then there's the ceiling: the same concepts that define the room's walls can be applied to the geometry, height and finishes of the overhead surfaces.

Unfortunately, after your monitoring setup is perfect, you might have to bring in equipment other than your speakers. That pesky console is usually the culprit in creating a major reflection into the operator's ears, so it is imperative that the relationship of the monitors to the console be carefully considered. Console surfaces should be kept as low as possible: those 10RU turrets on each corner of the work surface with the solid plexiglass copy stand between them are a sure recipe for acoustical problems. Similarly, a full-height equipment rack almost anywhere in the control room (especially if it's a foot behind the operator's ears) represents a reflective surface that is certain to create sonic anomalies.

What? There will be other people in the room who have to listen, too? First of all, tell them to be quiet, then push the back wall out another five or six feet so they're not right up against it. Then go about modifying the monitor spacing, room finishes, equipment layout, and everything else you've done to establish a compromise that makes everyone happy.

And all you wanted to do was to see if that fire engine outside the studio window made it onto the news break...

spread those modes out over the audible spectrum to avoid overlapping modes and prevent pronounced resonances. The optimum ratios of a room's dimensions are those that yield the most uniform density of modes across the audible spectrum.

Other considerations for overall room dimensions include keeping microphones and listeners' ears away from the room's boundaries, where "bass build-up" creates a low-frequency response that is misleading. In an audio monitoring environment it's also critical to maintain appropriate relationships between the axial and lateral dimensions as they relate to the configuration of the operator and the monitor loudspeakers. For example, wide but shallow control rooms generally don't sound very good.

You can have a room the size of a football field, but if it has an eight-foot ceiling, acoustically that's what you'll perceive as its dominant attribute.

Ceiling height is typically the limiting room dimension in creating appropriate interior acoustics, since the smallest room axis governs its modal characteristics. You can have a room the size of a football field, but if it has an eight-foot ceiling, acoustically that's what you'll perceive as its dominant attribute.

• **Shape:** The geometry of an enclosed space is key to creating the desired interior acoustical characteristics. Proper finishes can enhance the acoustics of a suitable shell, but cannot undo the effects of poor choices in the basic room shape.

One of the first goals is to limit audible anomalies such as flutter echo by eliminating opposing parallel surfaces that are acoustically *hard* (that is, reflective to sound). Non-parallel walls are a hallmark of traditional acoustical design, and rightly so. Make sure, however, that the angle between surfaces is sufficient to do the job. To be effective over a reasonably wide bandwidth, splayed walls should be at least 12 degrees out of parallel. Be aware that the benefit of this approach disappears as the frequency decreases.

In a similar vein, be cautious in using angled glass in acoustical windows. This is one of the myths of traditional studio design because the angle is usually too small to improve transmission loss at low frequencies where it's needed most. In addition, angling the glass generally doesn't eliminate reflections into nearby microphones, it just moves the point of reflection to a different spot on the glass.

If implemented properly, non-parallel geometry enhances the acoustical environment by increasing the complexity of sound reflections (in time) and stabilizing the density of room modes (in frequency). It can also be instrumental in creating an area of optimum audio monitoring that, by virtue of the room's geome-

Architectural Acoustics:

By keeping the console equipment below the operators ears, detrimental sound reflections are minimized. (WBUR, Boston)

try, is free from sound reflections that would otherwise convolute the sound emanating from the monitor loudspeakers.

• **Finishes:** Given a room of appropriate size, shape and overall dimensions, it is the surface finishes which provide an opportunity to fine-tune the acoustical response and create a particular sonic environment. The most widely used tool for this purpose is sound absorption, predominantly in the form of fibrous materials covered with aesthetically acceptable facings.

The location, type and amount of acoustical absorption generally has to satisfy two primary goals: first, to create an overall room environment that is pleasant for the occupants and a suitable background for any recorded sound; and second, to address specific reflection paths that can affect the room function.

Reflections from surfaces near a source of sound combine with the sound that travels directly from that source to the receiver (the listener or microphone). Because the path lengths are slightly different for the two sounds, at some frequencies the perceived level will be augmented, and at others it will be greatly diminished. The "comb filtering" that results from this constructive and destructive interference can drastically affect the tonal characteristics of the original sound. When the source is an audio monitor, the accuracy of reproduction suffers; when the source is a musician or talker, the naturalness of the recorded signal suffers.

Since windows and doors represent room surfaces that cannot easily be covered with absorptive finishes, their placement within the space is critical, and can significantly affect the overall room sound, as well as the effects of local interactions.

Acoustical diffusion is another desirable characteristic that can be enhanced by the proper selection of finishes and their placement. In addition to prefabricated products that are designed specifically for this purpose, diffusion can be achieved through the complexity of the room's geometry and the appropriate placement of materials with different absorptive properties.

In light of the potential problems that come from unwanted sound reflections, it might be tempting to suggest a completely non-reverberant, or *anechoic*, environment for radio control spaces. The problem with this approach, however, is that while it may be possible to create ideal listening conditions for a single operator in one ideal position, real-world operators need the freedom to move in order to run the equipment, and often others in the room need to hear just as much as the primary operator.

Clearly, the issues that comprise architectural acoustics are fundamental to the operation of the technical spaces in a radio station. If the design of these spaces includes proper attention to acoustical concepts, the result can be rooms that are quiet enough, isolated from each other, and with interior acoustical environments that allow quality radio programming to be created within.

Richard Schrag is a consultant with Russ Berger Design Group, Dallas, TX, a design firm specializing in recording and broadcast studios.

Photos courtesy Russ Berger Design Group

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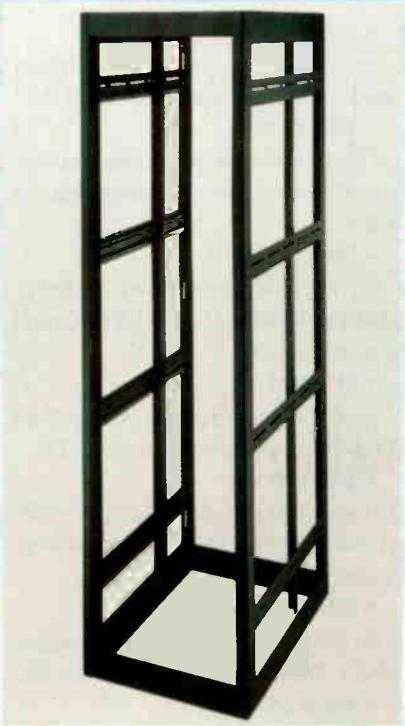

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News

NAB Radio Board election results announced

The National Association of Broadcasters announced the final results of the 1998 Radio Board elections. The terms for the newly elected will begin in June, 1998.

• District 2

(I) William O'Shaughnessy, president, WRTN/WVOX, New Rochelle, NY

• District 4

(I) J. William Poole, general manager, WFLS-FM, Fredericksburg, VA

• District 6

(I) William McElveen, president, WTCB/WOMG/WISW, Columbia, SC

• District 8

(I) Stephen C. Davenport, president, WTCD/WYMX/WKXG/WFMN, Telesouth Communications, Jackson, MS

• District 10

John Dille, president/owner, WTRC-AM, Federated Media, Elkhart, IN

• District 12

Jerry Zimmer, president, Zimmer Radio Group, Cape Girardeau, MO

• District 14

(I) Mark Hedberg, general manager, Hedberg Broadcasting, Mason City, IA

• District 16

(I) Dick Maynard, owner, KSLF-AM-FM/KEKB-FM/KBKL-FM, Grand Junction, CO

• District 18

John Cullen, president, WACO, Gulf Star Communications, Austin, TX

• District 20

Ron J. Davis, owner/GM, KBOW-AM/KOPR-FM, Butte Broadcasting, Butte, MT

• District 22

(I) Jerry Ryan, general manager, KSEZ-FM/KOAZ-FM, Phoenix, AZ

• District 24

George Nicholaw, vice president/GM, KNX, CBX, Inc., Los Angeles, CA

(I) denotes incumbent

Harris announces relocation

Harris Corporation's Broadcast Division announced that it will relocate its studio products business to northern Cincinnati, where construction of the Broadcast Division's new world headquarters is already underway. Harris anticipates that its studio business warehouse will move to the new location by the end of June, 1999, while the other functions — including sales, marketing and service — will move by August, 1999.

The new headquarters will also house division sales an marketing activities, radio and TV digital engineering, and systems integration, as well as other administrative and management functions.

As radio and TV take increasingly wide steps toward fully digital signal paths, Harris has found it necessary to consolidate operations to better accommodate its four rapidly converging product lines: radio, studio, TV and systems. In doing so, the company leaves two locations completely, the Richmond, IN, and Florence, KY, facilities, and another, Quincy, IL, for manufacturing only.

Additionally, Peter Ferrara, senior vice president, Clear Channel Communications, has been appointed to the Board and will represent District 7 (Florida, Puerto Rico and the Virgin Islands).

Ferrara is replacing Dean Goodman, who resigned from the Board in January, Ferrara's term will end in June, 1999.

Michigan show continues to grow

The Michigan Association of Broadcasters held the Great Lakes Broadcasting Conference and Expo on February 24 and 25 at the Lansing Center in Lansing, MI. Nearly 1400 attendees visited exhibits from 78 companies occupying 105 booths in the Lansing Center. The sessions covered various tracks for programming, sales, management and engineering, and featured 77 speakers.

While most local shows are smaller in nature and focused topically on issues of more local concern, the MAB Conference and Expo distinguished itself as future aware. While focusing on radio-related topics like the Internet, DAB and digital facilities, MAB also cast a serious eye toward DTV and its related topics. Attendance drew not only from Michigan, but Ohio, Indiana, Illinois and Wisconson as well.

Next year's Conference and Expo is scheduled for February 23 and 24, 1999 in Lansing. For more info on the MAB, visit them online at *www.michmab.com*.

Do you have an item for the News? Contact us at beradio@intertec.com

Reader Feedback

Little bits

Dear Skip,

Just saw your February *BE Radio* editorial "Bits is Bits." I think you are on the mark with your vision of the possibilities if we become a digital medium. I just don't see how radio can "break its traditional, singular association with audio content" to get there. Sure, many among us see how flexible a digital data stream is — Glynn Walden of CBS is known to quote Nicholas Negroponte on "being digital," and tells us we will become "broadcasters of bits." I was fortunate to get an inside look at digital potential while working on the Lockheed-Sanders/WCRB-FM Digital concept. The telling lesson about radio becoming digital is in what the average broadcaster was asking me about our technology. Their concerns were largely about new technology's cost and impact on audience share. Revenue-for-audience-for-audio-content is the only thing on the minds of many radio broadcasters, and so it should be.

I think it goes deeper than expecting a bunch of companies in an industry to think outside the box. Whether it is your story about railroads not figuring out that they were transportation companies so long ago, or stories of how carburetor companies did not become fuel-injection companies, or how Xerox lost its lock on the market, there are reasons why industries get stuck in their way of doing things. Their cultures, their core competencies, as well as their economics, play into the inertia of the organization and the industry. Mature industries like ours will get milked for dollars as intellectual capital is put into new enterprises.

No, Skip, I think radio is an audio service... or at least the radio players are audio service people. Maybe CBS will transform it if/when they get their IBOC concept accepted, but I'll bet it's the Microsofts who buy the CBSs who make your vision happen. Even Disney may have a chance. They have skills and infrastructure to launch new entertainment services using acquired enterprises. Disney's kids' radio network is on a tiny AM station here in Boston, but it is a start. That network is a giant Disney promotion. And what Disney is doing to transform ABC is nearly as obvious. There was a sci-fi book many years ago where there were countries that were corporate nations. The country became the icon of the corporate culture. Here in Boston, the Citgo sign became the corporate icon of Red Sox games and Kenmore Square (there is no Citgo now but we defend that garish neon thing as an icon of pop culture). For your vision to work, many, if not all, radio stations would become corporate icons. Disney radio is an easy stretch. Microsoft radio is a little farther out there. How about Chase Manhattan, or AT&T, or IBM, or Mobil (use your speed pass to get into Sony movie theaters...), or Sony (too bad about SW Networks, try again!)?

If we in radio are going to be more than just audio, it looks to me to be a change from the outside in. *BE Radio* readers are either owners (who will adopt a technology the big guys make or sell out to the big guys) or employees (who have no control of the destiny of their businesses). The employees would be best served by being shown what to learn to remain adaptable in what is sure to be a changing marketplace — thinking digitally, using multimedia tools, repackaging and remarketing the content you work so hard to make to go on alternative media, surviving job changes, helping your company in transition be successful, etc. Something you could do on these pages.

Well Skip, you got me going with "Bits is Bits." Radio is a cool industry. Your vision is tantalizing. It's fun to imagine.

David Maxson
Vice president
Charles River Broadcasting
Boston, MA

Skip Pizzi replies:

You may be right David, although I hope it doesn't come to that. Maybe you can teach an old dog new tricks. (It's happened before. Remember how radio changed when TV came along?) I'd also hate to see the consumer lose a broadcast medium that is at least primarily concerned with audio, and I hope this will never happen. If it did, we need look no further than the video and multimedia worlds to see audio's potential fate. It may be up to future radio broadcasters to maintain one place where audio doesn't become just "the noise next to the picture." Conversely, though, these same folks may soon be able to add some visual and other data-enhancements to their service's sound. Let's start thinking about how these enhancements can be integrated without dethroning audio from its predominant status in the radio of tomorrow.

E-mail: beradio@intertec.com
FAXback: 913/967-1905

Caveat emptor

I am interested in the proceedings between the state of Illinois vs. SBE and Novell on the subject of the use of the title 'engineer.' In addition to being a member of SBE and holding their top level certification, I am also a member of NARTE and have been certified at their top engineering level since 1986. I am also working toward my Novell CNE certification. I'm seriously considering writing a letter to NARTE asking them to join hands with the SBE and Novell in their legal battle.

I'm also curious to know the thoughts and feelings from the people who are licensed PEs and who are also certified engineers by SBE and NARTE. Those people obviously know the difference (and importance) between the two types of certifications, or they wouldn't have spent the time to become certified beyond the "god-like" PE status they already had.

There is already plenty of regulatory muscle in place to deal with anyone pretending to be a PE or anything else, without adding confusion over general titles. This thought could easily be extended to any other field of expertise or profession. Think what would happen if suddenly Ph.Ds could not be called "doctors" because they might be confused with those practicing medicine. And what would the world be like if policemen couldn't be called "officers" because they're not in the military. This thing could easily get way out of hand. It's stupid already, and I don't want to see it get ridiculous by the setting of an unnecessary precedent.

It always boils down to "buyer beware." Before you hire anyone claiming to be a professional anything, check out his true credentials.

We have several professional organizations with similar goals and it seems like they would rather ignore each other. At least that's the way it looks to the casual observer.

Jeff Keith, CPBE, NCE
WMJI-FM
Cleveland, OH

Chriss Scherer replies:

You raise some good questions, Jeff. I have forwarded your letter to the Society of Broadcast Engineers for an update and some insight into how things are proceeding with the State of Illinois and Novell issue. Because of time constraints, their response will be printed next month in the Reader Feedback column.

As to your second question concerning people holding PE certification as well as SBE and/or NARTE certification, I ask for comments from our readers. If you are in this situation, how do you feel about the use of the term "engineer?" I am interested in hearing from them as well.

Business/People

BUSINESS

Intraplex, Westford, MA, announced a new partnership with Glenayre Western Multiplex, Sunnyvale, CA, a provider of wireless telecommunications equipment, to provide high-quality, fully digital T1/E1 STL solutions based on spread-spectrum technology. Widely used for PCS, cellular and data communications networks, spread spectrum provides highly reliable, point-to-point wireless links without requiring an FCC user license.

Pacific Research & Engineering, Carlsbad, CA, announced a contract with Las Vegas' National Public Radio affiliate, KNPR-FM, to build and install equipment and studio systems for its new 7000 square foot studio complex. KNPT's new studios will be built, wired and installed by PR&E. Three Radiomixer and two AirWave audio consoles are included in the order.

Leitch Technology, Toronto, announced the acquisition of Silicon Construction, Sweden AB (SiCon). SiCon designs sophisticated micro electronic circuits fabricated as silicon chips, and its addition gives the Leitch family the ability to design chips for use in its own products. SiCon has 15 years of experience in advanced full-custom ASIC design and test, including advanced mixed-signal circuits, high-speed digital circuits, A/D and D/A conversions, and synthesis from VHDL to full custom ASIC.

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PEOPLE


Mueller

Mark E. Gurvey joined ComStream, San Diego, CA, as vice president, sales and marketing for the Satellite Products Division.

Stuart DeMarais was named to the board of Solid State Logic, Ltd, Oxford, UK, as sales director.

SSL also appointed **Michael Mueller** as vice president of broadcast and post production, East Coast.

Kirk Stirland was appointed vice president, sales and marketing, for Digital Courier International Corporation, Vancouver, BC.

Rich Rogers was named as vice president of client services for GlobeCast, New York.

Bruce Mosca was promoted to RF applications engineer for Sennheiser Electronics, Old Lyme, CT.


Mosca

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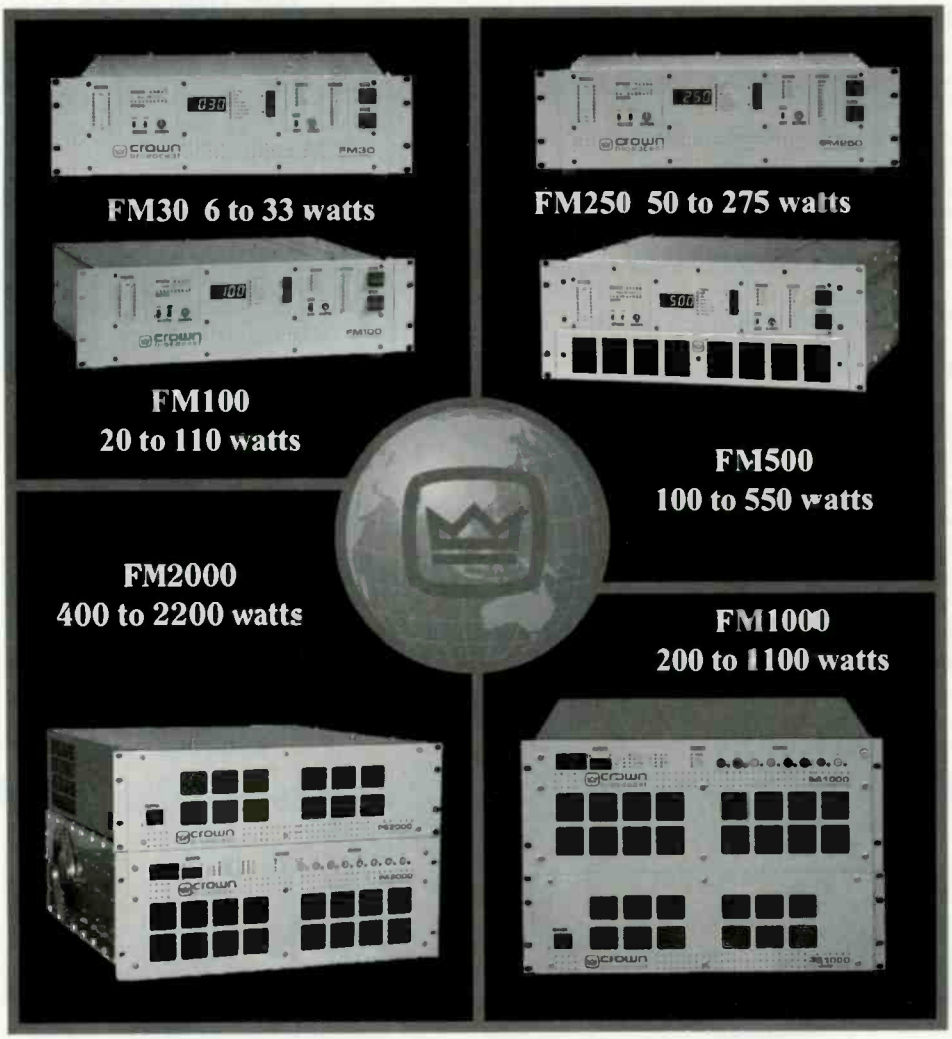

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Get on the bus, Gus (part 2)

By Skip Pizzi, editor-in-chief

Last month, we discussed the IEEE 1394 ("FireWire") serial bus, one of two emerging standards for the interface of peripheral devices to desktop computers. The other is the Universal Serial Bus (USB), which is about to become the primary peripheral interface in the PC environment. Over the next year or two, consumer computer equipment will gradually move to USB for the interconnection of keyboards, mice/trackballs, monitors, speakers, printers, modems, scanners, outboard storage drives and other devices.

USB is a serial bus operating at 12Mb/s ("full speed") or 1.5Mb/s ("low speed"), which allows up to 127 devices to be connected to a single PC. Most PCs purchased today are already equipped with USB, although not much peripheral hardware employs it yet. This will soon change as Windows98 and NT 5.0 are released with USB drivers, and peripherals begin to offer USB ports along with their traditional interfaces. Eventually those legacy interfaces will disappear, taking along with them the current limitations as to the number of peripheral devices that can be installed on a PC, and the inconvenience of their installation.

USB allows "hot-plugging" of peripherals without rebooting or cumbersome initialization and conflict-resolution. Unplugging the device is equally simple. The need to open the CPU chassis to set up a new peripheral will become increasingly rare: no more DIP switches, jumpers, IRQ settings, DMA channels or I/O addresses to worry about. Daisy-chaining and standard connectors make cable management much easier, and DC power can be carried to low-power peripherals on the USB cable.

Peripherals need not be daisy-chained if a central hub configuration is physically more convenient. To ease plugging and unplugging, somewhere other than the back of the CPU can act as this hub. One possible location for this is the video monitor. Another is a peripheral device made specifically for this purpose — the USB hub, a small box that would serve as a plug-in strip for multiple devices.

Smart and cheap

USB is a "smart" bus, in that it automatically senses and configures itself for the hardware it sees online, including the proper allocation of bus bandwidth and identification of driver software requirements. Unlike FireWire, however, USB places no burden on the PC's operating system for this bus management. It is also designed for maximum cost effectiveness, such that it will add little or no cost to PCs or peripherals for its inclusion.

Like FireWire, USB can operate either asynchronously or isochronously, meaning that it can transfer data in a file-based form (like traditional serial buses), or it can operate as a "real-time" channel bus (e.g., for streaming media signals), respectively.

Different strokes

But because its maximum speed is significantly slower than FireWire (See Table 1.), USB may be best utilized for operations that don't involve high-speed video or multichannel audio requirements. For these needs, FireWire excels, which is why observers expect both standards to coexist.

INTERFACE TYPE	MAX. SPEED	MAX. DEVICES	NOMINAL CABLE LENGTH	POWER	SIGNAL PAIRS
USB	12Mb/s	127	5m	+5VDC	1
FireWire	400Mb/s	63	4.5m	+8 to +40 VDC	2

Table 1. A comparison of the two new serial bus standards.

USB will likely dominate the low- and medium-speed interface needs of monitoring, control, communications, file storage and image I/O, while FireWire is used for media I/O and other high-speed communications or storage interfaces. Once this interfacing becomes routine, a behavioral shift may also occur, by which PC users will frequently plug and unplug portable appliances (such as digital audio and video recorders or cameras) into their computer systems. More of the systems within the home or workplace environment may also be permanently attached to the PC via these buses.

For broadcast users, these new interfaces will enable further flexibility and convenience in operations, along with simpler hardware reconfiguration and maintenance. All of these attributes should make the buses welcome in the increasingly PC-based radio facility.

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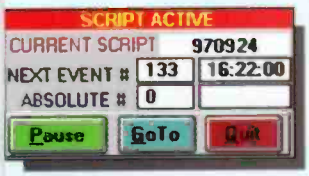

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