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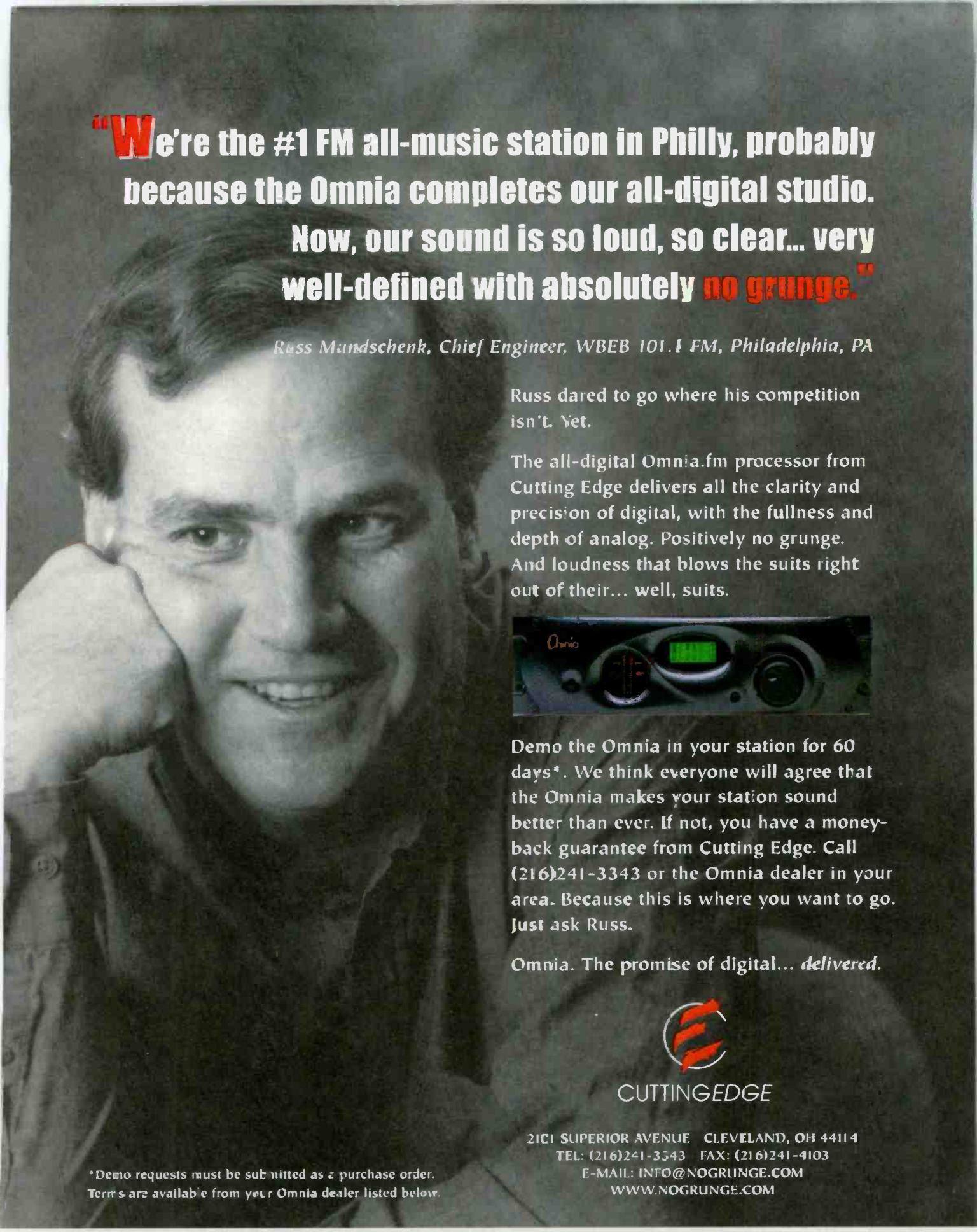
ON THE COVER: Welcome to the NAB98 wrap-up. Putting it all together — and making sense out of it — is easier with our coverage. (Photo by Chriss Scherer. Cover design by Michael J. Knust.)



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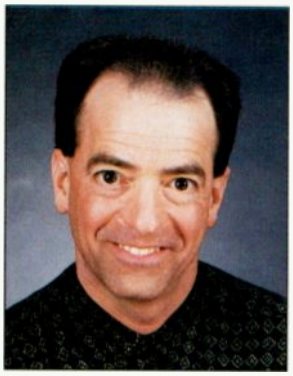
Still tied to the mast

NAB 98 was yet another year of IBOC progress reports and tabletop demonstrations. Although new players and developments are added each year, the manifestation of a viable DAB system for US radio seems no closer than it was at the start of this decade. Sorry to say, the annual IBOC chalk talk *déjà vu* is getting a little tired.

Although serious technical work continues, IBOC has become the broadcast equivalent of a Kenneth Starr investigation — promising for years without delivering the goods. It makes one wonder just how much rope the format will have before broadcasters give up on it. Similarly, luckless proposals of the past have died in far less time, quickly becoming history after one or two stumbles. In contrast, IBOC has seemed almost invulnerable, surviving ostensibly mortal blows on numerous occasions.



It is the desperation of an industry with no alternative that gives IBOC such cat-like landing ability and multiple lives. For US broadcasters today, there's no digital radio without IBOC, so it darn well better work. "Make it so, Mr. Engineer." Meanwhile, the best and brightest minds struggle at what may be RF alchemy.

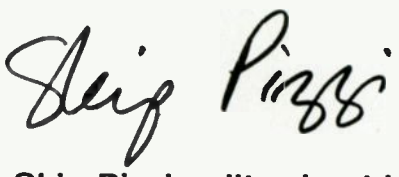
Even if IBOC is possible, its predominant design criterion of backward compatibility to the technical (and economic) environment of US radio may result in a system so flawed that it's nearly useless by the time it arrives. Meanwhile, the landscape is changing fast, and IBOC developments may distract broadcasters from reacting more appropriately.

To wit, IBOC's siren song has already seduced US radio broadcasters away from lobbying hard for new spectrum to accommodate DAB. This may prove to be IBOC's greatest legacy: diverting the US radio industry's attention from pursuing new allocations at a pivotal time. Although any effort to gain new digital radio spectrum may have ultimately proven futile (particularly given its concurrence with the difficult DTV allocation process), the promise of a transition to DAB that preserved existing market structures seemed so alluring that radio broadcasters never put up much of a fight. Now they're facing a battle with numerous new digital media competitors, wielding an uncertain IBOC as their only weapon.

IBOC has always been a business plan in search of a technology. This is not unique — many great American inventions have been mothered by management's edict. Consider the Manhattan Project, NASA's Apollo program or the USAF's Stealth aircraft. All it takes is enough time and money. While some IBOC developments reported at NAB98 did inspire mild optimism, such temporal and financial resources may be running out. This year's arrival of DTV, followed by next year's S-DARS launches and continuing online radio growth will all place IBOC development in a very different context by the end of the decade. (One well-informed colleague at NAB98 forecasted that online audio would achieve full fidelity at 5.1 channels before DAB happens in the US.) Internationally, the continuing emergence of Eureka 147 DAB systems will also cast the US in an unaccustomed, trailing-edge position.

> **"Faced with having to change their views or prove there is no need to do so, most people get busy on the proof."**
>
> **– John Kenneth Galbraith**

This doesn't imply that the DTV or Eureka models are the answer for US DAB. Given consumer confusion, cost consciousness and cable concerns, there are several train wrecks still ahead for US DTV. And Eureka 147 has never been a good fit for the independent broadcast environment of the US. It's clear that there's a need for fresh thinking and new answers — perhaps including some new spectrum — to seed the future. Without such guidance, US radio is doomed to drift in an endless sea of promises with no hope of reaching shore.



Skip Pizzi, editor-in-chief

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Viewpoint

In memory

We see emerging technologies each day in all the things we do. Broadcasting is no exception. In last month's *Vieupoint*, I talked about the basics of radio and how even with new technology, the basic groundwork, the nuts and bolts of radio, remains in place and probably will for some time to come. The title, "Real

Radio," was uttered by a colleague of mine while we worked on an AM transmitter and antenna array in sore need of attention. I didn't mention the exact station; it wasn't important for the point I was making. However, several people have asked. It is an old set of call letters: WHK, Cleveland. News of the passing of the "father of directional AM" brings that station to mind again.

Carl E. Smith died on Sunday, May 3. He was 91 years old. I learned much about Carl's work while I was at WHK. The oldest part of the transmitter building was built in the 1920s, and there are still (or were when I left) plenty of station records and notes that pertain to tests and maintenance records from the time that Carl worked at WHK, including references to the proof of a previous three tower array Carl designed when he was the assistant chief engineer. Later, the engineering department at the station was split into "engineering," for the routine maintenance, and "super engineering," led by Carl and directed toward the planning and testing of new technologies.

While I only met him once, it was as big a thrill for me as if I could have traveled back in time and met Marconi or Armstrong. The photo here was taken in August, 1996. The Northeastern Ohio SBE chapter holds an annual picnic, and that year we celebrated the 75th anniversary of WHK and invited any of its former employees to come out and share some of their stories. We posed for this shot in front of the Western Electric 405B that was installed around 1947 (and operated until the middle 80s). After the photo was taken, I watched as he looked around the room and surveyed the equipment. No doubt he was being reminded of past times in that same room, the room where my own "real-radio" experience had taken place.

Many people were influenced by his work. Some of my friends have had the pleasure of working with him at some time, including our technical editor, John Battison. I am told that Mr. Smith was an able tower climber as well, sometimes scaling a tower to verify an adjustment made by a worker.

Many people will remember him for the technical seminars and master classes on RF and antennas he gave at what is now the Cleveland Institute of Electronics and at some 23 different NAB conventions. These classes and the books he wrote on antenna patterns — which are still thought of as the bibles for such work — influenced and inspired many of us in radio engineering, as did his work in the area of circular antenna polarization and multiplexing

Carl was truly a pioneer in radio history. In his lifetime alone he saw broadcasting grow from its infancy to DAB (at least internationally). I only wish he could have seen DAB become functional in the US.

Our thoughts and prayers go to Carl's family.

Chriss Scherer

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Computer integration, part 2

By Kevin McNamara, CNE

Last month we covered some of the fundamental issues surrounding the integration of a PC-based computer network in your facility. In this issue we'll get to the nuts and bolts of designing an infrastructure delivering maximum performance and reliability — not only within a building, but to the outside world.

At this point you have established your specific needs, determined how many (and what type of) file servers will be required and which operating system(s) to use. The term "access method" defines the set of rules that allows several computers (and other devices) to communicate over a common medium. In terms of designing any network, it's important to understand how the specific access method you choose actually allows the various devices on the network to communicate. This discussion is limited to Ethernet-based networks, since it is by far the most common found in a radio facility.

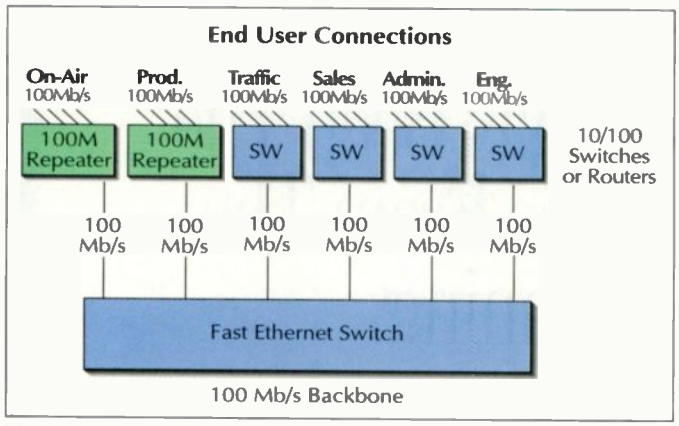

Figure 1. Different standards can be mixed within a facility.

How fast?

The most common Ethernet networks currently in place are operating at 10Mb/s and are typically connected by a specially rated cable containing four twisted-pair wires, commonly called *Category Five* (or Cat 5). This type of network is also called *10BaseT* (10 = 10Mb/s rated throughput, "Base" = baseband [signal], and the "T" = twisted pair cable). As I mentioned last month, standards now exist for networks, known as *100BaseT* or *Fast Ethernet,* that operate at throughputs of 100Mb/s . There are three general 100BaseT network standards: 100Base-T4, which uses fours pairs of telephone-grade twisted-pair cable; 100Base-TX, which uses two pairs of data-grade cabling, and; 100Base-FX, a fiber optic version of the TX. To further confuse the issue, another standard, 100VG-AnyLAN (VG = voice grade) has also recently been standardized. One of the advantages touted for this standard is its ability to use existing wiring. The bottom line is that the price for deploying either type of 100Mb/s network is rapidly falling, and even if you presently have an investment in a 10Mb/s system, it still may make sense to implement the higher speed technology as you add new equipment. The two standards can coexist with proper planning, as shown in Figure 1. As for hardware, I recently saw an ad for a relatively inexpensive network interface card (which plugs into one of the slots on the PC) that supports both speeds, so it does exist.

As of this writing a "gigabit Ethernet" standard is nearing final approval, and several vendors are now providing equipment that supports the proposed standard. Gigabit Ethernet will operate over existing Category Five-EX cabling, as well as coaxial and fiber optic cables. It's unlikely that radio broadcasters will be implementing this anytime soon, but you can expect that it will grow in popularity over the next couple of years.

Putting it together

I recently read that more than 70% of network problems relate directly to cabling. Be aware that specifications exist for every aspect of the physical implementation of a network, especially cabling. Most Ethernet networks in use are connected using Category Five cable terminated with modular RJ-45 connectors. The spans (typically cabling) between devices connected to your network are called "segments." The physical length of each segment is defined in that specification. These lengths were derived from the propagation factor of the transmission media and the inherent signal delay that would result. Care should be exercised when installing any network cabling because bends, kinks, poorly made connectors, and placement in close proximity to interfering sources (i.e. electrical wiring) will degrade network performance. It's possible to significantly slow the performance of your entire system with a defective cable in just one segment.

The transmission media itself is defined within the same specification. For example, Category Five twisted-pair cable is graded to reliably pass 100MHz at 328 feet, which is more than acceptable for a 10BaseT network. If you're designing a 100BaseT network, consider using a higher performance grade of cable such as Category Five-EX, which is rated to about 300MHz for equivalent lengths.

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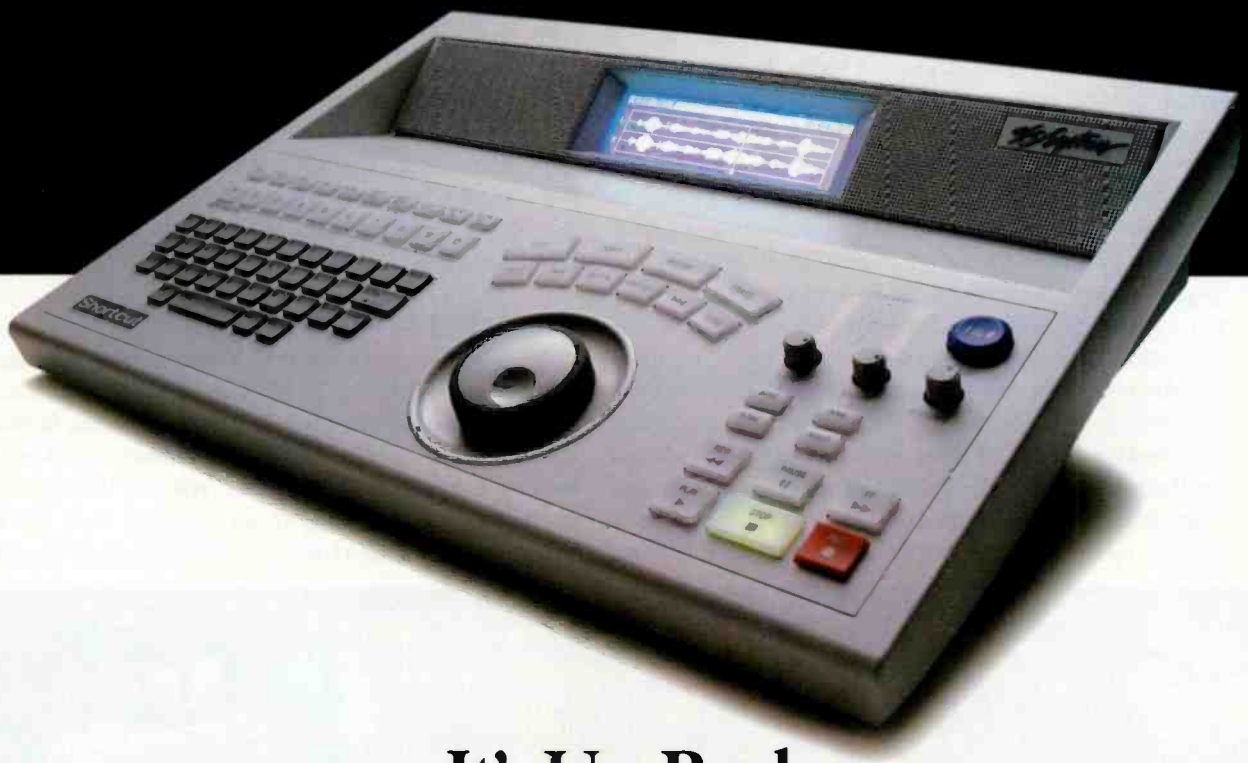

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There are several different hubs available, so you should carefully research your options. Choices include basic units that support only a single throughput speed, hubs that will adapt to 10 or 100Mb/s (either by autosensing or manual selection), and even hubs that can mix and match different media (i.e. twisted-pair wire and fiber optic cable). For obvious reasons, hubs that adapt to more than one speed must be able to buffer data transmitted from the higher speed segment (100 Mb/s) to a 10Mb/s segment. This creates two problems from a performance standpoint: the hub must have sufficient memory to temporarily store the more quickly received data, and; if the network has a large amount of traffic flowing through it AND the hub cannot retransmit data from the high-speed segment to the lower segment in a timely fashion (microseconds), the Ethernet protocol takes over, assumes the data was lost, and calls for the originating device to retransmit. This can cause a serious performance problem.

A new variety of hub uses intelligent switching techniques to route data directly to its destination, not unlike the way a telephone central office routes a phone call. The technology is known as *layer three switching*, and there are about 12 different vendor-specific choices. The prices vary with application, but are becoming more affordable. Standards also exist for these devices, but many switches on the market use some form of proprietary technology. Many of these switches offer the ability to operate in a full duplex mode, which eliminates the speed limitations imposed by the CSMA/CD access method by establishing discreet paths for the transmitted and received data. Network performance typically doubles — a good reason to spend a few dollars more.

Because the signal propagation delay is critical on an Ethernet network, you must limit not only the length of the segment, but also the number of hops from end-to-end. In this case "hops" means any network device, such as a hub, that retransmits data. The rule of thumb for 10Mb/s networks, also known as the "5-4-3 rule," is:

- No more than five segments in series;
- No more than four hubs, and;
- No more than three populated segments (applies to coaxial-based networks only).

The rule is pretty much the same for the 100Mb/s networks, except that they tend to limit the amount of hops allowed because the total system signal propagation delay must be decreased in order to sustain the higher speeds.

Connecting to the outside

The growing need for network users to be connected to the outside world (i.e. telecommuters, Internet access, and interconnecting networks between various facilities) has caused an explosion in the number of affordable remote access solutions. Called *routers*, these devices connect two or more networks using the most efficient path available. What a router is really useful for is its ability

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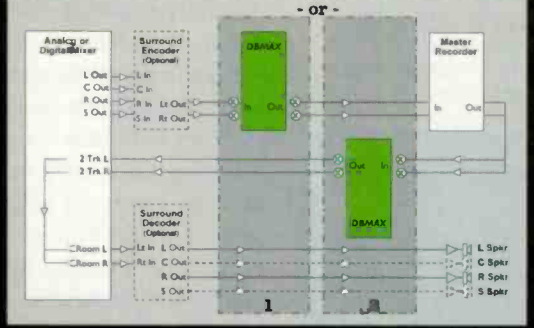

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to pass only network traffic (in one network) destined for a different network. The Internet is a good example of how routers work. When you specify a particular website on your browser, that name is forwarded to a domain name server which, in turn, associates the name with a specific numeric address. The path to that address is established through one or more routers located throughout the world. Most routers are configurable in terms of how and what traffic is allowed to pass through.

Other types of routers are used to connect the network to private or public networks. Routers such as these can be purchased to interface with virtually any type of outside network in existence, including POTS, ISDN, switched 56, full (or fractional) T1/T3, frame relay and ATM. Most of these routers are intelligent and can be programmed to establish connections with dial-up services from any authorized users connected to the network, as well as to allow authorized users to have direct access to certain network resources.

Performance issues

Current digital-based broadcast facilities offer an interesting challenge to network design. Unlike most other businesses where the networks are used to access files, share resources, or even access the Web, radio broadcasters have the additional requirement of passing various forms digitized audio and streaming data through it. Recall that in an Ethernet network, any network device may transmit at any time, and collisions due to simultaneous transmissions will need to be retransmitted at some random future time. Networks that are designed to carry streaming data are typically sending huge amounts of traffic for long periods of time, thus tying up the systems for other devices. Networks intended to carry streaming data must be properly "segmented" in order to maintain network performance throughout the system. In context, segmenting a network means that only certain data is allowed to pass through to another network, while the remainder of traffic stays within the respective network.

One of the most important goals in designing a flexible, high-performance network should be to understand and contain collisions within separate network segments. The techie term for this is "collision-segregated domains." Computer networks within most radio facilities are installed to address the specific needs of particular vendor equipment (i.e. audio storage/ workstations, traffic systems, general accounting systems), that has created a great deal of discontinuity within the facility. The problem is further compounded by the vendors themselves, who typically specify minimal (*"spend more with us, not on the network"*) network infrastructures designed to provide specific types of connectivity in order to accommodate their equipment.

I read that much of the technology we will use in two years hasn't been invented yet. My advice is evaluate your own requirements as a total system and build an infrastructure that accommodates not only your present operation, but can exploit some of those yet-to-be- developed technologies.

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; e-mail: exegesis@unidial.com.

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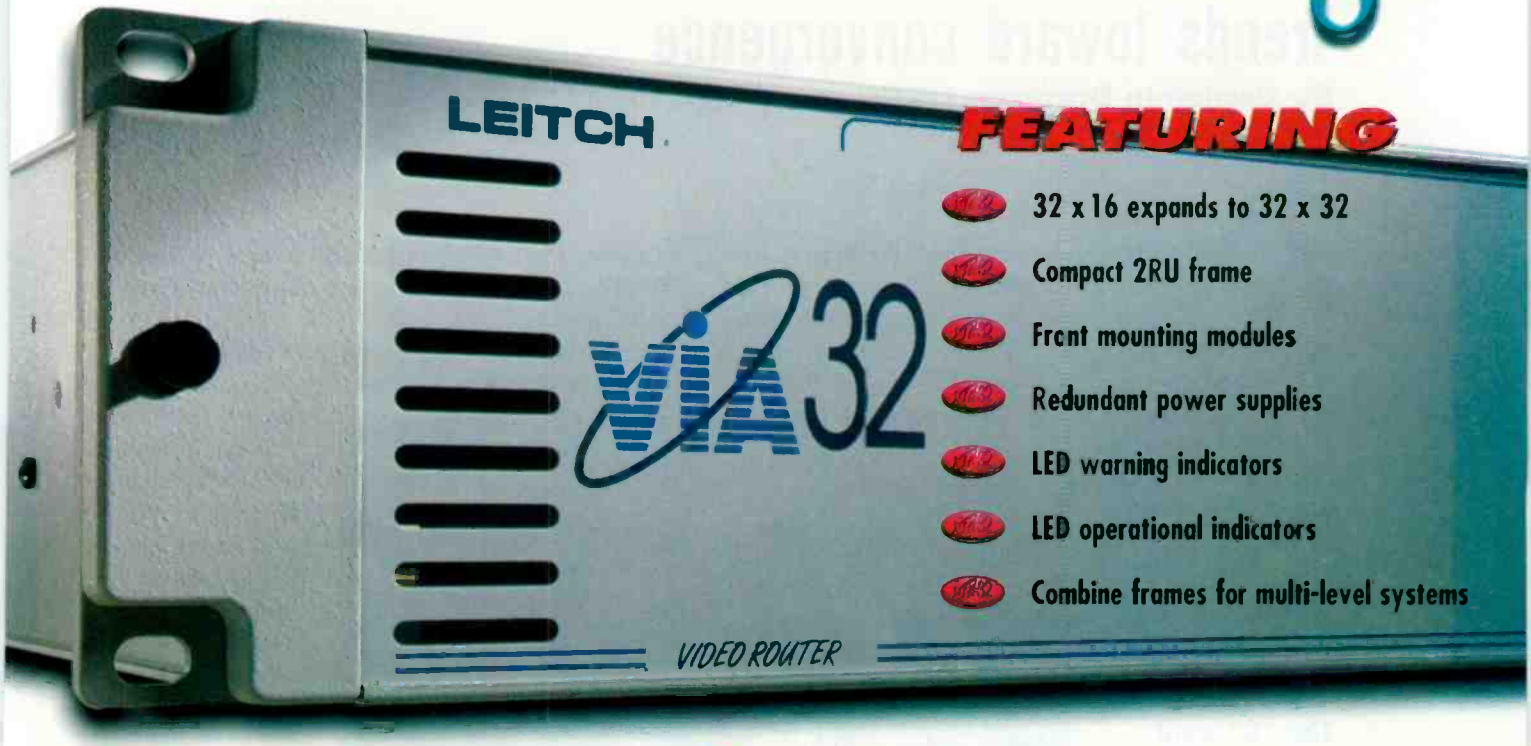

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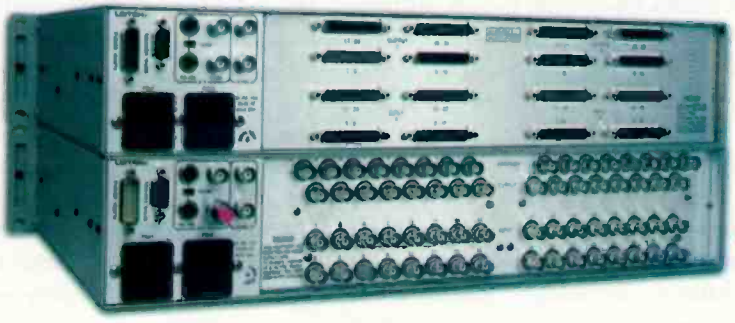

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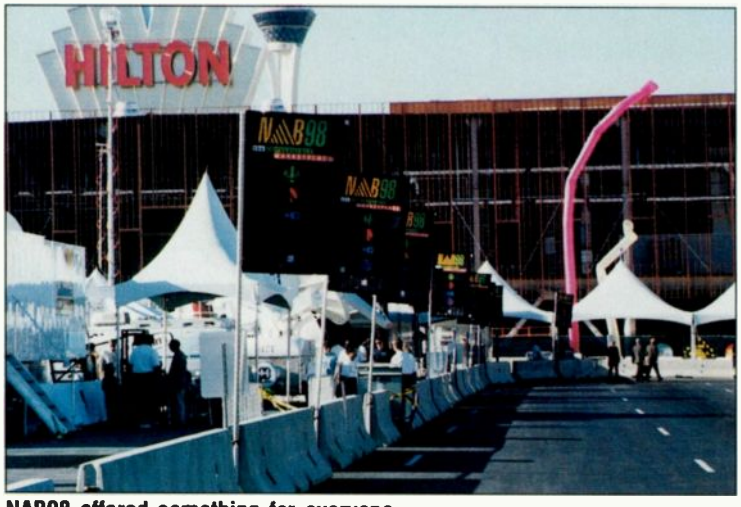
Trends toward convergence

By Benjamin Brinitzer, CSRE

Another NAB has come and gone. For most of us it was time well spent, getting reacquainted with old friends and learning the new trends and technology that encompass our business. Sessions offered a multitude of topics on management, engineering, programming, promotions, and the Internet. The hot topic was of no surprise — digital convergence and consolidation. How do we handle our new world?



NAB98 offered something for everyone.

The "C" word

Consolidation, consolidation, consolidation. The scuttlebutt on the floor was about everything from how to merge stations that have been at each other's necks since time began, to how much equipment is needed to make a successful transformation to consolidated facilities? There was much to see and do on the convention floor and in the sessions regarding this very hot topic.

Management sessions dealt with a wide variety of topics to help us begin our journey into this brave new world. "The Monopoly Manager" session on Monday covered different opinions on managing the consolidation of multiple station operations. Experience gained from companies that have already completed consolidation was key to most of the discussions. Emphasis was placed on methods of dealing with people and environments that are (or were) fierce competitors. Opinions differed on rushing the physical consolidation historical rivals. Some felt it was better policy to leave stations operating as separate units, while others found the cost reduction realized through consolidation too good to pass up, and therefore, to be completed as quickly as possible. Consolidation was the general consensus. We must make this transition with care to avoid total chaos among the operations. One interesting note: Almost all of the speakers agreed that engineering seems to take care of itself through attrition, while other departments require special attention.

One management session covered whether it is valid to rush to replace analog equipment during consolidation in order to standardize physical operations. The speaker asked this simple question: Since many stations have relatively new equipment in operation, does it make sense to replace this equipment just for the sake of standardizing a facility? The jury is still out on this one. In each case, examine current operations and determine if capital expense is justified. Are facilities that are under consolidation and have different automation or HD systems going to replace two- or three-year-old equipment to standardize, thereby reducing work load? The predominant feeling among engineering and programming was that it will be necessary to consolidate these systems to achieve any benefits of technical consolidation. That was probably the hardest pill to swallow. There were others that believed it was better to leave facilities separate to allow diversity and competitive operation. This obviously reduces the immediate impact on both capital and staff, while adding to the bottom line for expenses.

It is apparent that there is not a standard template for us to use in planning the consolidations of the future. Only you know what is best for your particular situation, the sessions just tried to help you make informed and educated decisions.

Leader or bleeder?

Engineering sessions covered everything from job attrition to designing digital facilities. (See "Digital Audio Superhighway," p. 78.) We gained knowledge from those

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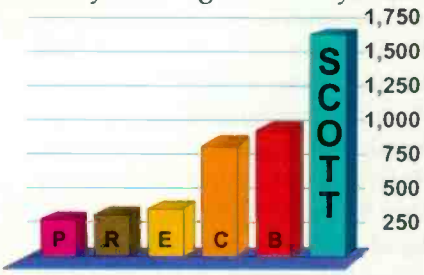

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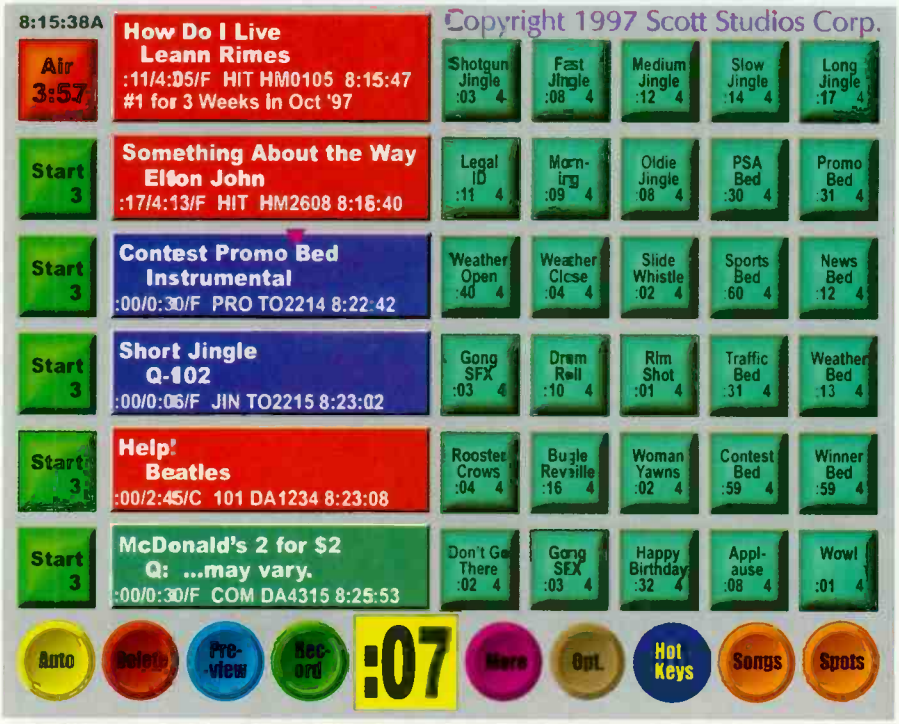

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At right, there's a "Wall of Carts" that lets you pick and play any recording by number or name. Or, number keys at the bottom load your cut quickly.

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of you who have already been on the "bleeding edge." Is it too early to jump into digital? Again, the jury is out. It was clear that there is still more work to complete before there will be any smooth transitions. The consensus on the floor was still one of caution. Although some engineers were vocal about successes in transformation into digital, others had horror stories to tell. My favorite was the lack of Emergency Alert System (EAS) equipment with digital interfaces. How do we insert analog EAS equipment into digital air chains to comply with the FCC rules?

Hello, Harris? TFT? Burk? Gorman-Redlich? Hollyanne? Are you listening? This is a call to help us convert. Please provide a digital interface in those new encoders!

This issue limits the implementation of a truly digital air chain. The successes most definitely outnumbered failures.

There is plenty of hot new technology to choose from to complete any consolidation. The exhibit floor held several new digital devices built to help us consolidate and improve our technical operations. Just one look at the Pick Hits in this issue (p. 68) will confirm that. Several facilities have already accomplished transformation from analog to digital during recent consolidation. These same facilities are (or were) going through a transformation of traditional design methods. This transformation requires re-

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Managing Technology

thinking of typical designs. Several new design suggestions were presented. These varied from centralized engineering plants with central rack rooms, to clustered designs maintaining the individuality and personality of the affected stations. The latter of these choices is by far the most expensive in most cases. It was agreed that if this is the method of choice from management, you would probably be better off leaving the separate operations in current locations unless distance made it an impossibility.

Other issues of interest to engineers, were the technical implications of using several digital devices in air chains. It was suggested by a leading processing manufacturer in one digital session that there was a need for revamping of digital interfaces for connection between digital processor and exciter to accommodate the processed digital signal. There were demonstrations on the show floor that were very convincing. Seeing those demonstrations made one ponder what other radical changes might be on the horizon.

There were also sessions on sales operations. One of the topics covered was: Is it better to have one rep for each client (this is a popular request among agencies) or is it better to have a rep per station per client? Again, the jury is still out, though most stations seem to be leaning toward the latter. Other sessions included tactics on selling web space and ways to generate other non-spot revenue, along with the traditional management sessions.

A walk around

Ah, the show floor. After hours of walking and looking at all of the new and old products, we find that our feet sometimes complain with a vengeance. So we race to find that one booth that has the "carpet from heaven." Once there, you find yourself overcome by others in the same shape you are. By day's end you feel that all of the walking was worth it. You came away with much more than you expected, just a little smarter and with a sense that the radio industry is in the infancy stages of a massive change in technology and operations. The trends continue in the direction of using technology to help the bottom line. NAB98 was indeed a show to remember. See you next year.

Ben Brinitzer is director of engineering, Southeast region, for SFX Broadcasting Inc., Raleigh, NC. Contact him at (919) 874-9850; e-mail benb@interpath.com.

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Solutions for Tomorrow's Radio

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Hot towers and cold antennas

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

Before the rapid expansion of radio services following WWII, the problem of mounting additional antennas on an AM tower was not faced very often. When such an operation was needed, the familiar quarter-wave stub isolator was frequently used. Basically, decoupling an extra feed line across the base insulator may be considered the same as placing a high impedance across the base insulator. That way, the now well-known metallic insulator effect of a quarter wave section removes the shorting effect of the new line while transferring the new signal across the base insulator.

Prior to WWII, grounded towers were relatively uncommon; the now popular folded unipole had not been developed by the late John Mullaney. Of course, if a grounded tower was in use, the problem of getting the new auxiliary signal across the base insulator did not exist.

The development of radar and other UHF and EHF techniques during WWII spurred utilization of the properties of quarter and fractional wavelengths of coaxial line. The high impedance (as seen by the AM tower) link across the base insulator with the new signal is really an obvious choice.

Three ways to get there

Sometimes a very high resistance is placed across a tower base to drain static charges. This high DC resistance can be replaced by a static drain choke with an approximately equal reactance at the AM operating frequency, so that there is a DC path — but effectively no RF path — across the base insulator. The lighting choke is another example of the use of a high impedance block to convey AC to the tower lighting circuits.

As more auxiliary services are needed by radio stations, the demand for tower space has increased. Difficulties in finding locally approved areas in which to place a tower are making every tower worth its weight in rental fees. In some areas there are towers used for auxiliary services only. The fortunate owners of several of these towers are making good incomes from non-broadcast services. This makes vertical real estate very valuable.

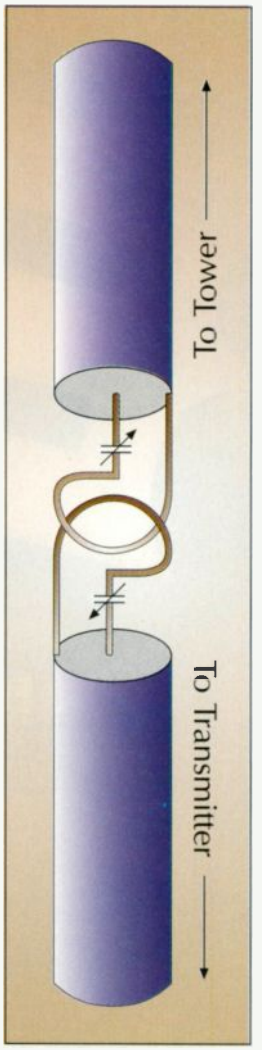

Figure 1. Basic schematic of an isocoupler.

Many radio station owners can realize reasonable additional income by renting tower space at several dollars per month per foot of antenna height. If the station is FM or television, there is normally no problem apart from possible frequency interactions and tower overloading. However, if the station is AM, something better than a quarter wave matching section is needed to get a number of new feed lines up the tower. If the tower is shorter than a quarter wave, the problem of sufficient space for a quarter wave section arises.

There are two major problems with quarter-wave matching sections. One is distortion of the antenna pattern caused by the offset extra transmission line up the tower on one side. The other major problem is poor bonding between the additional transmission line and corroded connections where the line is connected to the tower at the quarter-wave point.

The second method is to use an isocoupler, which is really a simple one-turn RF transformer whose primary and secondary windings are connected respectively to the transmitter side and antenna side of the transmission line.

Most of us have seen the Austin lighting transformer long used for tower lights. It consists of two intersecting loops coupled inductively, mounted across the base insulator. The Kintronics isocoupler looks very much like that on a smaller scale contained inside a suitable housing. Each "winding" forms a series-resonant, low "Q" 50Ω circuit tuned by means of an integral variable capacitor. The insertion loss is only about 0.2dB. A basic diagram is shown in Figure 1.

As many isocouplers as are needed to carry all the transmission lines can be added as required. The insertion losses are all individual and not additive, and do not affect the AM signal. For instance, WROK in Rockford, IL, has 12 isocouplers in use.

Examples of the third alternative, the isolation coil, are the Multi-Coax Isolation Inductor, by Kintronics, and the ColoCoil, by LBA Technology. These two devices are quite similar and work on the principle of inserting a high

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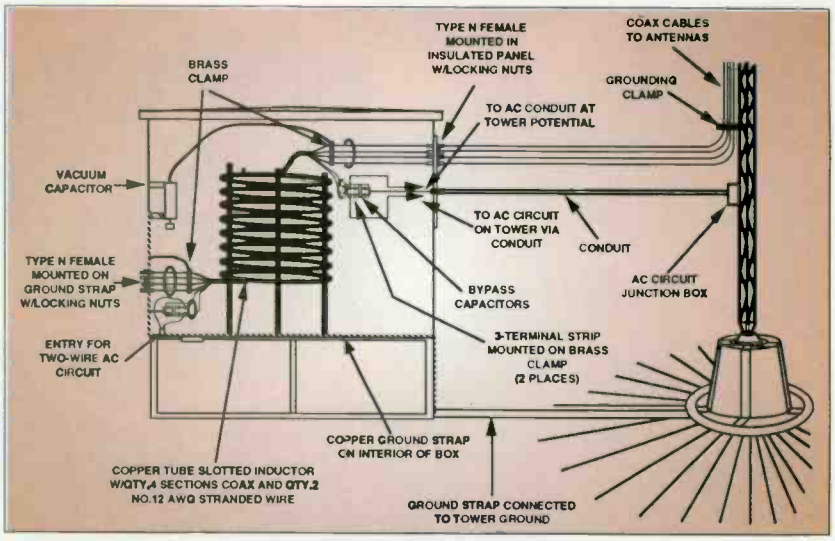
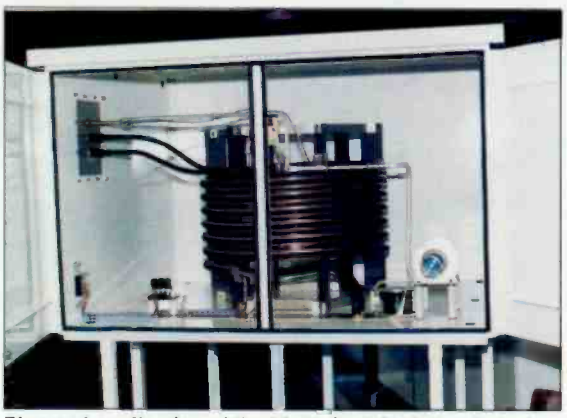
impedance across the tower base and running the necessary auxiliary transmission lines "through" this impedance.

The ColoCoil, available in sizes up to the megawatt level power, is made of slotted copper tubing, and additional transmission lines can be inserted into the turns of the coil as needed. The inductance is about 200μH and the reactance is too high to affect AM tower operation. The inductance is tuned by a suitably rated variable capacitor.

The Multi-Coax Isolation Inductor is made of slotted copper tubing and is normally designed to carry several cellular lines or similar circuits. Additional transmission lines can be added or removed as needed.





Plan and application of the Multi-Coax Isolation Inductor. (Courtesy of Kintronics.)

If used with towers over 120° in electrical height, a variable vacuum capacitor is used to tune the unit to anti-resonance. Q is kept low so as to maintain broad AM bandwidth.

More on quarter-wave stubs

Consider the case where we have a tower that is a little more than 90° high. We can take our FM, or other auxiliary antenna transmission line, and run it up the tower on insulators for a distance of approximately 90°.

This line is then bonded to the tower from the 90° point up to the FM antenna. The immediate effect would be to short the base insulator, and present an undesirable impedance to the AM driver.

Adjusting the tower operating impedance is comparatively simple. An in-line operating bridge is placed in the tower base RF drive line. The operating impedance is read and a rigger then moves the shorting bar up and down the tower until the desired base impedance is found. The shorting bar is then firmly secured to the coax outer conductor and the tower. It is essential that very clean and secure connections are made.

Because of the lumped impedance effect of the long section of shorted line on the tower, the distance from the tower base to the shorting point is usually less than a quarter-wavelength.

If the tower is too short to mount a quarter-wave section on it, the section

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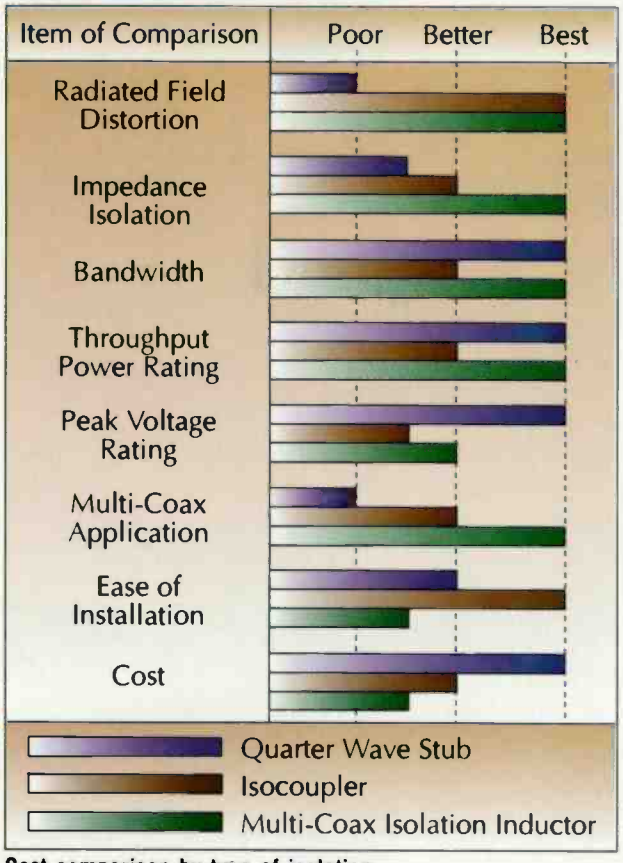


Cost comparison by type of isolation.

can be mounted partially up the tower and on the ground horizontally. The impedance is adjusted as in the case of a vertical section, except that a tower climber is not required.

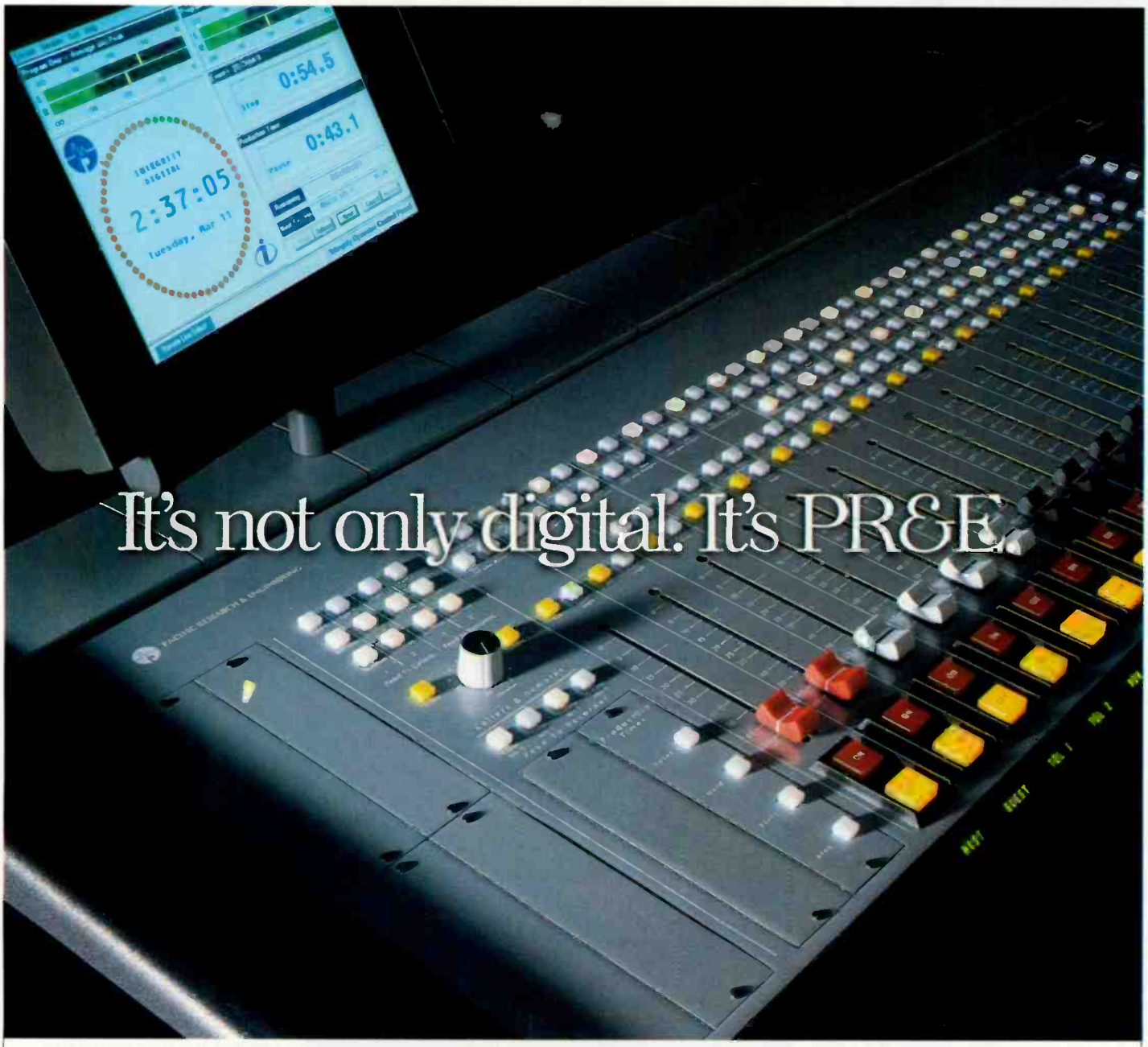
There are obvious undesirable aspects to this type of installation. The long horizontal run has to be protected from contact with the public and station employees, and there is the continual risk of RF burn.

Either type of installation can be "fine tuned" by connecting a suitably voltage-rated variable capacitor across the line to ground, and tuning for perfect match. This type of drive is frequently used by ham operators to get good HF antenna matches.

Sometimes a newcomer to the radio field comes across such an installation and "adjusts" this "antenna trimmer" with predictable results. I've come across several instances where this "improvement" resulted in several hours of work.

There seems to be no reason why most series-fed AM towers cannot be used as a support for additional antennas. As the AM power increases, it is reasonable to expect interference and other problems so that a point may be reached where it makes more sense economically to use a separate tower for low-power and sensitive installations.

Acknowledgements to LBA Technology and Kintronics for illustrations and data for this article. Phasetek makes similar equipment but did not respond to our request for information.



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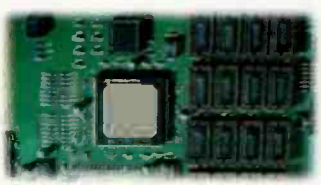

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Has the digital mixer arrived?

By Chriss Scherer, editor

This is a question that you have probably already asked yourself, especially if a new console purchase is in your near future. As the center of any on-air control or production room, the audio console has, for the most part, been the last analog link in an otherwise fully digital (or potentially so) signal chain. As more and more choices become available in digital consoles, the number of features increases as the costs decrease.

The road traveled

The first digital consoles designed for radio started showing up two or three years ago. Most of these early entries were priced substantially higher than the analog counterparts they were meant to replace. Within about the last year, the obstacle of cost has been reduced to the point of being only slightly higher than the analog designs, but there are additional features and advantages that make them very attractive.

There are two basic designs for digital audio consoles: one for on-air use and one for production settings. Some basic considerations are similar for both applications. The number of inputs, outputs and faders are a factor when choosing any console. Many installations (with analog consoles) have increased the number of inputs to avoid some of the input switching required, usually to avoid mistakes and incorrect settings. With a digital console, many of these considerations can go away.

The appearance may be new and fresh, but the function remains the same. (Photo courtesy Pacific Research & Engineering)

Going on the air

On-air digital consoles are being designed in two different directions. Analog consoles have always been self-contained, with all the sources coming directly into the console. This same approach can be applied to a digital console, thereby making a console upgrade fairly simple by almost literally removing the old console and dropping the new one into its place.

Another approach comes from the audio routing view. Routing switchers are commonly used in many facilities because they reduce the amount of wire needed between rooms and speed updates and changes. If the router is handling digital audio, the idea of adding additional DSP to control-level mixing and functions is a natural progression. The console itself is now a control surface for a central audio unit installed in the back of the room, down the hall, or possibly even further away. In a way, the console acts in a way similar to how a computer keyboard allows control and manipulation of your PC.

In an air studio, a digital console could have 40 inputs, but only need 10 faders. The idea of source switching comes into play again, but now the individual steps needed to change the personality of the console are made much simpler, because of the digital design. Individual shows can change the settings of the console with a single button press. Similar to changing a scene on a lighting controller, when the shift changes from one show to the next, the incoming person can change the personality of the entire console at one time. For example, the morning show may have needed only two CD players, but had four microphones and four virtual cart machines, while the midday shift only needs one microphone, four CD players, and one fader for all the spots (delivered from an on-air system in live-assist mode). Instead of selecting each of these changes every day, and possibly forgetting to switch one of the CD players until it is needed, a single setup can be recalled for the show. If a schedule is set up in advance, this could even be accomplished automatically. This kind of a dynamic setup could be easily used in day-to-day operations.

As machine integration continues to increase, the digital console is ready to interface into the commercial delivery system, and even change personalities based on the show clocks being used.

The number of outputs is determined by each situation. At least two stereo buses would be required in almost any situation. Add mix-minus feeds for telephones and remotes and the count goes up. The

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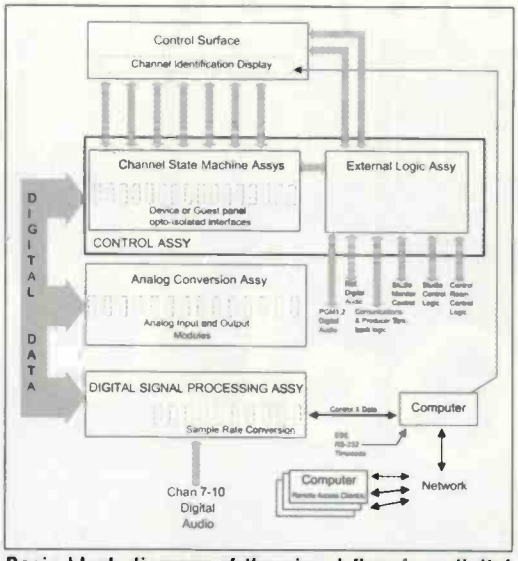
number of buses on a digital console can possibly be specified on an as needed basis.

Production uses

The production studio is a different concern. The personality of these rooms seldom changes with different users. There is also a greater need for patching and control of effects and processors. In an on-air setting, most of the inputs would need to be stereo. But in a production environment, the number of mono sources could be greater. (Some of these would not truly be mono, but individual elements from a multi-track session.)

There are several manufacturers that offer digital consoles for production use as well. Most of these consoles are designed for smaller and project studios, but the smaller size and simpler controls make them attractive for radio production as well.

In the production room, the console is almost always the main focus during any type of work, unlike an air studio where gathering materials and updating information will regularly change the operator's focus. Most multi-effects processors have external control capabilities, and the console can become the interface for these changes. The room focus would remain on the console instead of rolling a chair over to the rack to make a change and then rolling back to listen. Changes can be made without leaving the sweet spot. Several audio processor manufacturers also have alliances with the console manufacturers to provide plug-ins for the console. This puts the power of your favorite processor in the console.



Basic block diagram of the signal flow in a digital console. (Courtesy Pacific Research & Engineering)

The status of the console at any given time needs to be displayed in an easy-to-read fashion. Some manufacturers have added video displays to show the status quickly, while others have expanded the on-board channel status to show information. Another advantage to the digital control is that titles can be assigned to inputs. As the source is recalled, the title on the console can change as well.

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REPCO

Next Wave

A look under the hood

The engine of the digital console is all in the DSP. The control frame of the console contains all the necessary modules for I/O switching. There can be analog or digital I/O cards. In some installations it may be more practical to install a console with many analog cards and a few digital cards to handle the current types of devices. As the station's needs change, so can the console.

In the designs that use an external I/O chassis, the main electronics do not need to be located within the control room. If it is also acting like a router, then the need for it to be located in the rack room becomes apparent. This may be an installation concern for sources that are dedicated within a room, like CD players or tape machines. The audio and control wiring would need to be run to the rack room. However, interfacing with a computer-based storage and delivery system may require runs of only a few feet.

More functionality

With the introduction of all the facility's sources into the controller frame, any audio source within a facility would be available at any time. This would greatly simplify the wiring infrastructure. The need for multiple wire runs would still exist for some applications, but the amount should decrease.

Having the console control external sources could even go one step further. A feature that shows some promise for future designs takes this control to the next level. An ISDN audio codec would already be an input source to the console system. Add the capability of control, and that one input could be assigned several virtual positions that would not only connect the audio to the proper output, but could control the codec even further. Instead of a console input being labeled simply "codec," there could be an additional virtual input labeled "stadium," which would route the audio as needed and also use a dialing preset in the codec to call the stadium for a football game. The operator would dial up the event like a dedicated telco loop without having to think about the proper preset and operating modes. When the next event is scheduled, simply dial up the virtual input for the dance club or music hall, and the console tells the codec what to do. There is only one audio path from console to codec, but several dialing presets that look like sources to the operator.

As stations move to a fully digital environment, the last holdout is the console. Digital editors and storage systems have become common, and the CD player made a successful introduction several years ago. Digital STLs and fully digital audio processors have completed the transmission chain. Digital consoles have shown that they are practical in today's facilities. To answer the question that started this column, "has the digital mixer arrived?" The answer is yes.

FOR MORE INFORMATION
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Pristine mic preamps, natural EQ, beaucoup exclusive features, astonishing headroom, an extra stereo bus... and tens of thousands of enthusiastic owners.

MS1402-VLZ

"Great mixer. Really cleaned up the sound of my recording and has done a great job live mixing keyboards with the band and as my main mixer on solo and duo gigs." (J.S., Martinez, GA)

"Finally, a lightweight/compact mixer loaded with practical features that delivers clean, no-noise sound!" (R.B., Franklin, WI)

"Beautiful layout and the smoothest faders I've ever seen in a compact mixer." (B.L., Cedar Hill, TX)

"Great product. Clean sound. Live recordings are great! (D.L., Denton, TX)

"I really like the Control Room mixing and Alt 3-4." (R.P., Fort Lee, NJ)

"I am greatly impressed with the very low noise of the mic preamps." (T.T., Belair, SA)

"I really dig all the features you pack into such a small price. My 1402 was really easy to get into and use." (R.R., Murray, UT)

"I didn't believe the hype until I bought an MS1402-VLZ. NOW I believe the hype." (J.C., Toronto, ON)

"Sure like that 'stereo solo in place' feature. Also, headroom is great with lotsa presence." (L.S., Forest Grove, OR)

"You've heard it all before, I'm sure. Great product. Great price. Options and versatility out the wazoo, from hardware design right down to panel labeling." (J.H., Ithaca, NY)

"I really like the EQ points you've chosen and the EQ curves." (B.M., Lanseshore, MA)

"Plastic mixers can break easily. The MS1402 is made of metal!" (M.S., Shorewood, IL)

"I will be using the MS1402 to track all keyboards on MANDBWDWTTWEL* for Atlantic Records." (R.H., New York, NY)

*Major act, name deleted because we don't want to tangle with entertainment lawyers.

6 mic preamps. The same high headroom, ultra-low noise (–129.5 dBm E.I.N.) preamps used in our 8•Bus studio consoles.

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2 aux sends per channel.

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Solid steel chassis.

Easy level setting via LED display; in-place stereo solo feature maximizes headroom & minimizes noise.

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Constant loudness pan control for precise stereo mixes.

Alt 3-4. The MS1402-VLZ's Mute button is really a second stereo bus in disguise. A Mackie exclusive.

60mm faders with true log taper for accurate fades throughout the controls' travel.

"The Alt 3-4/Mute is ingenious!" (B.L., Cedar Hill, TX)

"On my test run — a live acoustic show — I was impressed by the quiet and user friendliness of the MS1402-VLZ. The audience was also impressed with its crystal clarity." (F.A., Bloomington, IL)

"The 'RUDE' solo light is certainly that, but you never have to worry about leaving it on by mistake." (L.B., Winnepeg, LB)

"The Low Cut button is a big help in cutting boomy stuff when running a big bass and arch-top guitar live." (G.S., Kirkland, WA)

"The quality of the EQ is amazing! I was blown away by the tone and clarity." (J.D., Pomeret, CA)

"The MS1402-VLZ is great — excellent specs (I teach audio engineering) and really clever routing options." (J.P., Los Angeles, CA)

"What I heard when I hooked up my MS1402-VLZ was exactly what I wanted to hear. Nothing. Cleanest mixer I have ever worked with." (R.S., Fergus Falls, MN)

"The 1402 RULES! People all the time come and tell me how wonderful the sound is." (P.F., Cinncinati, OH)

"It survived and played through a glass of iced tea spilled all over it at a fashion show for a very important client of mine. Show was perfect. Client paid. I'm buying more Mackie." (H., Houston, TX)

"I do work as a Senior Executive Producer for [major classical music label]. The MS1402 was highly recommended by several studio engineers." (S.E., NY, NY)

"Great product!" (C.B., San Francisco, CA)

Below: A few of the 400+ folks who work at Mackie Designs in Woodinville, WA, 20 miles north of Seattle.

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June 30 deadline for tower registrations

By Harry Martin

In March, the FCC announced that all tower structures built before July 1, 1996 must be registered by June 30, 1998. The Commission established a two-year period (from July 1996 to June 1998) for owners to register existing structures of more than 200 feet in height. To facilitate the registration process, the Commission established filing windows based on geographic location. Only the Texas window, which closes June 30, is still open.

Owners who have been granted waivers to register all of their towers together, and those who have missed their filing windows must submit registrations by the announced June 30, 1998 final deadline.

Nevertheless, owners of towers built before July 1, 1996, for which a new FAA study is required, should not register their structures until a valid FAA determination has been received. Towers built after June 30, 1996 which require registration must be registered prior to construction.

Antenna structure registration applications may be filed either electronically, or by mail using FCC Form 854. Those who register electronically will receive a registration number within minutes. There is no registration fee, nor will owners be required to renew their registrations. However, structure owners must notify the FCC of any change in structure height, ownership, the owner's address, or upon the dismantling of the tower.

After registering an antenna structure with the Commission, the tower owner will receive an FCC Form 854R containing a unique 7-digit number identifying the tower. Tower owners are reminded that they must post the registration number for their structures in a conspicuous place on or adjacent to the tower structure so the number is readily visible.

Review of ownership rules commences

The FCC has commenced a formal inquiry to review the continuing necessity of its broadcast ownership rules. If the FCC determines in the course of its inquiry that any rule should be modified or eliminated, it will commence a subsequent rulemaking proceeding to do so. This initiative is responsive to a Congressional mandate for biennial review of such rules included in the 1996 Telecom Act.

Not included in the formal inquiry are the TV duopoly rule (prohibiting ownership of two television stations with overlapping "Grade B" contours), the "one-to-a-market" rule (prohibiting ownership of both a TV and radio station in the same market), and the daily newspaper/radio cross-ownership rule (prohibiting ownership of both a daily newspaper and radio station in the same market), which are already undergoing review in separate rulemaking proceedings. The FCC anticipates taking action in these rulemakings by the end of the year. Additionally, the FCC does not believe its attribution standards are subject to biennial review.

The 1996 Act relaxed the local radio ownership rules to increase the number of radio stations an entity may own in the same market, with the number varying by the size of the market. The FCC states that the 1996 Act relaxed the local radio ownership rules to a much greater extent than it modified the national TV ownership rule. Concerned about the resulting concentration of control in radio, the FCC is seeking comment on the effect of the local radio ownership rules on competition in radio, diversity in radio, and minority and female ownership of broadcast stations.

While this rulemaking proceeding is pending, the Audio Services Division of the Mass Media Bureau is deferring action on transfer and assignment applications which involve the creation of combinations of stations where a single entity will control 50% or more of market revenue or two entities will control 70% or more.

Comments regarding the ownership rules under review in this inquiry are due May 22, 1998. Replies to the comments will be due on June 22, 1998.

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 jurisdictions must file their annual ownership reports by June 1, 1998: Maryland, Virginia, West Virginia, District of Columbia, Michigan, Ohio, Arizona, Idaho, Nevada, New Mexico, Utah and Wyoming.

The ownership report deadline for stations in the following states is August 3, 1998: North Carolina, South Carolina, Illinois, Wisconsin and California.

Tower owners in Texas must register with the FCC between June 1 and June 30, 1998.

Annual Emplyment Reports (Form 395-B) are due September 30 instead of May 31.

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PUTTING IT ALL TOGETHER

The BE Radio reporters were busy on the show floor this year investigating all the new products. While the real buzz was about DTV for our TV cousins, there was plenty of news for new products in radio. The trend of less vaporware and speculative products was also obvious. The products being shown were not mock-ups. This is not to say that manufacturers aren't looking ahead. Many had information and demonstrations about works in progress, but they weren't the main focus. Many of the products mentioned here will be featured in the August Product Source guide issue of BE Radio.

Index:

By Jeffrey A. Keith, CPBE, NCE

Audio processing can play a major role for your station. The on-air sound is your signature. The tools used in production can give some extra sizzle to the work being created. While there were a few new product introductions, much of the news dealt with new versions of software or improved interface options.

Inovonics Inc. introduced the Model 235 Tri-band AM Broadcast Audio Processor, a fully NRSC-compliant and AMAX-certified product. The Model 235 features a slow, gated AGC ahead of a three-band compressor/equalizer designed to optimize the input program's spectral density and which can be controlled via its on-board RS-232 serial data port.

T.C. Electronic was showing the new Gold Channel, a two-channel digitally enhanced microphone preamplifier. It features high-resolution, 24-bit, 96kHz A/D conversion with equalization and dynamics processing. The Gold Channel's features include an expander/gate, compressor/limiter, equalizer and additional processing tools, all accessible through an easy-to-use channel strip interface. Also displayed was the new DB MAX II featuring 24-bit A/D and D/A converters, an auto hardware analog bypass function (allowing signal to pass through the unit even if the unit is off), a new EQ with a multiband clipper function, five bands of expansion, compression and limiting, and a new adaptive automatic gain controller, all combined with the ability to simultaneously insert multiple signal processing functions pre and post.

Also announced was an alliance with Yamaha to manufacture the TC Unity effects plug-in card for the O2R console.

Aphex Systems has announced the addition of the Big Bottom Pro plug-in to its growing line of TDM products for Pro Tools. The new plug-in provides features similar to those found in the hardware version of Big Bottom, as well as some new features that provide even greater flexibility. Also introduced were several plug-ins: the Type IIIpi, TDM plug-in and the Aural Exciter, which has been a hardware standard for over 20 years. The Aural Exciter Type IIIpi will give production greater depth, clarity, intelligibility and natural brightness — all quickly and easily — without eating up headroom. Also on display was the FM Pro Model 2020, introduced last year.

Orban introduced the Optimod-DAB 6200, specifically designed to meet the unique demands of digital audio radio, two-channel TV broadcasting, and webcasting. It offers several levels of processing power, including Protection Processing, which provides peak control without audible compression; Two-Band Processing, which controls dynamic range while maintaining the frequency balance of the original program, and; Five-Band Processing, with a flexible set of equalization controls that lets a broadcaster create a signature sound. Multi-band processing has also been shown to greatly increase the intelligibility of webcasting. Also introduced was version 3.0 software for the Optimod-FM 8200, a sweeping upgrade to the current software that not only contains newly created presets, but many "power user" features as well. There is now a phase rotator on/off control, adjustable output controls for the five-band compressors, an adjustable bass clipper threshold, and control of AES3 status bits to accommodate digital STL's.

Eventide introduced the new Model DSP4500 Ultra Harmonizer, a combination of the DSP4000, DSP4000B, and the GTR4000. The DSP4500 is a limited edition, with every preset of the three previously mentioned units and then some. There are more than 1000 program presets and an 87-second internal sampler. The DSP4500's presets draw on the capabilities of the 147 distinct effects modules, and an "algorithm construction set" allows you to build totally new effects by linking modular effects as "building blocks." The DSP4500 also supports all common sample rates, as well as a user-defined sample rate, if so desired (a factory installed user-supplied crystal is required). All internal processing is at 56 bits for superior dynamic range. True 24-bit AES3 I/O is supported, as is standard analog I/O in balanced and unbalanced formats via 20-bit A/D and D/A converters. SPDIF digital I/O and user-selectable SCMS copy inhibit are provided, as well as MIDI I/O/Thru jacks.

dbx introduced the DDP, a 1RU, programmable multi-effects processor. Effects include compressions, expansion, gating, reverb, delay, EQ and de-essing. The display lets you see what changes are being made with a graphic plot, allowing finer control and greater versatility. The extensive line of dynamics processors was also on display.

Cutting Edge Technologies has been busy working on applications and enhancements to the Omnia processor. The D/CET (Digital Composite Enabling Technology) interface was introduced. Designed to connect the output of a digital processor's stereo generator directly to the modulator in a digital exciter, the unit allows better control of loudness, modulation, and improved audio quality. A prototype setup was on display with an Omnia.fm and a Harris Digit exciter. Also being shown was the enhanced control software for the Omnia family. The new software operates on a Windows machine. Also on hand was a new member to the Omnia family. The Omnia.fm.jr allows users to get the advantages of the Omnia processor in a scaled-down package that is fully upgradeable to a full Omnia at a later date.

Independent Audio represents Cedar, a manufacturer of audio tools for the removal and suppression of unwanted noise, particularly for use in restoring archived material. The DCX Deticker (for removing ticks and pops), the CRX Decrackler and the DHX Dehisser can be used to transfer rare vinyl or aging tape recordings for future use. Independent Audio was also showing audio processors from Calrec, including the RQ series of processors: RQQ 2200 dual mono EQ, RQP 3200 pre-amp, EQ compressor/expander, RQD 6400 dual stereo compressor/limiter and the RQP 4400 four stereo-microphone pre-amp.

Broadcast Electronics was showing the Lynx digital stereo generator. This DSP-based unit accepts analog or digital input signals and is ideal for stations with digital STLs that still want to use their analog exciters.

Jeffrey A. Keith is Chief Engineer at WMJI-FM, Cleveland, OH.

By Marty Conser

With near continual steps forward in convenience and capacity, NAB98 pushed the audio recording envelope. Several companies, recognizing that those steps could translate into leaps toward market share, announced the integration of new storage technologies as part of updates for existing product lines. Most new recorders included new media capability as part of their slate of attractions. All in all, the media was the message.

360 Systems showed its DigiCart/II Plus, which now supports a ZIP drive. Existing DigiCart users with the Bernoulli drives will be offered the opportunity to upgrade. All of the 360 Systems products support fully compatible file transfers. Also shown was the Instant Replay with version 2.0 software. The new version supports an external SCSI drive for audio backup and storage.

Quantegy displayed its full line of recording media, including CD-R, DAT, ADAT, DTRS, MO and cassette. New to the line is a high-performance ADAT formulation for critical recording applications.

Iomega, makers of the already-popular ZIP family of storage solutions, announced shipment of 2GB JAZ drives and disks. The 2GB drives offer a maximum sustained transfer rate of 8.7MB/s, twice the capacity and 40 percent higher performance than the original 1GB JAZ drives. The higher capacity disks offer broadcasters more than three hours of CD-quality (44.1kHz, 16-bit) audio.

Akai showed its DPS12 Digital Personal Studio, a 12-track random-access digital disk recorder and digital mixer. The unit allows users to eliminate complex product interfacing while keeping data in the digital domain. Recordings can be stored on optional, removable JAZ cartridges or optional SCSI hard disks. Six balanced, analog inputs feature high-quality mic preamps and a SPDIF stereo digital input enables the DPS12 to record on all eight tracks simultaneously, with 12 tracks of uncompressed, full random-access edit capabilities with no generational loss on playback.

Tascam unveiled several items. The 130 cassette deck is a three-head deck with vari-speed and Dolby B, C and HX Pro and is rack mountable. Also shown was the new CD-A500 integrated cassette and CD player, ideal for situations where space is limited or frequent CD-to-cassette dubs are made. The RC-828 is a remote controller for the Tascam DTRS multi-track machines. It can control up to four machines at once. Also new are the MMR-8 and MMP-16 multitrack hard-disk recorders. The optional MM-RC remote control can operate up to 100 of either of these machines for even further integration.

Sonifex was showing software version 1.0 of the Courier PCM/CIA digital recorder, a portable stereo recorder and editor, and the Sentinel series of audio loggers.

Eventide displayed its complete line of audio logging systems, including the newest member of the family, the VR204HF. The popularity and success of the VR204 has been enhanced to record full FM-quality fidelity, ideal for logging and rebroadcast applications.

The newest version of the DCR-10 removable media recorder from Fidelipac was shown, replacing the DCR-1000. The first designs for this product were unveiled several years ago and refinements and advances have been made. It is available with ZIP (100MB), high-density floppy (2MB) or MO (640MB) drives and an optional hot start keyboard can be attached to provide "cart-wall" access. A sampling rate of 32kHz is standard. It can also be configured with a digital I/O and 44 or 48kHz sampling rate.

Marantz has unveiled two PCM/CIA recorders: the PMD680 and PMD690. These are mono and stereo (respectively) versions of a portable recorder that can record linear or MPEG Layer II audio onto removable PCM/CIA cards. Mic and line inputs, built-in editing, and a parallel data port for the export of files to a PC are all standard. (See Pick Hits Honorable Mentions, p. 68.)

HHB, manufacturers of digital recorders, offered its CDR800 CD recorder and PDR1000 DAT recorder. Also on hand eight-track digital recorder. HHB also carries a full line of recordable media for DAT (audio and data), CD-R, MiniDisc (audio and data), MO, DTRS and ADAT formats.

By Yasmin Hashmi

Some might think that there are already enough digital audio workstations to choose from, but for those always on the lookout for something new, NAB98 was no disappointment. Of course there were enhancements and new releases, and developments in the area of file compatibility in particular were certainly encouraging, but proving that manufacturers are ever-confident of finding a hole in the market, yet another clutch of new products was also on show.

New systems, bundles and cards

Sonic Solutions introduced new CD and DVD audio workstations for mastering up to 24-bit, 96kHz multichannel audio, as well as a new high-density I/O supporting up to 192kHz sampling, and a new DSP plug-in processor that can run third-party applications. On the subject of CDs, as well as showing its OMR8 24-bit modular eight-track recorder, Digital Audio Research made its first US showing of CDAdvance. This com-

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bines faster-than-real-time transfer with varispeed and scrub facilities, and allows CD material to be accessed directly from a DAR SoundStation or Sabre, or via a network.

Other new systems included the WaveFrame 408 Plus that supports eight-channel playback through a single SCSI bus, seamless compatibility with the Tascam MMR-8, OMF 2.01 compatibility and .WAV, AIFF and SD2 import/export. Steinberg introduced Nuendo, a software application that takes advantage of the built-in AES3 and ADAT interfaces of the Silicon Graphics O2, Octane and Onyx workstations.

For lower-budget applications, Antex announced price reductions and a new bundle comprising its StudioCard AV Pro and its newly released Antex Breakout Box. The company also introduced two new 20-bit products in the form of the StudioCard 2000 and the Broadcaster. This 20-bit audio card can simultaneously record at one sample rate and playback at another. The card has eight balanced analog outputs, one stereo AES3 output, two analog inputs and one stereo AES3 input. Antex has also made partner agreements with several DAW and automation manufacturers to incorporate Antex cards into their systems.

Digigram's PCX bus family

Meanwhile, in addition to announcing Xtrack LC, a low-cost, light version of Xtrack for news and other basic editing operations, Digigram launched the PCXnp PCI bus and the "value-priced" LCM range of cards. The PCX820np (analog out) and PCX821np (digital out) have four stereo outputs and one stereo input. Digigram also announced several alliances with DAW and automation developers to include the Digigram audio cards as part of their systems. Other card launches included the Applied Magic On-Stage four-channel PCI audio card that is compatible with third-party Windows NT editing packages and includes DSP supporting eight-channel real-time mixing, and the new four-channel APT ADK200 Windows NT-compatible card, available in 16- or 20-bit versions with a choice of coding algorithms to complement apt-X.

If you already know these interesting facts about Akai Digital Recorders . . .

8 Track simultaneous disk recording • Expand to 28 tracks • Link up to 8 machines • 18 bit ADC • 64X oversampling • Internal processing • 16 channel digital mixer • Dynamic MIDI mix automation • Point autolocator • AES/EBU and S/PDIF digital I/O • 50 pin SCSI port • 8 levels • 8 in 8 out +stereo master (DR 8) • 8 in 16 out + stereo master (DR16) • Control with fine resolution mode • Varispeed playback • MIDI automated mixing • MIDI Machine control • Autolocate • Word clock/video sync input • Switchable + Overview™ SVGA card - $699 • ADAT interface - $299 • BiPhase film sync - $299 • 2nd SCSI port - $299 • 16 channel EQ - $550 • 16 channel 3 band parametric EQ - $ • Non-destructive editing • Simultaneous disk recording • 20 bit DAC • 8X oversampling ADC • 64X oversampling • Built-in mic preamp • Dynamic MIDI mix automation • 1/4" TRS in/out • 50 pin SCSI port • Balanced input + stereo master (DR16) • Balanced input • Compatible with DR8, DD8 and DR16 • Adjustable preroll • 50-pin SCSI port • +4/-10db line levels • Auto punch In • MIDI interface - $299 • S.M.P.T.E. controller - $299 • MT8 MIX EQ - $699 •

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PR&E displayed the Sound Fire, an audio engine that operates on the IEEE 1394, or FireWire, bus, providing a connection to offer multiple streams of audio from a single computer. It is capable of eight stereo streams, six outputs and two inputs.

Alesis has also entered the world of random access with the introduction of its AT-PCR PCI card. Designed to allow transfer between 20-bit ADAT Type II multitrack tape recorders and Windows 95/NT or Power Mac platforms for editing, the ADAT-PCR includes editing software, ADAT optical digital I/O and a sync interface that not only allows sample-accurate transfer to/from the computer, but allows the computer to act as a virtual ADAT, effectively adding another eight tracks to an ADAT system.

Self-contained compacts

Designed for radio broadcast applications where sound effects, music cuts and other audio items must be frequently updated and cued, the new 360 Systems Instant Replay Version 2.0 was on show, providing instant access to 1000 audio cuts and supporting both linear and Dolby AC-2 compressed recording. For the small recording studio, Akai unveiled the DPS12 with 12 editing tracks, eight-track simultaneous recording of uncompressed audio using JAZ or SCSI drives, and a built-in two-channel digital mixer with full MIDI or snapshot automation.

More bits and tracks

Fairlight announced that its MFX now supports 16, 18, 20 and 24-bit clips, which can be sequenced in the same session, and Digidesign declared that its Pro Tools/2 24-bit system now supports up to 64 tracks of recording and playback, depending on hardware configuration. The new AMS Neve AudioFile 98 supports sequencing of 16-bit and 24-bit recordings in the same session, as well as waveform displays and audio threshold recording, while the new Otari RADAR II also sports 24-bit recording, and can be controlled using a 48-track remote with optional meter bridge.

Controllers and plug-ins

Digidesign previewed its long-anticipated ProControl hardware surface for Pro Tools TDM systems. ProControl allows not only mixing and routing control, but also control of all editing functions, as well as direct control of menu selection and alpha entry. In fact, a full-featured version of Pro Tools III software is included in the Digidesign AudioVision. Having been re-engineered to run on PCI Power Mac computers, AudioVision now has the ability to run more than 100 TDM plug-ins.

In addition to D-Vision and Lightworks audio compatibility, new plug-ins are also available for SoundScape Version 2.0. These include Synchro Arts VocAlign automatic post sync dialog replacement, SoundScape Au-

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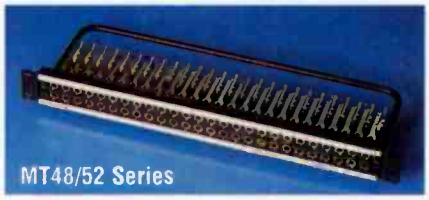

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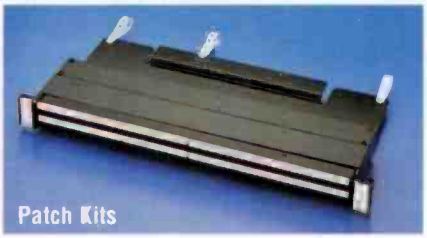

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dio Toolbox dynamics and delay, and C Electronics reverb. All of these plug-ins, as well as the SoundScape V2 mixer, are also supported by the new SoundScape Mixtreme 16-channel PCI card aimed at the prosumer market. Meanwhile, Merging Technologies has developed a plug-in for Pyramix in the form of TimeZone time compression/expansion, and has also introduced the new Keops PCI audio card that supports 16 tracks of live I/O, plus 16 tracks of disk-based playback, and the Sphynx digital audio interface that allows for the selection of sync sources from within the Pyramix application.

Networking

As manufacturers strive to improve the work flow of complex studio operations, more are developing networking solutions that avoid the need for physical transfer or material duplication.

The key feature for the new Orban Audicy Version 2.0, for example, is its Windows95/NT networking capabilities that support file transfer, including .WAV file interchange and download from the Internet. The new AMS Neve StarNet fibre channel audio network allows multiple AudioFile workstations to connect to any combination of multitrack projects, source material and sound libraries, by means of replacing the direct connection between the AudioFile and its local storage with connection to any storage device on the network, including network-wide offline backup and restore devices via the new AMS Neve MediaToolbox.

File compatibility

Perhaps the hottest subject at the show was file compatibility, not only for editing systems but also modular recorders, since these are often required to be used with a range of disparate systems. Such recorders include the Akai DD8, that can now load OMF files, Mac disks, and Pro Tools native audio and sessions including ProTools 24-bit files. The system can also create a Pro Tools session for direct opening by a Pro Tools system, can load WaveFrame format MMR disks and export EDLsoft cue printing software. The new Version 1.3 software for the Tascam MMR-8 eight-track recorder/player and MMP-16 16-track player can play BWF format files created in the Zaxcom Deva, and also allows the MMR-8 to record SD2 and Pro Tools session files directly to a Mac disk.

Another system that supports Pro Tools playback and OMF is the Fairlight DaD dubber, which now allows native playback of Timeline, WaveFrame, .WAV and AIFF files.

Compatibility is also an issue for those editing systems that must be able to work with files used by other systems, such as on-air delivery systems. The dSP Postation and Desktop for example, now support OMF Connect Version 2.1 software, that allows OMFI file import/export, as well as import/export of .WAV and AIFF files, and Spectral now offers seamless integration of its Prisma system with the Enco DADpro and DADpro32 on-air delivery systems.

Taking things one stage further, a group of companies led by Avid, Digidesign and Microsoft is collaborating to develop the Advanced Authoring Format (AAF) for cross-platform, cross-product digital media sharing and exchange. According to Digidesign, all applications supporting OMFI 2.x will be able to share files with AAF applications. OMFI will be migrated to the Microsoft Structured Storage container format to form the core of AAF, and AAF will also employ the Microsoft Component Object Model, an inter-application communication protocol supported by programming languages such as C++ and Java. The result will be a software developer's kit available for many different platforms and operating systems, including MacOS, due to be available in late 1998. If all goes well, perhaps we can look forward to some exciting announcements at NAB99.

Yasmin Hashmi is a partner in SYPHA, publisher of The Tapeless Audio Directory, a buyers guide that provides details on over 300 disk-based audio systems. Reach her at sypha@compuserve.com or +44 181 761 1042.

Audio test & measurement

By Kirk Harnack

Testing and troubleshooting a consolidated plant presents its own set of challenges. Time efficiency necessitates automated testing methods. Moreover, tests must be accurate, quick, and lead to problem resolution.

NAB98 witnessed the introduction of several new products and numerous product upgrades in this category. Here are some noteworthy offerings.

Audio test and measurement equipment

Audio Precision introduced the Portable One Dual Domain audio analyzer. Unlike A/D analyzers which use D/A or A/D converters to translate the signal under test, the Portable One Dual Domain analyzer generates and analyzes audio signals in native domains. The analog half of this new Portable One can generate and analyze all the standard signals such as sine and square waves, SMPTE (or DIN) signals, plus the ability to

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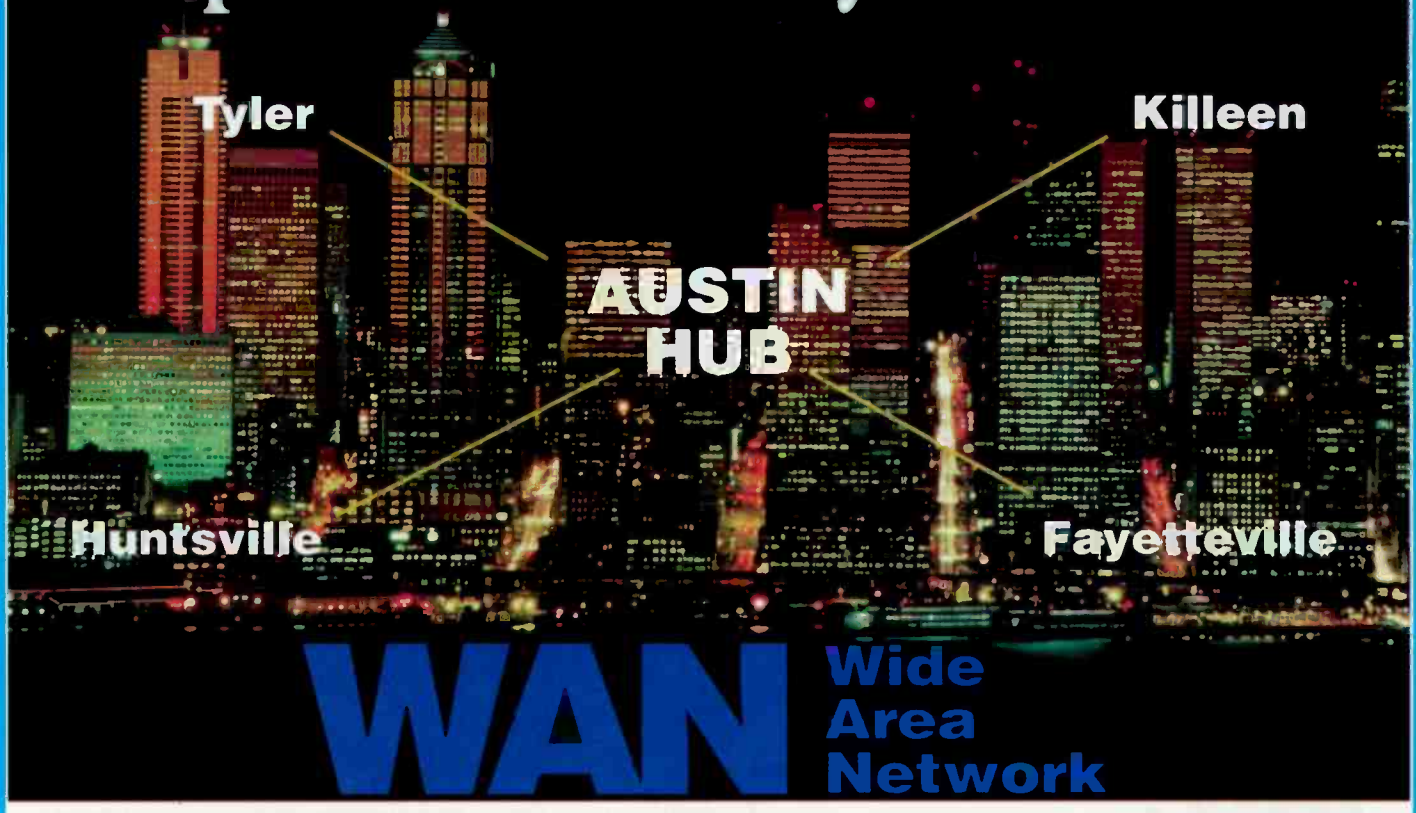

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analyze wideband and bandpass amplitude, frequency, phase, THD+N, SINAD, crosstalk, and wow and flutter. The digital side of the Portable One can also generate and analyze a standard compliment of signals in the digital domain. Additionally, impaired digital signals may be generated and analyzed. Jitter amplitude, jitter frequency, jitter frequency range, spurious jitter and other impairments may be dialed in and added to the precision output signals to determine the "digital cliff" in a system. Both the digital generator and analyzer offer AES3, SPDIF-EIAJ and optical interfaces. A range of sample rates and word lengths are also available to the engineer. The unit also features save and recall of stored tests and data.

Audio Precision's Portable One Dual Domain audio analyzer

DGS Pro Audio is representing the upgraded Prism Sound DSA-1. The DSA-1 is a hand-held, battery-powered test set for digital equipment and systems. The newest version 2.1 upgrade provides several new functions, including signal generation, channel-status editing, printing and uploading of test results, user-definable test sequences, transmission bit-error testing and jitter generation. Several options for controlling the DSA-1 with a PC are now available. Existing DSA-1 owners may upgrade their units with a PC and serial connection to the DSA-1's FLASH memory.

Neutrik was showing its A2-D audio analyzer for analog and digital measurements.

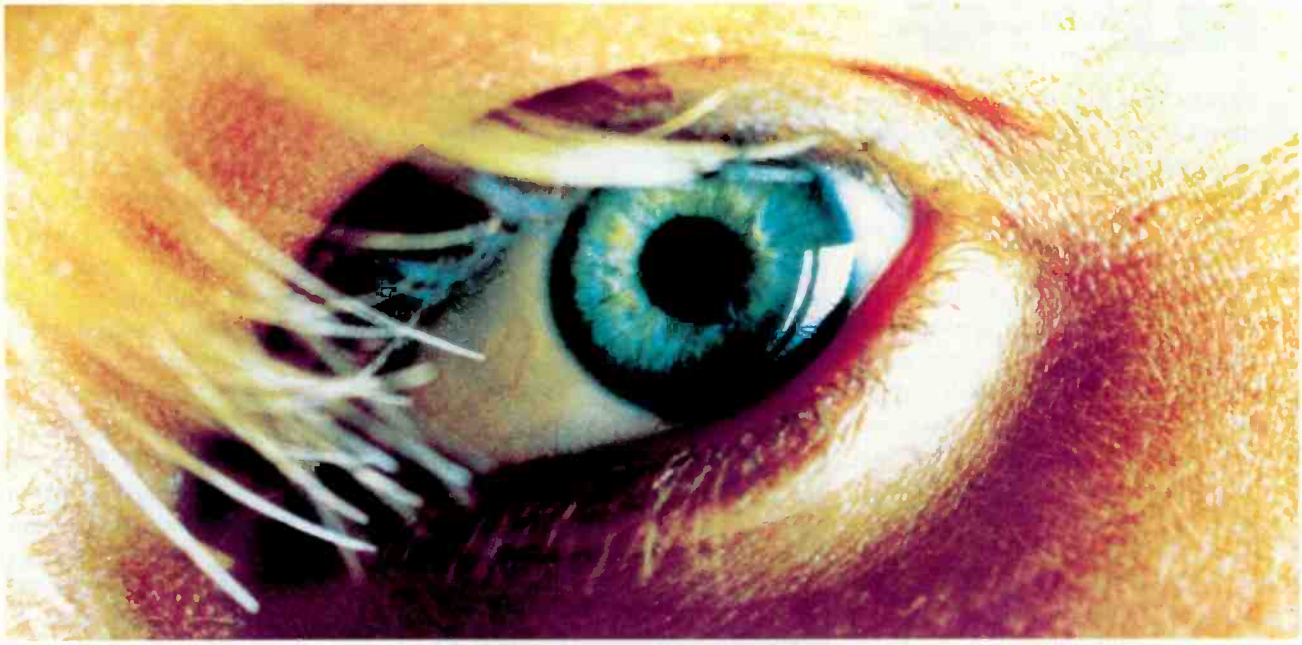
Ward-Beck introduced the Bit Spitter to go with the Bit Buddy for digital trouble shooting. Both offer adjustable rates, and battery power for the engineer on the go.

Kirk Harnack is president of Harnack Engineering, Inc. and director of engineering for Delta Radio, Inc.

Wire & distribution

By Kirk Harnack

The radio industry is consolidating. Engineers who once cared for two or three studios are constructing and maintaining five, six or even 20 audio suites. While patch bays and punch blocks still have a place, today's facility design often calls for more sophisticated audio and data routing solutions. A consolidated radio facility can



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require that one hundred or more audio sources be dynamically routed to as many destinations.

Broadcast Electronics introduced its AudioPOINT routing switcher (see Pick Hits, p. 68.). The AudioPOINT simultaneously routes analog and digital audio using a DSP-based routing engine. The DSP-based routing engine allows advanced functions not usually associated with routing switchers. Programmable audio delay, creation and analysis of test signals, gain adjustments, EQ control and mixing of audio sources are all possible. Routing of sources and destinations is format independent — analog, digital, synchronous, asynchronous, or MADI (multi-channel audio digital interface) inputs can all be mixed and synchronously switched in the same system. System size begins at 32x32 and is expandable up to 1024x1024 using one DSP core. Additionally, using the AES-10 standard known as MADI, an AudioPOINT

system can connect several audio centers within a building or campus. Using two coaxial cables between MADI interfaces, 54 bidirectional channels of audio and machine control may be routed from studios or other facilities some distance from the DSP core. Software configurable remote panels are available for individual studios. Sophisticated PC control is available locally or from other PCs via standard PC networking.

T1 is the focus of Intraplex and its new equipment. Through a partnership with Glenayre Western Multiplex, Intraplex demonstrated wireless T1 connectivity between sites (See Pick Hits, p. 68.). This solution, integrating Intraplex' STL PLUS and Glenayre's LYNX.sc spread spectrum radio, provides an alternative to congested analog STL frequencies, leased analog lines or leased T1 circuits. The STL PLUS and LYNX.sc solution provides bi-directional channels for transmission and backhaul of compressed or uncompressed digital program audio, plus voice and data. No FCC license or frequency coordination is required.

Intraplex also introduced a new family of digital cross-connect systems to reduce T1 network costs and enhance reliability. Two new prod-

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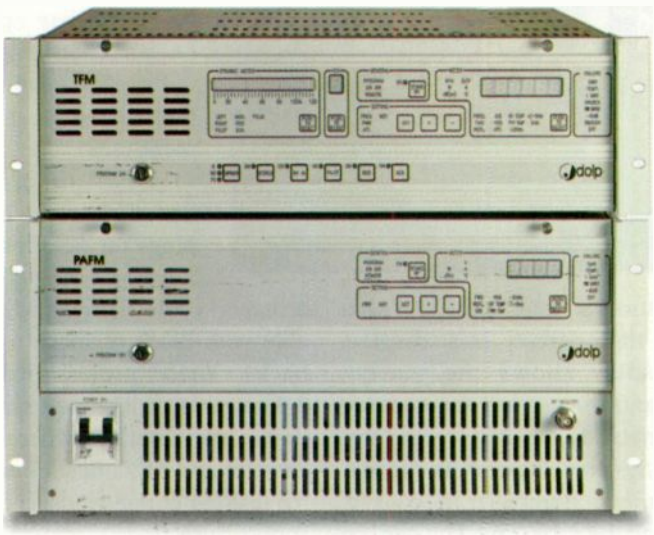

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ucts, the DCS-9500 Digital Cross-Connect System and the DCS-9560 Cross-Connect Access Server, allow traffic from up to six under-utilized T1 lines to be combined on a single T1, without degradation. The DCS-9500 allows digital transmission bandwidth to be shared between production studios, broadcast studios and transmitter sites. Program audio, data and voice circuits can be dynamically routed among up to six locations. Because digital data streams can be switched between T1 lines without demultiplexing, signal quality is preserved and multiple analog-to-digital conversions eliminated. The DCS-9500 works in conjunction with Intraplex' STL PLUS and TDM-160 Series T1 multiplexers. The DCS-9560 Cross-connect Access Server has the same features at the DCS-9500 with additional space for Intraplex channel cards. By consolidating and combining traffic onto a single T1 circuit, broadcasters can reduce the monthly charges for leasing multiple lines that are not used to capacity.

Leitch, a name common to TV engineers, introduced a digital routing switcher with applications for today's radio broadcaster. The Integrator modular router is available in analog audio, AES, analog video and serial digital video versions. It lets users mix analog and digital formats in the same frame. The hardware is front-loading and features hot-swap capability for power and logic cards, as well as backward compatibility with all Leitch products. The Integrator is available as small as 32x32 and expandable up to 124x64. A dual output version is also offered. All versions feature deterministic, field-accurate switching, software-configurable matrix partitioning, tie line management and source restrictions.

Symetrix, known for audio processors, displayed its DA the 581E. Comprised of four 1x4 sections, it is 1RU and shows impressive audio specification, and each section includes an input level LED indicator.

Sierra Automated Systems (SAS) continued its development of compact routing switchers with the introduction of the SAS 16000-D. It provides a 32x32 AES3 matrix in a 2RU chassis and provides full system access controls and alphanumeric displays on the front panel. Included is Sierra's SAS CMC Configuration Management and Control software. Other features include non-volatile system memory, built-in confidence monitoring and analog outputs, compatibility with all SAS remote control heads and convenient installation wiring accessories. SAS also introduced a new control head for all SAS routing switchers. The new head fits into a standard audio console frame and features a "take" button with a built-in high-density LCD display. The display shows the current source and the pre-selected source simultaneously.

Radio Systems showed its repackaged distribution amplifier, the da4x4a. This quad four by one DA can be strapped for quad, stereo or mono operation and has audio peak LED indications on each section.

Neutrik USA introduced two new products — a family of AES3 digital audio adapter transformers, and a new XLR connector called EaZyCon. The AES3 adapters are designed to allow longer runs of AES3 audio over 75Ω unbalanced coaxial cable with conversion back to 100Ω balanced connections at each termination. The adapters perform impedance matching between 100Ω and 75Ω, transition of balanced/unbalanced circuits (balun), electrical isolation (optional), and reduction of hum and noise. Insertion loss is less than 0.3dB at 0.1 to 10MHz. The adapters are available in either male or female terminations for the 75Ω BNC connector.

The new EaZyCon XLR connector family offers rugged construction, a soft-coated surface for solid, wiggle-free connections and a choice of wire terminations. Gold plating is standard, but a solder version is available with pre-tinned and pre-fluxed contacts. The solder version takes less time to assemble (and fewer hands).

Switchcraft introduced several innovative patch bay systems in both 1/4" and TT patch sizes. Those preferring EDAC connectors can now use them for patch bay wiring with Switchcraft's TT96EDAC series. Another TT patch bay featuring a slide-out tray and IDC connectors was introduced. Wiring to this patch bay appears to be very convenient since terminations can be made from the front the equipment rack.

Switchcraft also introduced a line of 3.5mm male plugs for field installation. They feature gold plating, a rugged cable clamp, and are available with black or nickel connector backs. These professional quality 3.5mm plugs will be a welcome addition in radio stations where portable cassette and MD units are used, and for making connections to computer sound cards.

Ward-Beck had several items on display for routing and manipulation of digital audio. The D8201 digital audio DA, the D8202 and D8203 D/A and A/D, and the D8204 75Ω DA. The POD line includes the POD10 6x1 AES3 audio switcher, the POD11 AES3 monitor, the POD12 AES3 reclocking distribution amp, and the POD13 dual D/A.

With so many stations making transitions to more digital routing, the cabling required must also change. Whereas we usually think of wire being simple copper runs, digital signals are not as forgiving. Belden,

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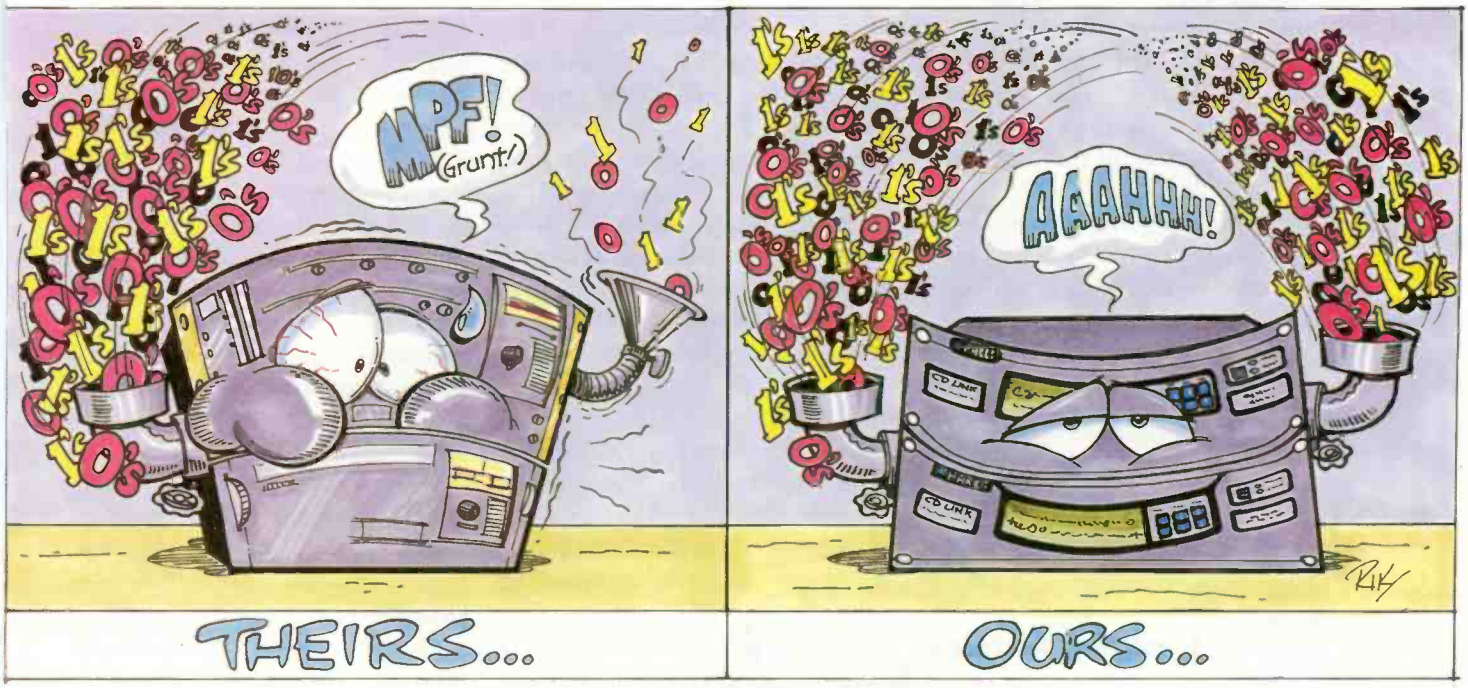

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A new world of broadcast solutions

Gepco, Clark Wire and Cable, Canare and Mohawk/CDT were all showing their latest product additions that adhere to the digital requirements.

One interesting tool shown by Canare was the TS100E coaxial cable stripper (See Pick Hits, p. 68). This handy tool makes cable preparation simple and fast, especially when multiple cables are being worked on.

Kirk Harnack is president of Harnack Engineering, Inc. and director of engineering for Delta Radio, Inc.

By Yasmin Hashmi

Unlike in previous years, when a new crop of systems was almost guaranteed to be launched, NAB 98 was more dominated by established players showing enhancements and new options, particularly in the areas of user interface operation and wider access to files and data. More were also keen to describe their systems as having an "open architecture," being based on standard hardware and allowing the user to choose which types of peripheral and/or audio card to use for example.

Open systems

Two new systems featuring an open architecture were the Windows 95/NT-based CBSI Digital Universe that supports up to 25 uncompressed stereo channels, and the IBM eWave, designed for the complete automation of radio stations of all sizes and marketed by Pacific Research & Engineering. Indeed, systems are also becoming more open by allowing file transfer, as in the case of D-CART, now available from Wormald Technology. In addition to its new drag-and-drop GUI with waveform editing, the system allows files to be edited and playlisted by D-CART or any networked PC with a standard sound card. If using the latter, the selected files are automatically converted to the BWF format while being transferred from D-CART, and can then be dropped into any compatible editing application such as the SEK'D Samplitude.

New features

Perhaps the most remarkable among the range of new developments on show was the dbm Systems Cartworks VIO option. Designed for visually impaired and blind operators, it provides aural cues using a speech synthesizer and can be operated using a Braille-encoded keyboard. Other new developments included the RapidRecorder feature for the Pristine Systems RapidFire that appears as a selectable window at the bottom of the main screen and allows live recording and editing while on air, and the Computer Concepts Maestro application, which is now Windows NT-based. In addition to traditional DCS functions, Maestro also includes a music system database interface, display of news and information text, a configurable screen layout, intro and outro times, and flexible control of all on-air operations.

News

For those particularly interested in news applications, Radio Computing Services (RCS) previewed a new module for its Master Control on-air system which implements the popular AP NewsDesk. This includes numerous text-based features such as instant access to bulletins and updates, scrolling headlines and multiple wire inputs, as well as audio capture, editing and embedding in text. Also on show was the completely revamped Radiomation News system. This system now allows up to 35 journalists to be networked, and new features include waveform editing, audio and text wire capture, a secure shared contact database, the ability to present

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items live from the terminal with scrolling text, and several ways to audition material for transcription.

Wide area networking

With the aim of reducing distribution costs and saving time, a marked number of manufacturers announced wide area networking (WAN) capabilities. Among these was Scott Studios with its multi-protocol Remote Recording Router. This allows up to four modems or other high-speed interfaces to be fed per computer, making it possible to send spots by WAN, dial-up phone lines, ISDN, T1, ADSL, Frame Relay and other Windows PC-compatible communications devices. Another was Prophet Systems, with its WANcasting network. This allows automatic background transfer of data and audio between remote Audio Wizard CFS sites, automatically inserting the new audio into the system playlist, and optimizing the network according to demand.

The MediaTouch WAN solution was announced in the form of its OpLOG 2000 radio broadcast control software for Windows. Using Intraplex T1 products and MediaTouch audio, Internet and intranet software applications, the system provides local and wide area networking, as well as live audio distribution. Enco was also offering WAN with its new Windows NT/98-based Enco DADpro32, shown demonstrating global wide area networking for the sharing of audio, scheduling, billing and associated data, as well as methods to integrate Internet capabilities.

Internet access

With the growing use of the Internet worldwide, is not surprising that manufacturers are increasingly seeking to take advantage of it for various applications. Broadcast Electronics for example, announced a cooperative venture with Waves Ltd. in the form of the AudioSTREAM single-box solution for webcasting. BE also announced the AVExplorer module for AudioVAULT, allowing audio file transfer, multiple station scheduling from a single location, remote voice tracking, and Internet scheduling and reconciliation. Meanwhile, MediaTouch, in conjunction with Broadcast Tools Inc., announced the WEB Alarm Internet Sentry software for remote facility monitoring and data acquisition, while Dalet launched its Inter-

Scott Studios' Remote Recording Router

Web software to allow reporters and producers to preview and transfer audio files over the Internet using audio streaming. It also allows scripts and logs to be transferred, and is accessible by anyone with a browser and a password.

Another system offering Internet access was the Windows 95/NT-based AEQ MAR4WIN. providing simultaneous access to local or remote databases, the system supports up to four Digigram, Soundblaster or compatible audio cards, and allows audio, text, and video objects to be displayed on a single configurable screen.

Displaying artist, song and station information online is a feature that has been implemented by RCS and Mediatron, whether the audio is being streamed or the information is simply placed online.

Non-PC

One of the few systems at the show that did not require a PC was the Arrakis DL4 Digital Audio Engine. Available as a rackmount, the system features triple play with simultaneous

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Digigram POWERED

FROM THE MAKERS OF Selector
THE MUSIC SCHEDULING SYSTEM

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record, and includes a built-in hard drive, separate outputs for each playback channel and console start/stop, cart-like control logic. In addition, up to four DL4-Jingle control surfaces or any RS232 devices can be connected for simultaneous control of a single unit. Another dedicated system is the Orban AirTime real-time, multitasking, networked delivery system that can now use Digigram PCX cards for both record and playback functions allowing even greater I/O density per CPU tower.

Even more

With the lack of vaporware announcements, several manufacturers were showing existing lines that already met the needs of many broadcasters. For example, SMARTS Broadcast showed its complete line of solutions.

Yasmin Hashmi is a partner in SYPHA, publisher of The Tapeless Audio Directory, a buyers guide that provides details on over 300 disk-based audio systems. Reach her at sypha@compuserve.com or +44 181 761 1042.

Audio backhaul & accessories

By Kevin McNamara, CNE

If you asked most engineers walking the radio floor what they have seen that's new and exciting, the answers were generally the same: "Not much." I have to agree, but considering that the glut of vaporware and useless niche products in past shows have all but disappeared, the products represented at this show perhaps represent the "short list" of manufacturers that offer products that finally answer the broadcasters needs.

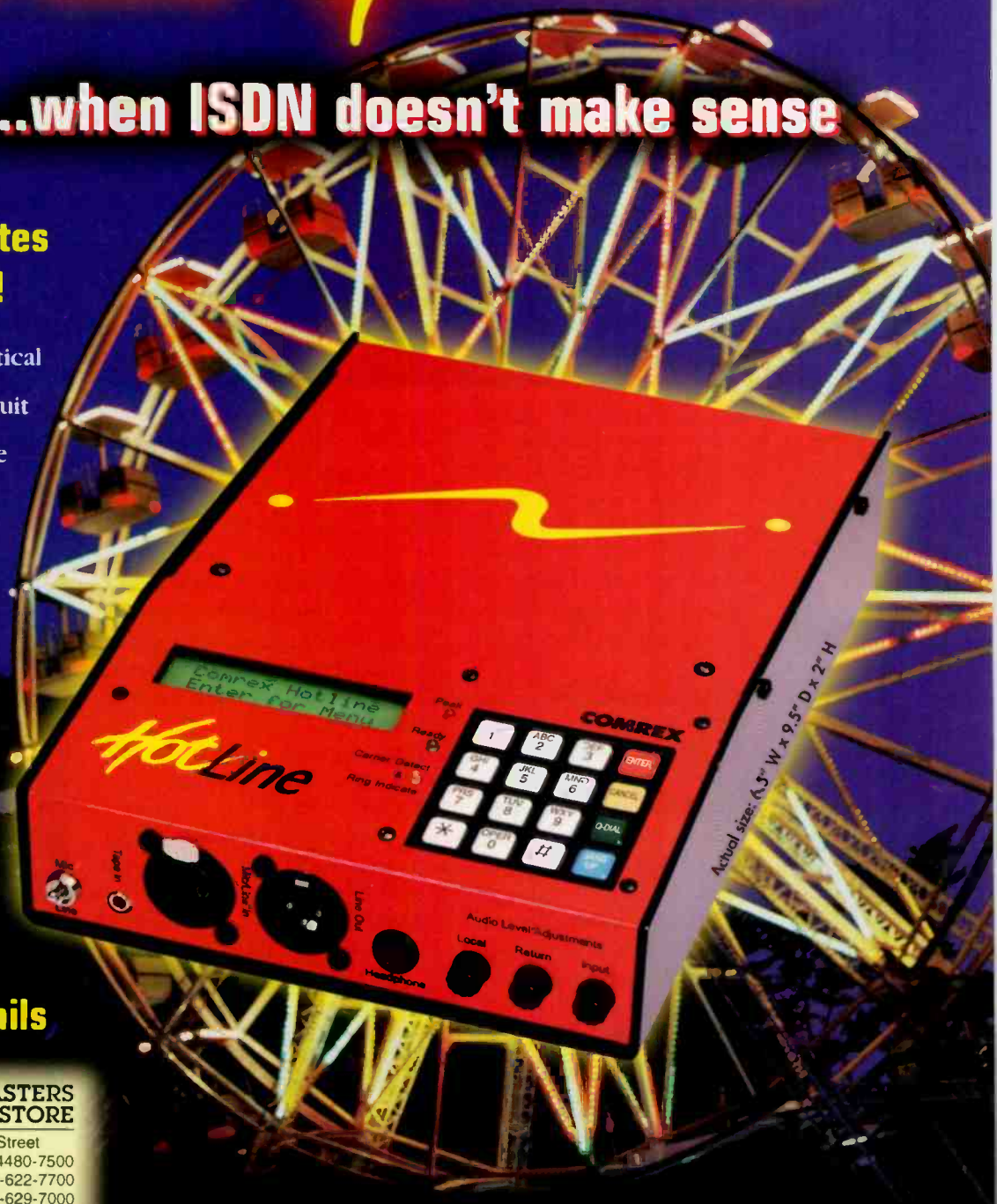
Probably the most talked about new device and one of *BE Radio's* Pick Hits (See Pick Hits, page 68) is a new POTS codec from Comrex called the *Vector*. The Vector is a self-contained audio mixer/codec which can deliver 15kHz of two-way audio over any standard phone line and provide a connection speed from 24- to 33.6Kb/s. When poor line connections are encountered, the Vector will negotiate at speeds as low as 9.6Kb/s. Comrex claims that the Vector can provide 7kHz of audio with connection speeds between 21.6Kb/s and 14.4Kb/s, or 5kHz of audio at 9.6kHz. If the quality of the connection deteriorates during a broadcast, the Vector will also renegotiate at a lower speed automatically. The Vector is also compatible with the Comrex Hotline POTS codec, albeit with reduced audio performance (up to 10kHz with a 33.6Kb/s connection). The Vector is available as portable or rack-mounted and includes three mic level inputs (one can be switched to line level), three headphone outputs and a host of externals. Like other Comrex mixer products, the Vector provides the usual complement of internal mixing and muting to satisfy most remote broadcast requirements.

In what they are calling The Select Series, Ward-Beck has introduced several new items. The AMS-4 is a powered rack mount monitor system that provides four selectable inputs. Each of the inputs can be either balanced analog stereo, balanced AES3 or unbalanced AES3-ID. The unit automatically senses the presence of the digital input and lights an AES lock indicator. The front panel features volume and balance controls as well as a stereo LED VU meter and in- or out-of-phase indicators.

Ward-Beck has also introduced four new plug-in cards that are frame compatible with its 8200 series powered frames. The D8201 is an eight-output digital audio distribution card that features cable equalization, data-reclocking, transformer-balanced inputs and a monitoring jack. The D8202, a 24-bit D/A converter, includes cable equalizer, selectable input impedance, alarms on detected errors and a monitor jack. The D8203

Use the HotLine

...when ISDN doesn't make sense



One-time remotes just got easier!

Sometimes it's impractical to install a special circuit like ISDN for a one-time remote. However, a plain telephone line is usually available. Wouldn't it be nice if you could have high quality two-way audio on that plain line? That's just what you get with the *HotLine*.

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We'd be happy to send you a HotLine to try.

Wideband two-way audio on POTS (Plain Old Telephone Service)

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is an A/D converter providing selectable sample rates or capability to lock to an external reference. Transformer-balanced digital output is compatible with balanced or unbalanced environments. The D8204 is a digital distribution amp combined with an on-board A/D converter. The card can provide either eight digital unbalanced outputs or four digital and two stereo analog outputs, depending on the termination assembly used.

Ward-Beck also unveiled a line of "low-cost problem solvers" called PODS. This line includes several slick solutions for interfacing audio (particular digital) in your station. These solutions include everything from analog audio switchers, amplifiers and interfaces to digital audio switching and monitoring. I like the fact that this line of switchers can be controlled via an RS 422/485 data port, which permits easy interfacing with external control devices.

MusicamUSA is introducing a new T1/E1 Audio Multiplexing System (TEAM). The TEAM system is a modular audio codec designed to operate over a T1(1.544MHz) or E1(2.044MHz) path. The system supports several analog and/or digital channels, the actual amount depends on your specific choice of audio coding standard, including linear non-compressed audio. Modules will also be available to support synchronous data.

Intraplex introduced the "spread spectrum STL," which combines the Intraplex "STL Plus" digital T1 multiplexer with the "LYNX.sc" spread spectrum radio system from Glenayre Western Multiplex, as an alternative to the congested analog STL frequencies, leased T1 lines or digital T1 circuits. The system provides a total solution for the transmission and backhaul of uncompressed digital audio, plus voice and data. The DCS-9500 and the DCS-9560 Cross-Connect Access Server provides an easy method to switch T1 traffic between various (up to six) T1 transmission paths. For most broadcast applications, this system can be utilized to automatically switch traffic between two or more T1 paths (i.e. microwave system and T1 leased line) in the event of a network failure or higher than acceptable error rates. The DCS-9560 offers additional support for the full suite of Intraplex channel units and can be used to consolidate and combine traffic onto a single T1 line, which can significantly reduce the monthly charges associated with leasing multiple lines that are not used to capacity.

Henry Engineering's new Portamatch is a battery-operated version of its popular MatchBox audio interface. The Portamatch is a level-and-impedance interface that converts consumer IHF audio levels (-10Bv) to/from professional +4dBm 600Ω levels. The Portamatch will operate for about 20 hours on two regular alkaline batteries, or 50 hours on lithium. Henry also announced a new version of its Audio Online system. Version Four now offers several new features, including: multi-level nested menus, instant message access, on-screen message & line status, multiple recording passwords and message lock.

JK Audio introduced three new products.The Inline Patch is a compact telephone audio interface that uses two back-to-back hybrids in order to have control over both sides of the call, and has on-board audio mixing capabilities. The company also showed two portable mixers, the Remote Mix 3.m can be used as a front-end mixer and headphone interface to your codec, or to feed an analog POTS line. The Remote Mix 3x4 can also be used as a front-end mixer and headphone interface, with the additional capabilities of routing audio to as many as four outputs — either line level or via analog POTS lines. Both mixers feature DTMF dial pads and VU metering. If you have need for movable soundproof space, the Acoustic Systems BB100 announcers booth features prewired electrical/lighting, ventilation system, sound-rated doors/windows and acoustical wall, all in about the space of a large telephone booth.

Graham Patten Systems has add-

ed five new items in its SoundPals line. The DTG-1 is a digital test generator which provides a variety of audio test signals generated entirely in the digital domain and output in the AES3 format. The new ADAT interfaces give users a family of modular building blocks for digital audio. The ADAT-1 combines eight analog audio inputs and combines them in a single eight-channel data stream intended to be sent on an optical fiber cable. The ADAT-2 is placed at the other end in order to separate the eight original analog inputs. The ADAT-3 and ADAT-4 have similar functions respectively, except using balanced or unbalanced AES signals.

The ISDN codec arena continues to grow, with products being shown from several manufacturers. The Zephyr Express from Telos will begin shipping. Other news of new ISDN codecs include the C400xr from SystemBase, the ACD-5001 from AEQ and the software-based system from Mayah being shown at the MusicamUSA booth.

AEQ also showed the new MPAC-02 codec, a system that includes a mixer and monitoring capabilities. It can communicate via ISDN or POTS lines.

Satellite services also continue to thrive. While the technology itself had no breaking news, service providers like NSN (National Supervisory Network) and NPR Satellite Services had its own information releases of new agreements and services.

The RPU area has not seen much recent action — until now. Energy-Onix unveiled the Roadcaster, a frequency-agile RPU system that is available in a standard one-way version (Roadcaster.1) and a diplexed version (Roadcaster.2), allowing one unit to send backhaul audio from the remote site and IFB from the studio with a single system. Rackmount versions of both units are also available.

Comstream did announce the unveiling of the new ABR-202, the next step in its product line, designed after the ABR-200.

Kevin McNamara, CNE, BE Radio's *consultant on computer technology, is president of Exegesis Technologies, a consulting firm in New Market, MD.*

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

One might think that the area of RF and transmission might have little new to offer. Not so! While the basic principles of RF haven't changed, improvements in amplifier efficiency and antenna radiation have. Add to this the effects of consolidation, and broad band antennas and frequency-agile transmitters make perfect sense for permanent or emergency uses.

Jampro Antennas showed a new version of the JCPB FM Broadband Broadcast Antenna. This is a broadband version of the Penetrator antenna with true circular polarization. It is grounded at every bay for maximum lightning protection and is available with multi-channel operation options.

Antenna Concepts showed its Ultra FM antenna accepting 20 kW per bay. Its isolated element design eliminates problems of tower influence on pattern shape, and half-wave vertical spacing reduces non-ionizing radiation downwards. New information is available on its website. (See Web Directory, p. 82)

Continental Electronics presented its latest AM transmitter, the 317E, capable of 50kW output power. By use of a serial combiner for the power stages, a reduction of 20 percent in occupied floor space is obtained. That, combined with high-efficiency and the ability to operate with only slightly reduced power in the event of PA failure, makes this a very attractive transmitter. Also shown was the 802D1 digital FM exciter. The redesigned front panel has a brighter display, and units can be synchronized via GPS. Also available is a Tkard option that interfaces with Intraplex equipment for a variety of T1 interface options.

BEXT introduced its model FMR LEX 25, a programmable combination FM receiver/transmitter for translator work. An optional built-in stereo generator/processor makes this a very useful tool for emergency or regular operation

OMB of Miami, Florida, produced its

As always, transmitters and peripheral RF products lured a steady stream of traffic. Here, a prospective buyer peruses Phasetek's newest.

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You've got your own set of problems. Multiple stations, numerous studios and locations. Change, change, and more change. So wouldn't it be nice if there was a complete digital studio system out there, that would let you configure your radio operation your way? There is. We call it AudioVAULT®.

And the reason why AudioVAULT is in use at more stations, in more countries than any other, is simple. It's configured by the people who use it. As a result, AudioVAULT delivers your program content in any format... from satellite to live assist to complete walkaway. And best of all, AudioVAULT does it efficiently, effectively, and reliably. No other digital studio system out there compares. It's the solution to your problems. All of them.

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BE

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"Transparent Ethernet Repeater" operating in the 2.5GHz band with one to five watts TPO. This is a bi-directional system providing a wireless link for LAN use.

Davicom Technologies Inc. showed its Model A-14050 center-fed collinear array antenna. Although L-band DAB is not presently envisaged for the US, Canada has allocated spectrum and energy toward an L-band DAB solution.

Harris introduced the latest in the Platinum line of transmitters. These solid-state units have PAs that are interchangeable with the IPA modules and allow hot (on-air) replacement. Power levels vary from around 800 watts to 20kW depending on the model desired. The Digit digital exciter and CD Link STL were also being shown.

Bird Electronic showed its complete line of RF watt meters and dummy loads.

Energy-Onix showed their line of transmitters including the Legend C series for FM and the Pulsar for AM.

Audio consoles and microphones

By Terry Garcia

There is a dominant trend for the large groups to incorporate the future of digital in their consolidation projects. Many manufacturers have risen to meet this challenge with more and more digital-based products. The console has always been the nerve center of the studio, and digital consoles continue to make inroads into studio settings.

Logitek's ROC-5

Audio consoles

Logitek showed the Roc 5 digital console, using the same audio engine as the Roc 10, which makes for easy expandability. Logitek has shown its commitment to digital consoles by committing all resources to them while no longer manufacturing an analog console.

Wheatstone and Audioarts showed off their console lines. The highlight for Wheatstone was the D-5000 digital console.

Fidelipac has brought back the Broadcast Audio name with the release of the BA1230 digital console. The 12-fader layout accepts up to 30 inputs. The partnership with Graham-Patten also continues in the DynaTools, of which the DMR4x1 is a part. This four-input, one-output digital mixer can literally fit in your pocket.

Pacific Research and Engineering celebrated the 20th anniversary of the BMX console. Among its showings were the Integrity digital console and the Airwave on-air console.

Auditronics, which has entered into a partnership with Broadcast Electronics, was showing the NuStar 3001, the next version of its digital console. Auditronics also debuted a touch-screen version of the Nustar called the Touch Star. Also planned is a new analog console line called the Comet Series 4600, which will be designed for applications in production and on air.

Autogram showed its line of cost-effective on-air consoles.

The DRC2000 from Harris/Zax-

Confiability with Life Time Warranty

EDUCATIONAL CIRCULAR SERIES

Model	Bays	Power	Gain	Price
MP-1	1	600W	-3.3	$250
MP-2	2	800W	0	$680
MP-3	3	800W	1.4	$980
MP-4	4	800W	3.3	$1,280
MP-2-4	4	2,000W	3.3	$1,820
MP-3-5	5	3,000W	4.1	$2,270
MP-3-6	6	3,000W	5.2	$2,740

LOW POWER CIRCULAR SERIES

Model	Bays	Power	Gain	Price
GP-1	1	2,000W	-3.1	$350
GP-2	2	4,000W	0	$1,350
GP-3	3	6,000W	1.5	$1,900
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

MEDIUM POWER CIRCULAR SERIES

Model	Bays	Power	Gain	Price
SGP-1	1	4,000W	-3.3	$690
SGP-2	2	8,000W	0	$2,690
SGP-3	3	10,000W	1.4	$3,595
SGP-4	4	10,000W	3.3	$4,500
SGP-5	5	10,000W	4.1	$5,300
SGP-6	6	10,000W	5.2	$6,100

The antenna gain may vary with the frequency. For powers up to 20 KW please, make the request to provide the specific configuration.

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com was on display in the Harris booth. The DRC2000 is a larger version of the DRC1000.

Radio Systems showed its new Millenium line consoles, which have many useful features and a distinctive styling.

The Klotz digital console is distributed by RCS. The modular approach allows virtually unlimited input configurations.

Mackie had its complete line of compact mixers, including the new Digital 8-bus.

Microphones

AKG showed its Solid Tube mic. The large diaphragm condensor has a 12AX7 at its heart. Meanwhile, Neumann showed the TLM 103. It uses a modified version of the U87 large-diaphragm capsule, and boasts the SPL and THD characteristics of a dynamic.

Auditronics' NuStar 3001

Studer re-introduced the On-Air 2000. All signal routing, gain structure, and EQ functions are controlled with a touchscreen and a handful of virtual knobs. The 12-fader configuration accepts up to 72 inputs.

Many pro-audio leaders are offering digital consoles that could find a home in a radio production facility.

Yamaha showed the 01V, the next installment to the existing line of digital consoles including the 02R and 03D. The 01V has 24 inputs, four outputs and built-in effects processors.

Tascam debuted the TM-D1000 digital mixer, which is loaded with impressive specifications. The 16-input console has TDIF-1, AES3 and S/PDIF outputs and can be expanded with an optional card.

Panasonic/Ramsa had the DA7, an eight-bus mixer. The unit is feature heavy, with 32 inputs, six aux sends and 24-bit capability being notable among them.

BeyerDynamic had the new M-8000. This dynamic hypercardioid mic has a classic look with modern performance.

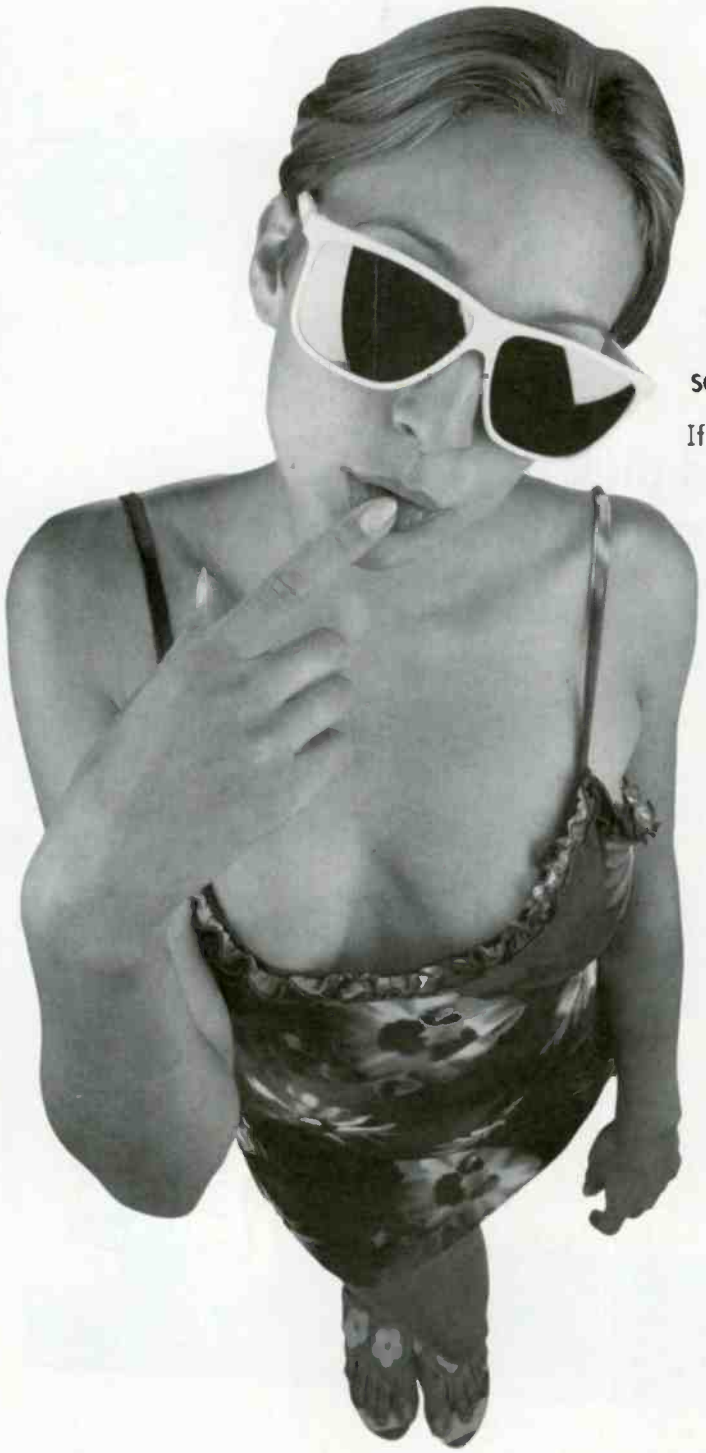
Tannoy showed the DPA 4060, offering high sensitivity, broad dynamic range, and gain before feedback with a 5.4mm capsule.

Shure was showing its complete range of wired and wireless microphones.

For stations having announcers who are hard on microphones or don't have the best mic technique, try using a kick drum mic. They are designed for the highest SPLs and handle severe transients, and most of them cover the vocal range very nicely. Sennheiser came out with the E 602, while BeyerDynamic showed the TG-X50, and AKG displayed the D112.

Terry Garcia is a design engineer with CMBE, El Dorado Hills, CA.

Why Should I Care?



What do you mean you don't know which soundcard is in your digital broadcast system?

If you care about radio frequency interference – and who doesn't? – it could be interfering with your broadcast signal. RFI runs rampant inside the PC that records and plays digital audio for your stations. Antex was the first to develop multi-layer board design with extensive ground planing. That prevents hostile RFIs from bombarding your signal. The leader in soundcards for more than a decade. Antex continuously upgrades its designs and components to give you nothing short of perfection. With over 100,000 soundcards sold world-wide, it's no wonder why the finest developers and manufacturers plug Antex Audio into their digital designs. They care about sound quality. Just like you.

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BE Radio®

NAB98

PICK HITS

Our judges pick the best of the show's new introductions

The show floor at the NAB convention was covered with new products, and while you were walking the aisles and investigating all the new technology, so were our judges. This year's panel (listed on page 75) looked at everything offered and came up with the following products which were awarded the highly-prized BE Radio *Pick Hit award for NAB98. The wide range of application needs addressed by the winning products demonstrates the fully rounded selection of offerings at this year's show, as they cover areas throughout the facility from the studio to the transmitter.*

The rules governing Pick Hit selection are at the end of the feature. Our judges are industry experts, work independently and anonymously, and select the top ten new products at the show. There were also some notable products offered that, while not awarded a Pick Hit, caught the judges attention as well and merited status as an honorable mention.

Avocet Instruments
AV-2000
Delay canceller

With so many remotes being done using digital transmission, the need for creating a mix-minus return feed is essential for success. Sometimes creating a mix-minus is not easy or practical. The Avocet Instruments *AV-2000* uses DSP to remove the local audio from a program feed to create a mix-minus automatically. The *AV-2000* will calculate the time differential up to 800ms, and then suppress the returned local audio, typically up to 40dB. Front panel indications for audio and delay correlation let the user see what is happening.

www.avocetinst.com

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Known throughout the world as the best performing, most reliable FM transmitters available, Continental's 816R Series combines superior design and audio quality with exceptional workmanship to give broadcasters an unmatched, field-proven record.

The 816R Series comes in power levels from 10 to 70 kWs. Available as an option is an internal control and monitoring unit which tracks trends, stores data and provides an exact visual replica of the transmitter's control panel.

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NAB98 Pick Hits

Broadcast Electronics
AudioPoint
Routing switcher

The Broadcast Electronics *AudioPoint* is more than just another routing switcher. This next-generation device uses DSP to eliminate cabling, wiring and relay panels. Instead of employing a crosspoint matrix, all incoming signals, once digitized, are treated as data and not audio. The *AudioPoint* can accept audio sources that are analog, digital, synchronous, asynchronous or MADI (multi-channel audio digital interface). In addition to simple routing, the *AudioPoint* can also perform programmable audio delays and gain and EQ adjustments. The system can be controlled via a graphic user interface that can be used across a network and support drag-and-drop programming. Remote panels are also available in 32-, 64- and 128-button X/Y controllers.

www.bdcast.com

Circle (151) on Free Info Card

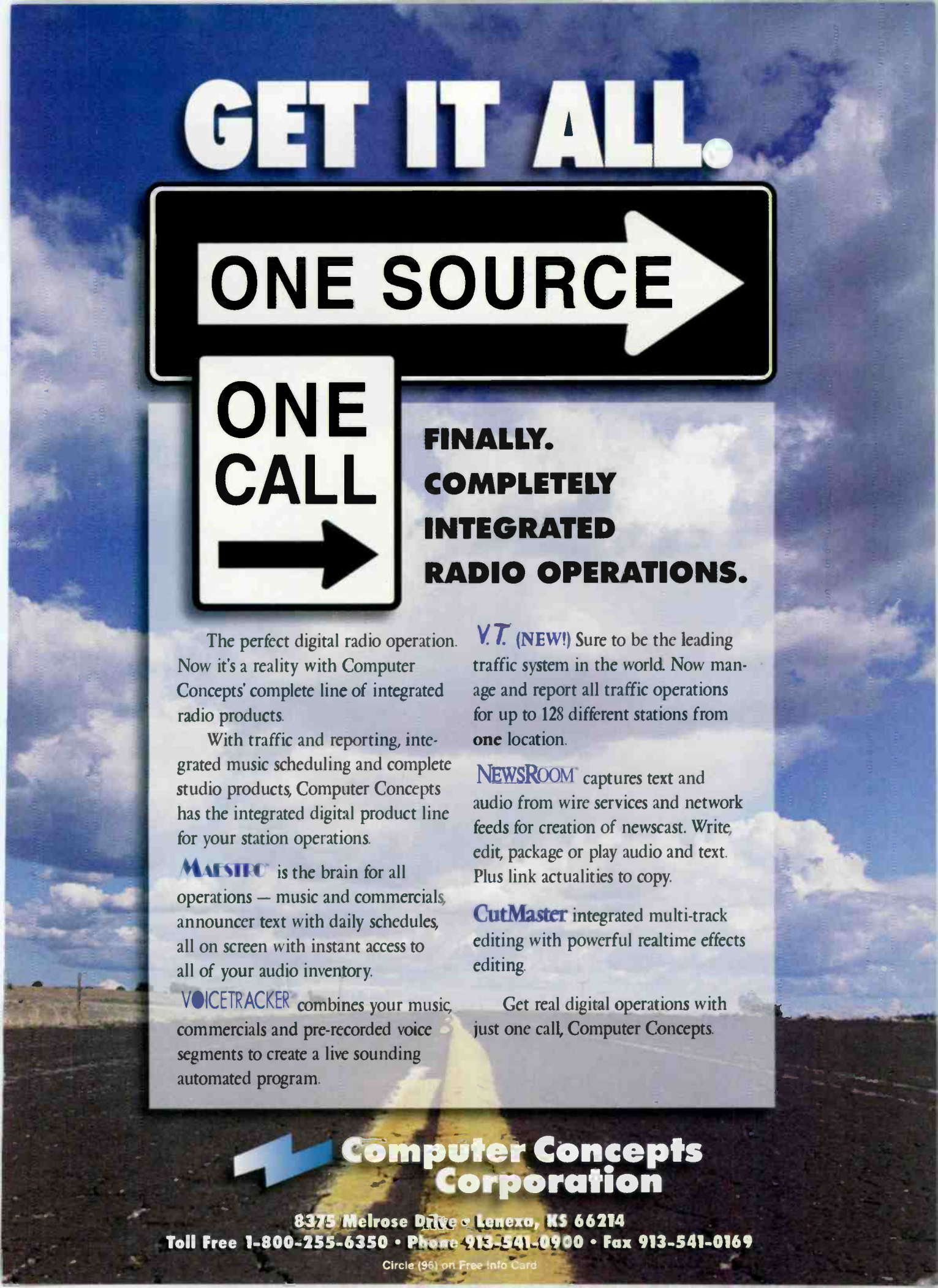
Canare
TS100E
Coaxial cable stripper

The preparation of coaxial cable can be a cumbersome task. Standard stripping tools often nick or cut into the outer shield. The *TS100E* has three circular blades that precisely and cleanly prepare the cable. The self-cleaning blades are easily replaced and are provided in a cassette handler.

One blade cuts down to the center conductor, another cuts the outer jacket, and the third slits the jacket for easy removal, while a window lets you observe the action in progress. The hardened, surgical-steel blades can perform approximately 1000 operations. Five cable presets allow fast preparations and the *TS100E* can accept coaxial cable in a range of sizes up to RG-6 and RG-11.

www.canare.com

Circle (152) on Free Info Card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NAB98

PICK HITS

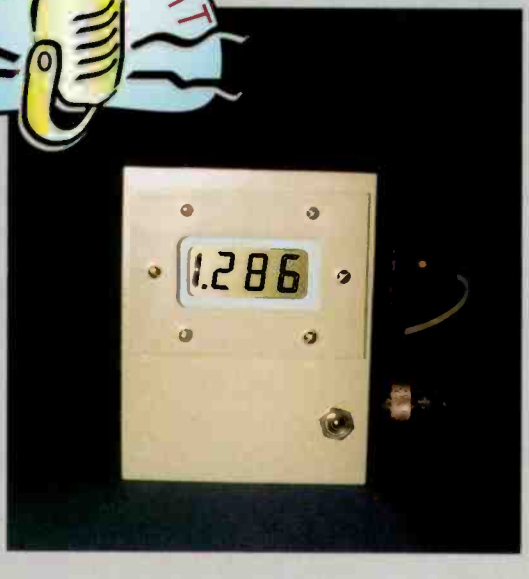
Comrex

Vector
POTS codec

The introduction of POTS codecs gave new freedom and flexibility to last minute remotes. The Comrex *Vector* has taken the next step for POTS codecs by providing up to 15kHz frequency with connection rates of 24 to 33.6kb/s. The *Vector* also includes a built-in four-input mixer, three headphone outputs with mix capability for local and return audio and an additional line output. The *Vector* can also be configured to communicate with the Comrex *Hotline* POTS codec as well. Memory dial, auto-answer and an internal peak limiter are included. The *Vector* can also be used in standard telephone mode in case of poor telephone line quality.

www.comrex.com

Circle (153) on Free Info Card



Delta Electronics

TCA-WB
Wide-band, wide-range RF ammeter

The *TCA-WB* is designed to operate over a broad current range so that it can accommodate a variety of applications and have suitable application in an installation with greatly varying power levels between modes of operation (day, night and critical hours). The wide frequency range covers the 20kHz to 5MHz range. The three-and-a-half digit LCD display shows an accuracy of better than two percent with a 2.15VDC full scale output. The range selection is automatic. Power requirements are 18 to 40VDC at 80mA.

www.deltaelectronics.com

Circle (154) on Free Info Card

Dorrough

PLM-120
Power line monitor

Stable electrical power is essential in any plant. The Dorrough *PLM-120*, available in a desktop or rack-mount package, can capture, log and alarm for all violations of the Computer and Business Machine Manufacturer's Association. The AC line voltage is sampled 3840 times per second, capturing transients as short as 5µs. With an RMS voltage range of 96 to 135V, the unit also monitors for overvoltage conditions and frequency and phase changes. All records are kept in non-volatile memory, and an RS-232-C port allows for download of all logs. All alarm points are user-selectable. Available in 115 or 220VAC nominal voltage versions, it is also self-calibrating and temperature independent.

www.dorrough.com

Circle (155) on Free Info Card

ESE
ES-102
GPS-based master clock/time code generator

A low-cost and highly accurate GPS master clock and time code generator, the *ES-102* provides timing signals in SMPTE/EBU, RS-232-C, ASCII, ESE-TC89 and ESE-TC90 formats. The unit also has a six-digit display and provides two one pulse/second outputs. An eight-channel receiver is capable of receiving as many satellites, although only one is required for operation.

www.ese-web.com

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The Rules

For a product to be considered for a Pick Hit award, it must meet the following criteria:

1. Products must be new, and not shown at a previous NAB Convention. In some cases, distinguishing a new product from a modified older one is difficult. For Pick Hits' purposes, a new product is one with a new model number or designation.

2. Products must have some positive impact on the intended user's everyday work. Judges search for equipment to be used on a regular basis. Products should provide new solutions to common problems.

3. Products must offer substantial improvement over previous technology. Unique circuit architecture need not be included, but some new approach or application must be involved in the product's design.

4. The prices of the products must be within reach of their intended users. The judges seek products appropriate to a wide range of facilities.

5. The products must be available for purchase within calendar 1998. Equipment must be on display on the show floor and currently (or imminently) in production. Judges take the exhibitor's word on availability dates. Products demonstrated in private showings do not qualify.

NAB98 Pick Hits

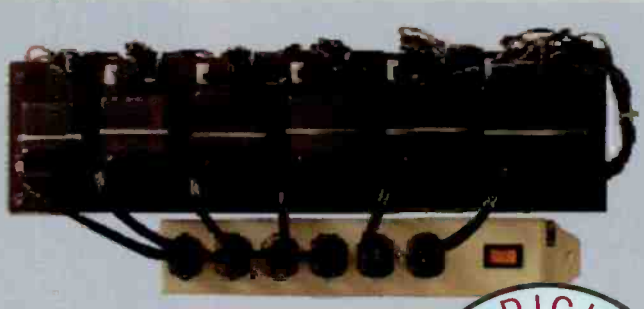
Intraplex/Glenayre
STL Plus
Spread-spectrum STL

Intraplex is already established as an innovator in transmission of signals over T1 circuits. Replacing multiple analog telco loops and offering multiple digital channels for audio, data, LAN, telephone/fax and control signals is the core of the *STL Plus* system. Add to this the cost savings of an RF STL along with license-free spread spectrum, and you have the best of both worlds. The Glenayre Western Multiplex *LYNX.sc* is a spread spectrum radio that operates in the 2.4 or 5.8GHz band, and emulates the same function as a wired T1 or E1 circuit. The joint effort between two companies offers the expertise of each over the system.

www.intraplex.com (Intraplex)
www.wirelessinterconnect.com (Glenayre)

Circle (157) on Free Info Card

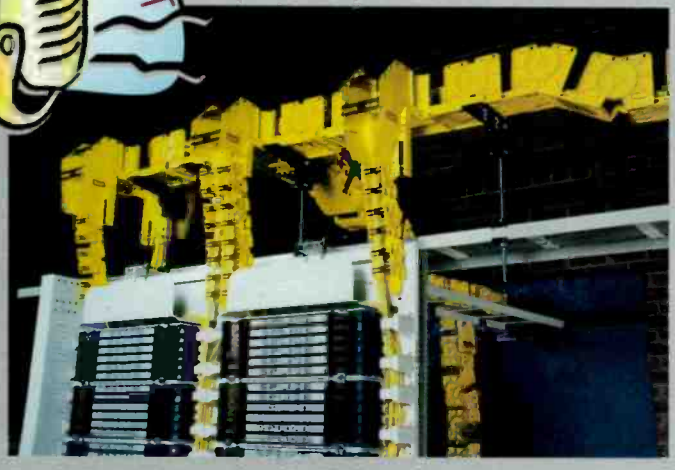
Radio Design Labs
WH1
Power supply mounting adapter



With more and more equipment using external, wall-mount power supplies, the space needed to plug in these "wall warts" has grown. Add to this that they are all different sizes and the result is several wasted outlets on a power strip. The *WH1* from Radio Design Labs mounts them on a single bracket where they can be spaced and secured as needed. An included six-inch power cord connects the supply to the power strip, thereby eliminating the wasted space. Each kit comes with the parts needed to mount up to six power supplies. The brackets measure 19" x 4.6" x 1.1."

www.rdlnet.com

Circle (158) on Free Info Card



Telect
CableLinks
Cable management system

Cable management can sometimes be a tricky problem. Keeping multiple cables in an orderly fashion but still being able to add or modify wiring at any time is challenging, and few things are more frustrating than a rat's nest of wire. These modular units snap together to carry a wide range of cable sizes and run requirements. Links are chained together to form the trough and they move horizontally and vertically to fit any space. The soft bends allow for routing of special handling cable like fiber optic and CAT5, where sharp bends will damage the cable and distort the data being carried. The yellow, fire-retardant plastic links are available in three sizes.

www.telect.com

Circle (159) on Free Info Card

The Judges

The judges operate independently, anonymously and select products based on the rules on page 73.

Margaret Bryant
Director of Engineering
and Technical Operations
ABC Radio Networks
Dallas, TX

Terry Garcia
Design Engineer
CMBE
El Dorado Hills, CA

Mark Krieger
Chief Engineer
WGAR-FM
Cleveland, OH

Andy Laird
Vice President of Engineering
Heritage Media
Santa Clarita, CA

Kevin McNamara
President
Exegesis Technologies
New Market, MD

Bill Ruck
Engineering Manager
Susquehanna, San Francisco
San Francisco, CA

Jeremy Ruck
Consulting Engineer
Markley and Associates
Peoria, IL

Richard Rudman
Director of Engineering, KFWB
CBS Radio
Hollywood, CA

Brian Sanders
Program Director
KUNV-FM
Las Vegas, NV

Milford Smith
Vice President of Radio Engineering
Greater Media
East Brunswick, NJ

NAB98 PICK HITS

Inovonics
520, 540, 701, PBX
New products for radio

Inovonics introduced four new radio products offering low-cost solutions to several different ideas. The *520 AM Modulation Monitor* is a 1RU unit that offers full monitoring of AM signals. *The 540 FM Subcarrier Monitor/Demod* can be used to measure performance of SCA, RDS/RBDS and high-speed data subcarrier signals. Fed with a composite signal from an FM modulation monitor, it can also reformat many data streams to RS-232. The *701 RDS/RBDS Mini-Encoder* offers an inexpensive and easy solution for stations needing to transmit basic RDS/RBDS data streams. With so many devices having POTS-line capabilities for modems or alerting, the PBX telephone switch can tie seven devices to a single telephone line, and more units can be daisy-chained for even more flexibility.

www.inovon.com

Circle (160) on Free Info Card

Marantz
PMD680/PMD690
Portable PCMCIA digital recorders

Portable, affordable digital recording has usually meant DAT as a format — until now. The Marantz *PMD680* and *PMD690* digital recorders use standard Type III PC (PCMCIA) cards for storage. The *PMD680* (mono) and the *PMD690* (stereo or mono) both offer MPEG-1 Layer II or linear recording, a backlit LCD display, a PC parallel port for file downloading, non-linear and non-destructive editing, analog (mic or line) and SPDIF I/O, and manual/limiter/auto record level control. Both units operate on 12VDC and weigh two pounds.

Circle (161) on Free Info Card

Moseley
Starlink SL9003Q
Digital STL

The latest addition to the *Starlink* series is the *9003Q*. Quadrature amplitude modulation technology allows the *SL9003Q* to deliver four 16-bit linear audio channels and two data channels over narrow-bandwidth 950MHz STL channels. Features include AES/EBU I/Os, a built-in sample rate converter, plug-in MPEG audio modules and digital multiplex for additional program, voice, FSK asynchronous and synchronous data channels. An ultra-linear four watt average transmit power out is achieved with redundant RF power modules.

www.moseleysb.com

Circle (162) on Free Info Card

QSC
Rave
Ethernet audio link

RAVE is a system that enables audio and control data routing via standard Fast Ethernet hardware and cabling, thus reducing cable costs, simplifying installation, increasing routing flexibility and improving audio performance. Individual units are capable of handling up to 16 channels of audio I/O. Using a front panel switch on each *RAVE* unit, blocks of eight audio channels can be transmitted or accessed at any point on the network. Sixty-four channels of audio can be operating on a dedicated audio network at one time with less than 6.3 milliseconds of delay to any point on the network. Inputs can be analog or digital.

www.qscaudio.com

Circle (163) on Free Info Card

Kintronic Labs
Optilink
Fiber optic control system

Control and monitoring of AM arrays can require extensive amounts of wire and interconnection. The *Optilink* uses fiber optic cable to communicate data from each tower instead of multiple runs of copper wiring. The fiber runs can be up to two kilometers with each tower requiring two cable runs. The system uses RISC processors to handle the gathered data. Up to three contactors can be controlled at each tower. RF immunity is inherent to the fiber optic cable, and each fiber link replaces 21 copper conductors.

www.kintronic.com

Circle (164) on Free Info Card

The online version of radio's technology magazine.

BE Radio .com

• Show Review

BE Radio brought you the best of NAB98 with our wire-to-wire coverage. And though the show is over, you can still get a look at what you missed, including session coverage and *BE Radio's* exclusive Pick Hits, by turning your browser to *BERADIO.COM*.

• Take part in the radio survey.

Every month, BE Radio will conduct a survey pertaining to an issue of interest to the radio broadcast industry. The results of the survey will be published in the following month's issue of BE Radio. Take the survey online and then see the results here. June's survey asks questions about one of our industry's hotbutton issues: consolidation.

• Do you have an on-air or production facility that is a showcase?

Tell us about it. The Studio Spotlight looks at a new facility every month with images and a description of the site. We are looking for facilities to show. Look online for the details, or contact us:

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Rules of the Road for the Digital Audio Superhighway

By Russ Mundschenk

Plan ahead and understand the rules when routing digital audio.

The storage and manipulation of digital audio has become commonplace even in the simplest radio studios. However, transmission, switching, mixing and distribution of program material has until recently been analog.

The availability of cost-effective digital consoles and other peripherals made it possible to implement a totally digital signal path at the time WBEB began studio reconstruction in 1996. The all-digital air studio came online in 1997. During the facility design and testing period, much was learned about digital audio interconnection.

The basic plan

The WBEB studio layout is similar to that of a well-designed analog facility. The plan allows for good line of sight between operating positions, and keeping production-related traffic away from the air studio. A centrally located equipment room houses much of the remotely located digital equipment. Co-locating as much equipment as possible allows for centralized interconnection and patching, as well as better environmental and primary AC power control.

A line backed up by a generator feeds two uninterruptible power supplies in the equipment room. The UPSs, generator lines and a utility feed all go to their own distribution panels. These circuits feed custom, rack or turret-mounted plugstrips in each studio, allowing for redundancy, isolation and better load balance.

WBEB's Dan Blackman on the air. The WBEB control room is the start of a fully digital signal chain.

The digital audio format

Two electrical formats are available for AES/EBU transmission. The first is AES3-1992. The 1992 standard specifies a waveform amplitude of three- to seven volts peak to peak and a balanced line impedance of 110Ω. The second and newer format is AES3-ID (referred to as DATS by some manufacturers). The AES3-ID data structure is the same as AES3-1992; the "ID" format, however, is sent unbalanced at 75Ω impedance and a one volt amplitude.

WBEB uses the AES3-ID 75Ω unbalanced format. Studios are equipped with full digital and analog patching capability. AES3-1992 and AES3-ID can be interfaced with a balun transformer. It should be noted that a balanced-to-unbalanced transformer should incorporate an attenuator to reduce the AES3-1992 voltage of three- to seven volts to the AES3-ID voltage of one volt.

Since the occupied bandwidth of an AES signal is up to 300 times greater than analog, selection of the proper cable is critical. Figure 1 represents the effect that the wrong type of wire can have on the waveform. Impedance mismatches and capacitive rolloff introduce reflections, low-pass filtering and attenuation. Eventually, the waveform becomes so distorted that the AES receiver chip cannot distinguish the time of transition and corresponding data value. The Crystal Semiconductor CS-8411

and CS-8412 chips, for example, cannot resolve a peak-to-peak amplitude less than 400mV.

There are only a handful of digital transmission formats available. The most popular professional two-channel formats are generically referred to as AES/EBU. This specification describes a serial digital protocol. 16- to 24-bit samples of the left and right analog waveform are surrounded by synchronizing and status bits. This control data formats the sample so it can be read by the receiving equipment. It also can be used to monitor and maintain facility-wide data integrity with transmission error-detecting devices.

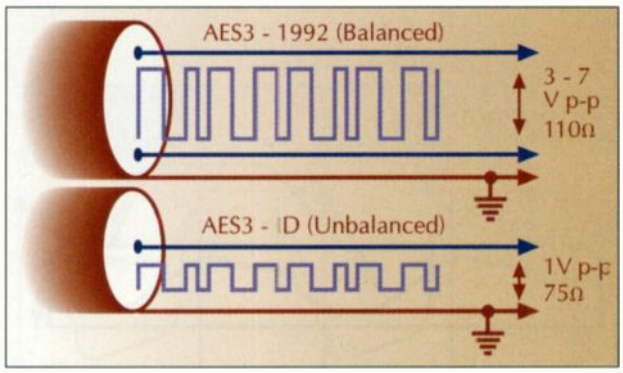

Figure 1. The AES3 electrical characteristics. While the data itself is the same, the characteristic impedance and signal level are different.

Like the RS-232 and RS-422 protocols, AES data is sent bi-phase coded. The *time*, not the *amplitude*, of state transition determines the value of the bit. A transition in the middle of a data bit defines a digital "one" and no transition defines a "zero." It should be noted that a bit stream of all ones occupies the most bandwidth — over six MHz. Bi-phase coding eliminates the need for a separate synchronizing line. AES3 signals may be AC coupled, and polarity is unimportant.

Timing is everything

It is critical that the AES source and receiving devices are synchronized. Even if you have selected the same sample rate on both units, there still is bound to be a small difference in the frequency of the time bases. If the receiving device's clock is not locked to the transmitter's (or both to a common standard), the receiver must rate convert.

Source devices that have an external synchronization input should be fed an output from the console they feed. This output then becomes a Digital Audio Reference Signal (DARS). Any output will do, because the AES bitstream is always active, even in the absence of audio. This eliminates the need to rate convert and synchronize that input of the console. Devices that have no external synchronization input must be synchronized at the console input.

Alternately, all synchronizable devices in the facility can be fed by a common standard — a master DARS sync generator. The house reference signal may be delivered by a dedicated device or any source device such as an A/D converter. You can make the DARS reference signal a reference tone or off-air monitor signal. However, it is absolutely critical that this signal be as high-quality and reliable as possible.

Adding a level of redundancy is a good idea. At WBEB, the output of our master sync generator is backed up with the output of the A/D converter that is used to convert Emergency Alert System audio.

It is essential that a house standard sample rate be adopted. Since many digital storage devices operate at different sample rates, you might decide on the one that most of them use. However, it is probably wiser, to standardize on the rate the industry is adopting most frequently. Most modern processors, STL's and transmitter exciters are using the so called "professional" standard of 48kHz. Also, conversion from 48- to 32kHz and vice versa requires a simpler algorithm than conversion from 44.1kHz to those rates.

Staying in sync

It is wise to monitor the accuracy of the DATS reference signal timebase (or the console's internal clock). Since most D/A converters synchronize to the incoming datastream (within a few percent), it is possible that the sample rate may be inaccurate — and the audio will still sound okay. The problem occurs when the digital audio is played back at the correct sample rate. A pitch change

equal to the ratio of the two frequencies will be audible. This is similar to the effect of analog tape speed variation, but without timing differences.

Unlike analog distortion, digital data distortion is easy to detect in program material. The bi-phase coding system mentioned earlier allows for immediate detection of gross timing errors, as well as an obvious loss of phase lock. Modern AES receiving chips such as the aforementioned CS8411 and CS8412, for example, provide BCD-coded outputs for many types of errors. It is a relatively simple matter to couple the receiver chip to a programmable IC capable of generating plain English error messages in RS-232 or RS-422 ASCII.

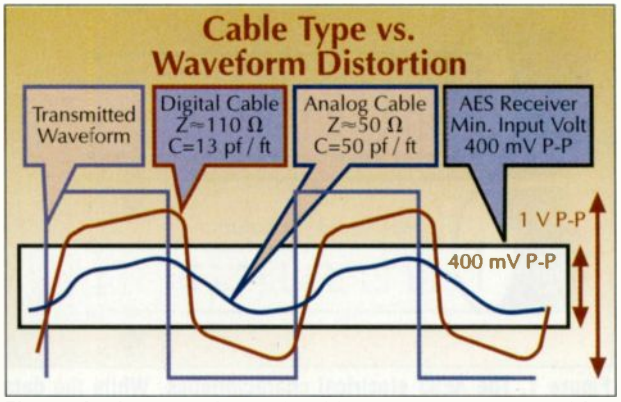

Figure 2. A comparison of cable types and the resulting waveform distortion.

At WBEB, most patching and interconnection is done digitally. This is made possible by converting as many analog sources to digital as possible, as soon as possible. Analog runs, (especially microphone level) are kept short, before they are digitized. For this reason, A/D converters are mounted close to the equipment they serve. We chose external A/D converters because they may also be upgraded easily.

Sending an AES/EBU signal to multiple destinations is simple, as long as it is done actively. Since resistive splits act as voltage dividers, they should be avoided. In the AES3-ID 75Ω format, non-clamping video distribution amplifiers may be used as long as they have sufficient bandwidth. If the signal to be distributed is noisy or originates from a long run of cable, an AES3 distribution amplifier that reclocks the data will restore the integrity of the waveform.

Mixing

Mixing two or more AES3 sources is very difficult and requires specialized equipment. Incoming data must be rate converted and synchronized (if necessary) and then number-crunched into a resultant product. This requires devices with a lot of signal processing horsepower. As you might imagine, the more channels integrated, the more complicated it becomes. There are small boxes on the market in the $800 range that will mix up to four channels of AES audio. Similarly, digital gain and attenuation must be done with high-power, specialized equipment.

It's okay to use a non-synchronous switcher, such as a video router, for non-critical or emergency applications. In fact, since most video switchers have both video and audio, the video half can switch AES audio and the audio half can switch analog audio. At WBEB we use this configuration for emergency routing. We feed original source devices into the unused inputs of the switcher to act as a backup in the event of console failure. We have also designed and built an interface that allows the use of multiple control panels on one switcher. This allows any studio to feed the air chain from that studio itself. (The switchers have been modified with a momentary "enable" switch that requires pressing two buttons to effect transfer of studios.)

The AES3-ID protocol uses standard 75Ω coaxial cable and BNC connectors. The format is compatible with some off-the-shelf analog video hardware such as routing switchers, distribution amplifiers and patch bays. Make sure that active video devices can accept the voltage transients that may accompany patching and loss of termination. Some video chips can be damaged by peak-to-peak voltage transients that exceed their power supply rails. Back-to-back zener diodes may be used to protect those IC's.

Critical applications require the use of a synchronous AES/EBU switcher. A good synchronous unit not only switches at the beginning of a sub-frame, but also quickly cross-fades audio sources to eliminate pops. Another

advantage to synchronous units is a clean frame-to-frame transition, which eliminates distortion-inducing sync-up time in downstream equipment.

Gain structure

It is wise to maintain the gain structure of an AES3 signal as close to the original as possible. If digital attenuation is employed, the least significant bits of resolution of the original data are tossed out as the level is reduced. Later restoration of the original gain structure cannot bring back these bits. Likewise, imparting digital gain may cause some waveform peaks to exceed the maximum value possible (all ones) and clip the audio.

For the same reason, A/D conversion should be done with the greatest number of bits (quantization) possible. Each bit of resolution corresponds to approximately six dB of dynamic range. The greater dynamic range afforded by 20 bits of resolution allows the user to maintain 16 bits (or 96dB) of noise floor while allowing 20dB or more of headroom. This is especially important in an A/D converter. The additional range provides a cushion against the digital "brick wall."

Another place where headroom is very important is in the mix bus of a console. A mixture of multiple 16- or 20-bit sources produces a large word length product. A high fixed-point, bit-value bus is the best option. Ideally, it should accommodate the product of all of its channels operating at high levels. The second best bet is to use a floating-point processed-mix bus. It can never clip, because the least significant bits of resolution are dynamically truncated as the product's word length exceeds its size. The effect, of course, is to lose low-level resolution. However, in the case of a high-level transient, that may not be so important.

Digital processing always introduces some delay. The delay is dependant upon the nature of the algorithm. In some data compression schemes it can be significant. The thing to remember is that digital audio can no longer be sent and returned from a processing device and then mixed back with the unprocessed material. This wet/dry mix must take place within the device itself where the differential delay can be adjusted for.

When properly programmed, the same DSP chips that mix multiple sources can provide a wide range of digital effects. Equalization, compression, limiting, expansion and reverberation on each channel are just some of the features of a well-designed digital console. Digital should work for you as well as sound good, but beware of the dark side. Digital systems are primarily serial in design. A failure of any one of many system components can take you down. There is an absolute necessity for redundancy and to make transfer to backup systems as automatic as possible. Don't be in a hurry to jump on the digital bandwagon. Design your studios to take the best advantage of what digital audio and its interconnection have to offer — not only better quality, but more versatility.

Russ Mundschenk is chief engineer at WBEB, Philadelphia.

— WEBSITE DIRECTORY —

Industry organizations

Audio Engineering Society
www.aes.org

ANSI
www.ansi.org

Acoustical Society of America
asa.aip.org

EIA
www.eia.org

CRTC
www.crtc.gc.ca

FCC
www.fcc.gov

IEEE
www.ieee.org

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NARTE
www.narte.org

SBE
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Dealers, manufacturers, services

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www.360systems.com

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Acoustic Systems
www.acousticsystems.com

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Advanced Furniture Systems
www.omn.com/afs

AKAI
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Audio Precision
www.audioprecision.com

Audio Processing Technology
www.aptx.com

Audioactive
www.audioactive.com

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www.magi.com/~blairc

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Audix
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Autogram
www.autogramcorp.com

Avcom of Virginia
www.avcomofva.com

BASF Corporation
www.basf.com/nafta

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Belar Electronics Laboratory
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Benchmark Media Systems, Inc
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Besco Internacional
e-mail: rgmal9471@msn.com

Best Power
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Bext
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B&H Pro Photo-Video
www.bhphotovideo.com

BGW Systems
www.bgw.com

BIAS - Peak
www.bias-inc.com

Bi-Tronics
www.bi-tronics.com

Black Box Corp.
www.blackbox.com

BOSE
www.musicwest.com/Sponsors/Bose/bose.html

Bradley Broadcast
www.bradleybroadcast.com

Broadcast Electronics
www.bdcast.com

Broadcast Service Company
www.broadcast.net/bsc

Broadcast Software International
www.bsiusa.com

Broadcast Supply Worldwide
www.bswusa.com

Broadcast Technologies Company (formerly HNAT-HINDES, Inc.)
www.hnat.com

Broadcast Tools
www.broadcasttools.com

Broadcasters General Store
www.bgsfl.com

Bryston
www.bryston.ca

BSS Audio
www.bssaudio.co.uk/bss

Burk Technology
www.burk.com

Caig
www.caig.com

Calzone Case Co.
www.calzonecase.com

Canare Cable, Inc.
www.canare.com

Cart Works, dbm Systems
www.cartworks.com

Carver
www.carver.com

CCA Electronics
www.ccaelectronics.com

Channel Master
www.channelmaster.avnet.com

Circuitwerkes
www.circuitwerkes.com

Clark Wire and Cable
www.clarkwc.com

Coaxial Dynamics
www.coaxial.com

Columbine/JDS
www.cjds.com

Computer Concepts
www.ccc-dcs.com

Comrex
www.comrex.com

ComStream
www.comstream.com

Conex Electro-Systems
www.pacificrim.net/~conex

Continental Electronics
www.contelec.com

Countryman Associates
www.countryman.com

Crest Audio
www.musicyellowpages.com/crest.htm

CRL
www.crlsystems.com

Crouse-Kimzey
www.proaudio.com

Crown Broadcast
www.crownbroadcast.com

Crown Satellite
www.crownsat.com

Crown International
www.crownintl.com

Cutting Edge Technologies
www.edgedsp.com

Dan Dugan Sound Design
www.dandugan.com

DataWorld
dataworld.com

DBM Systems/Cartworks
www.cartworks.com

dbx Professional
www.dbxpro.com

Delta Electronics
www.deltaelectronics.com

Denon
www.denon.com

DGS Pro
www.music.ch/gotham/products/dgs.html

Dielectric
www.dielectric.com

Digidesign
www.digidesign.com

DigiGram
www.digigram.com

DigiKey
www.digikey.com

Digital Audio Labs
www.digitalaudio.com

DK-Audio
www2.dk-online.dk/users/dk-audio

D.L. Markley and Associates
www.dlmarkley.com

DOD
www.dod.com

Dolby
www.dolby.com

Drawmer
www.proaudio.co.uk/drawmer.htm

DRS Ahead Technologies
www.itc-net.com

Dwight Cavendish
www2.interaccess.com/catalogue

EAO Switch Corp.
www.eaoswitch.com

EAW (Eastern Acoustic Works)
www.eaw.com

EdNet
www.ednet.net

EEV
www.eevinc.com

Eimac
www.eimac.com

Electronic Associates
www.elecassoc.com

ENCO Systems
www.enco.com

Energy-Onix
www.energy-onix.com

Ensoniq
www.ensoniq.com

Equi=tech
www.equitech.com

ERI – Electronics Research, Inc.
www.eriinc.com

ESE Timers
www.ese-web.com

Euphonix
www.euphonix.com

Event Electronics
www.event1.com

Eventide Audio
www.eventide.com

Fairlight
www.westworld.com/~fairlte

Fidelipac
www.fidelipac.com

Focusrite
www.focusrite.com/focusrite

Fostex
www.fostex.com

Freeland Products, Inc.
www.freeland-inc.com

Furman Audio
www.furmansound.com

Genelec
www.genelec.com

Gentner
www.gentner.com

Gepco
www.gepco.com

Gorman - Redlich
www.gorman-redlich.com

Graham-Patten Systems
www.gpsys.com

Grainger
www.grainger.com

H.L. Dalis
users.aol.com/hldalis2/HOMEPAGE/home.html

Hafler Pro Audio
www.rockfordcorp.com/hafler

Hammet and Edison Consulting Engineers
www.h-e.com

Hamtronics
www.hamtronics.com

Harris Broadcast
www.broadcast.harris.com

Harrison by GLW
www.glw.com

Henry Engineering
www.henryeng.com

HHB Communications
www.hhb.co.uk

WEBSITE DIRECTORY

Holaday
www.holadayinc.com

IBM
www.ibm.com

Imation Corp.
www.imation.com

Innovative Devices
www.innovadev.com

Inovonics
www.inovon.com

Intelix
www.intelix.com

Intraplex, Inc
www.intraplex.com

ITC (International Tapetronics) - DRS Ahead Technologies
www.itc-net.com

Itelco - Dolp
www.itelco-usa.com

Jampro
www.jampro.com

JBL Professional
www.jblpro.com

JDR Microdevices
www.jdr.com/JDR

Jensen Tools
www.jensentools.com

JK Audio
www.jkaudio.com

KD Kanopy
www.kdkanopy.com

Kintronic Labs
www.kintronic.com

Klipsch Professional
www.klipschpro.com

Kurzweil
www.youngchang.com/kurzweil

LBA Technology, Inc.
www.lbagroup.com

LEDtronics
www.ledtronics.com

Leitch
www.leitch.com

Lexicon
www.musicpro.com

Lightning Eliminators & Consultants
www.lightningeliminators.com

Lightning Master
lightningmaster.com

Liquid Audio
www.liquidaudio.com

Littlite/CAE
www.caeinc.com

Logitek
www.logitekaudio.com

LPB, Inc.
www.lpbinc.com

Mackie
www.mackie.com

Marti Electronics
www.marti.bdcast.com

Maxell
www.maxell.com

McCurdy
www.mcradio.com

Media Touch
www.omt.net

Mediatron
www.mediatron.com

Microtech Gefell GmbH
www.gprime.com

Microwave Filter Co.
www.microwavefilter.com

Minidisco
www.minidisco.com

Monster Cable
www.monstercable.com

MOOG Music
www.moogmusic.com

Moseley Associates, Inc.
www.moseleysb.com

Mouser Electronics
www.mouser.com

MTS Communication Products
www.mts-comm.com

Multidyne
www.multidyne.com

Murphy Studio Furniture
www.murphystudiofurniture.com

Musicam USA
www.musicamusa.com

Nady
www.nadtwireless.com

Nagra
www.nagra.com

Nautel
www.nautel.com

Neato CD Labeler
www.neato.com

Neumann USA
www.neumannusa.com

Neutrik
www.neutrikusa.com

Norsat International
www.norsat.com

NSN
nsn.net

OMB America
members.aol.com/OmbRacioTV

OpAmp Labs
www.opamplabs.com

Orban
www.orban.com

Otari Corporation
www.otari.com

Pacific Research & Engineering
www.pre.com

Panasonic
www.panasonic.com

Penta Labs
www.pentalabs.com

Peter W. Dahl Co.
www.1eagle1.com/commercial/pwdco

Phasetek
www.phasetek.com

Potomac Instruments
www.pi-usa.com

Pre-Sonus Audio Electronics
www.presonus.com

Prism Media
www.prismsound.com

Pristine Systems
www.pristinesys.com

Professional Audio Supply
www.rab.com/pas

Prophet Systems
www.prophetsys.com

QEI
www.qei-broadcast.com

QSC Audio
www.qscaudio.com

Quantegy
www.quantegy.com

R C S
www.rcsworks.com

R F Specialties
www.rfspec.com

Radio Design Labs
www.rdlnet.com

Radio Programming and Management
www.tophitsusa.com

Radio Systems
www.radiosystems.com

Radiosoft
e-mail: pmoncure@america.com

Rane
www.rane.com

RE America
www.re.dk

RealAudio
www.realaudio.com

RF Specialties
www.rfspec.com

Richardson Electronics
www.rell.com

Rode
www.event1.com

Rohn
www.rohnet.com

Roland
www.flex.net/~apt/rpa.htm

RPG Diffusor Systems
www.rpginc.com

Russ Berger Design Group
www.rbdg.com

Sabine
www.sabineinc.com

SAGE Alerting Systems
www.broadcast.harris.com/sage/index.html

Sascom Marketing Group
www.sascom.com

SCA Data Systems
www.scadata.com

Scala
www.scala.net

Scientific Atlanta
www.sciatl.com

Scott Studios
www.scottstudios.com

Selco Products
www.selcoproducts.com

Sennheiser
www.sennheiserusa.com

Shively Labs
www.shively.com

Shure
www.shure.com

Sierra Automated Systems
www.sasaudio.com

Silicon Valley Power Amps
www.svpa.com

Sine Systems
www.sinesys.com

Smarts Broadcast
www.smartsbroadcast.com

Sonic Foundry
www.sfoundry.com

Sonic Solutions
www.sonic.com

SonicNet
www.sonicnet.com

Sonifex
www.sonifex.com

Sony
www.sony.com

Sound Techniques
www.soundtechniques.com

Soundcraft
www.pavilion.co.uk/plasa/sndcrft.htm

Soundtracs
www.soundtracs.co.uk

SpaceWise Broadcast Furniture
www.flash.net/~spacwise/home.htm

Spectral Inc.
www.spectralinc.com

Spirit
www.spirit-by-soundcraft.co.uk

Studer
www.studer.ch/studer

Studio Audio - SADiE
www.sadie.com

Svetlana Electron Devices
www.svetlana.com

Sweetwater Sound, Inc.
www.sweetwater.com

Switchcraft
www.raytheon.com/re/swc

SWR
homepage.third-wave.com/swrweb

Symetrix
www.symetrixaudio.com

SYPHA
www.mandy.com/2/sypha.html

t.c. electronic
www.tcelectronic.com

Tannoy
www.tannoy.com

Tascam/ TEAC Professional
www.teac.com

Techni-Tool
www.techni-tool.com

Telect
www.telect.com

Telex
www.telex.com

Telos Systems
www.zephyr.com

TFT, Inc.
www.tftinc.com

THAT Corp.
www.thatcorp.com

Thomcast
www.thomson-csf.com

TOA
www.toadigital.com

Transcom
www.trcorp.com

TSA Sites
e-mail: 104174.654@compuserve.com

Turtle Beach
www.tbeach.com

Universal Electronics
www.ueinc.com

USRobotics
www.usr.com

Ward Beck Systems
www.wbsltd.com

Warner Electric
www.warnernet.com

Waves
www.waves.com

Wheatstone
www.wheatstone.com

Whirlwind
www.whirlwind.com

Xing Technology
www.xingtech.com

Yamaha
www.yamaha.com

Zaxcom Audio
www.zaxcom.com

Zercom
www.rrtrade.org/nortech/Zercom/Broadcast.htm

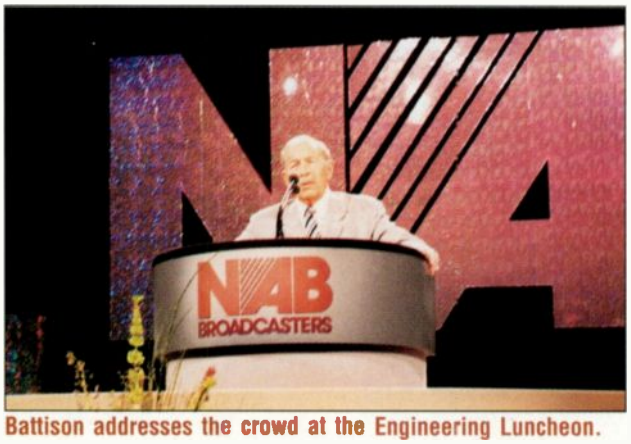
All information is as accurate as possible. BE Radio *is not responsible for any errors or omissions. Corrections and additions can be sent to* beradio@intertec.com.

Battison remembers 52 YEARS

Every year at the Engineering Luncheon, the NAB presents the prestigious Engineer of the Year award to two engineers; one representing radio and the other, television. This year's recipient of the radio award was John H. Battison. John has been a broadcast engineer for more than 50 years. He is a licensed Professional Engineer, was a founder of the Society of Broadcast Engineers and is currently Technical Editor, RF for BE Radio. *He has been a contributor to BE Radio since it began, and before that wrote for our sister publication,* Broadcast Engineering. *To know John is to know the history of our industry, and to hear him speak is an education in itself. The acceptance speech he delivered at the luncheon outlines part of John's amazing career and perfectly illustrates to the industry's relative newcomers just how far we've come. A transcript follows.*

Good afternoon NAB, fellow engineers, ladies and gentle men. Thank you National Association of Broadcasters and my sponsor for this honor. I'm very proud to receive it. I finally retired this spring and it's 1000dB nicer than a gold watch.

Looking back over 52 years of broadcast engineering, I want to thank all the people who have helped me. Among these are Frank Marx, who hired me in the ABC Engineering Department, and especially Carl Smith, who has been a very good friend for most of my engineering life, as well as a fine employer.



Battison addresses the crowd at the Engineering Luncheon.

Television came to life when ABC received its TV CPs, and we had to find a TV studio site in New York. We decided on the old riding stables just off Central Park. Then we had to get rid of the birds and the horses' souvenirs.

We had hoped to put the WJZ-TV transmitter on the RCA building. In the interim, we put it on the Pierre Hotel and got a horrendous ghost in Westchester County.

I've met most of the famous engineers who made US radio what it is today, and many of the pioneer radio inventors including Lee de Forest and Major Armstrong, the inventor of FM. I built an Armstrong Super Regenerative receiver in the 1920s, so of course I already knew his name. When I met him, he was "Major FM."

As time passed, AM became "ancient modulation" and FM became the "forgotten medium." Eventually, FM took hold and we engineers pretty well filled up the New England area with FM stations.

In 1961, in a *BE* [*Broadcast Engineering*] editorial, I urged the creation of a broadcast engineering society. I received lots of support. In 1963, I personally wrote to every radio and TV chief engineer – about 6,000 letters – proposing that we start one.

In 1964, NAB gave us space in the Chicago Convention; about 100 engineers turned up. I was made steering committee chairman, and the Society of Broadcast Engineers was formed. We published a quarterly SBE journal with a lot of member input. We had great industry support and led off with a greeting from the FCC chairman.

In 1965, I was elected president. We had about 400 members and eight chapters around the country. I handed [the reigns] over to Charlie Hallinan as president in 1966, and the SBE never looked back.

Also in the sixties we had the "10% Rule," which allowed us to build new AMs — provided there was not more than 10% interference! Finally, the FCC imposed an AM freeze to undo the mess that AM was in.

Then there was a burst of activity from the daytimers and Ray Livesy headed up another attack on the FCC to liberalize night operation. This resulted in some strange night powers ranging from about six Watts to several hundred. Many small towns received some level of new, local night radio service.

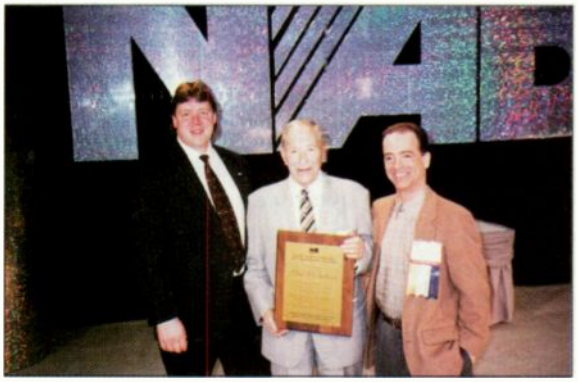
Sometime during this period, AM stereo came – and went – mainly through FCC vacillation. By the way, I liked Leonard Kahn's system best.

The US participated in the Region Two World Administrative Radio

Conference in Buenos Aires in 1980, and I was honored to be on the FCC/ Industry team. We went down to the conference with strict orders from the FCC to plug for eight kc AM separation.

The reason given was compliance with the official Region Two channel spacing and to make room for more AM stations. Another argument was to avoid one kc heterodynes from increasingly powerful AM stations in Europe and the emerging nations. Actually, there were very few "whistles."

After being in Buenos Aires for about four days, we had succeeded in persuading many other delegations from the Americas that the change was good. Then we suddenly received orders from the FCC to forget nine kc separation! With rather red faces, we had to change horses in midstream and persuade them to switch back to 10kc.



Battison (center) with *BE Radio* editor Chriss Scherer (L) and editor-in-chief Skip Pizzi (R)

The FCC introduced the "standard" antenna pattern. It replaced the old MEOV that was the consulting engineers lifeboat when a pattern wouldn't come in.

The end of the eighties saw LPTV come into bloom and CPs were issued by the hundred — but not all were built.

By this time, engineers in radio stations were a thing of the past. "Five-week wonder" first class licenses made DJs into engineers, and remote control took over many of the operations. Automated transmitter operation and reduced FCC logging requirements were introduced, andonly high-power and directional AMs had to make log readings every three hours.

I wonder how many remember the days of logging transmitter readings every half hour? Or logging base currents daily? It's quite different today.

So different, in fact, that we don't need licensed operators any more. Unfortunately, the pirate broadcasters think *they* don't need licenses either!

The AM band has been expanded to 1710 kc and a few new stations are on the air.

We've advanced from the Conelrad system, through EBS to EAS. This still has problems, but no doubt, eventually, it will work as planned.

Perhaps the greatest change has been the introduction of a piece of rare metal contaminated with an exotic oxide — I'm referring, of course, to the transistor. This little device has changed the radio engineering world. First came transistor radios plugged into the world's ears. Then came its big brother — the transmitting transistor. Transmitter manufacturers switched from tubes to transistors as fast as new methods of RF power generation were developed.

The old, single-modulated channel, Class A, triode AM transmitter has developed into multi-channel units like its FM brother. Satellites are offering direct multi program sources and the days of the crystal receiver and headphones are numbered!

When the digital revolution hit radio, its amazing versatility spawned new transmission methods. Almost every day we hear of new ones.

Spread spectrum, once top secret, has given us legally unlicensed STL operation with low power and low costs.

I haven't even touched on Eureka, DAB, RBDS, cell phones, PCS, GPS, wireless services and the dozens of things still to come.

Radio engineering's advances from 1945 through 1998 have been fantastic. Someone will say, "He's forgotten – whatever." I apologize. Too many things have happened to cover them all.

Speaking as an RF engineer, I still maintain: "Audio is something that messes up a nice, clean carrier."

NAB, fellow engineers and ladies and gentlemen — I thank you.

News

ARMA Expo set for June

The American Radio Manufacturers Association (ARMA) has fixed the date and location for its first Equipment and Technology Expo, June 4-5 at Harrah's Atlantic City.

The newly established group was formed by radio equipment manufacturers to "show ...appreciation for our past, present and future customers by providing free regional radio equipment exhibits, complete with no charge radio engineering, radio management, and industry-related educational and informational seminars for attendees." It is ARMA's intention to schedule several smaller regional shows around the country as "mini-conventions" to allow greater attendance and lesser bottom-line expense among its patrons.

Planned equipment exhibits will showcase consoles, digital storage systems, RF systems and ISDN and POTS codecs. Seminars scheduled at press time include Ratings & You, Digital Transitions, Equipment Trends, and Ownership Changes.

Those wishing more information can contact ARMA at (609) 653-6130, by e-mail at mail@armagroup.org, or online at www.armagroup.org.

SBE addresses shortage of engineers

Addressing a perceived shortage of industry engineers in the future, the Society of Broadcast Engineers (SBE) announced the institution of a program to educate young people about technical career opportunities in the broadcast field.

SBE President Ed Miller explained that "many radio and television stations have found it increasingly difficult to fill the needs they have. Technology advances have made it more important than ever for broadcasters to maintain a high degree of competency among staff and contract broadcast engineers and technicians." He went on to say that, "In recent years, many broadcast engineers have left the industry for jobs in related fields where many times money was better and the hours shorter and more predictable." Economic cutbacks at stations were cited by Miller a factor contributing to the exodus.

Using a combination of educational information and contact with broadcast engineers in the field, the SBE hopes to increase the number of high school-aged youth who wish to continue their education and eventually become broadcast engineers. As part of the program, each of the SBE's 103 nationwide chapters will be encouraged to hold "Student Night" meetings enabling students to see a broadcast facility up close and learn first hand what broadcast engineers do on a day-to-day basis. Also included in the program will be a college scholarship awarded to a graduating senior who has an interest in pursuing a degree in a broadcast engineering-related field.

.FM extension launched

The Federated States of Micronesia, in cooperation with BSM Media, has launched a .fm Internet extension intended for use by FM broadcasters. While the

Mackie claims dismissed, defamation counterclaim filed

A federal judge in Seattle rejected copyright and patent claims brought by Mackie Designs, Inc. against Samson Technology, citing Mackie's repeated failure to identify the copyrights it alleges were being infringed or to provide any valid evidence to substantiate its claims. The Order follows Judge Barbara Jacob Rothstein's earlier decision to dismiss claims brought by Mackie against Sam Ash Music Corporation, its CEO, Richard Ash, and Samson CEO Scott Goodman. Judge Rothstein also dismissed defendant Uhlrich Beringer, CEO of Behringer GmbH from the lawsuit.

In response, Samson has filed a $10 million defamation counterclaim against Mackie, alleging that Mackie has damaged its reputation and business by, among other acts, publishing false claims against the company on the Internet. Mackie had posted the original copyright and patent infringement complaint on its website.

The copyright and patent infringement suit was originally filed by Mackie in June of 1997, and claimed that Sam Ash Music Corporation, Samson, Ash and Goodman conspired with Behringer GmbH to infringe Mackie's claimed copyrights and trademarks relating to a mixing board.

designation offers no technical superiority over the more common .com extension, it does provide the opportunity for superior branding and marketing for stations looking to build an audience and an identity online.

The .fm extension is open to all stations worldwide and can be registered on a first-come, first-served basis. Registrants for the extension do not need to be providing audio content via the Web at this time. For those stations interested in registering an .am extension, BSM is negotiating to make that service available.

Parties interested in registering their site with a .fm extension can do so at www.dot.fm.

Former SBE president Hallinan passes

Charlie Hallinan, one of the original organizers of the Society of Broadcast Engineers, passed away on April 22 in Binghampton, NY, after a long illness. He was 79.

Hallinan was a founder and long-time chairman of SBE Chapter 1 in Binghampton, and served two terms as the SBE's second national president from 1966-68. He also served as the Society's vice president and secretary. He was instrumental in the beginnings of WKOP and WINR in Binghampton, and was a consultant to more than 40 radio stations in all. He was a member of the Radio Institute of Engineers (IRE) and the Audio Engineering Society (AES).

Brad Dick, editor of *BE Radio*'s sister publication, *Broadcast Engineering*, documented the early history of the Society in his 1983 Master's thesis. In it he writes of Hallinan's long-term effect on the SBE. "Hallinan served only two terms as president of the Society, yet he was instrumental in guiding the fledgling organization from conception to national notoriety. His skilled hand continued to be felt for many years, not only with the organizational procedures he established, but with his leadership in other positions within the organization."

Memorial contributions can be made to the Ennes Educational Scholarship Fund, 8445 Keystone Crossing, Suite 140, Indianapolis, IN 46240.

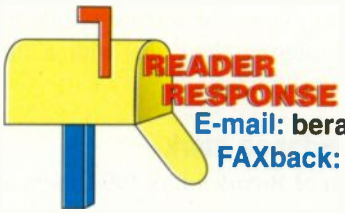
NAB98 sets new attendance mark

The National Association of Broadcasters 1998 convention in Las Vegas set a new mark for attendace, topping the 100,000-attendee level for the second year in a row. This year's announcd figure of 104,805 is the highest ever for the annual show.

Another record was set for exhibitors, with 1307 companies showing products. They were rewarded by the presence of more than 65,000 registered buyers looking to take equipment home.

The only area of attendance showing a decline was that of international attendees. This year's mark of 22,654 was notably down from last year's number near 25,000.

Reader Feedback



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

In the April issue of BE Radio, Jeff Keith, CPBE, NCE, asked about the status of the litigation between Novell and the state of Illinois concerning the use of the title "engineer." Jeff also inquired as to whether other professional organizations, particularly NARTE, were contacted to work together on the issue. Jeff also solicited response from individuals that hold both Professional Engineer (PE) licenses and trade certification from SBE or NARTE. Among the replies we received, following are the letters from Chris Imlay, general counsel for the Society of Broadcast Engineers, and Dane Ericksen, P.E., CSRTE, and SBE board member. While the topic of debate is not a new one, it does continue to resurface. Look for more letters on this topic in the next issue as well.

Chriss Scherer, CSRE, editor

SBE activity

Dear editor:

Thank you for allowing SBE the opportunity to review the letter of concern from one of your readers regarding the participation of SBE in the Novell litigation. I don't usually speak for the Society, but as SBE General Counsel, I have some experience in state registration matters, and was asked to respond by SBE President Ed Miller. Your correspondent suggests asking NARTE to join hands with SBE and Novell in the litigation, and expresses concern that SBE and NARTE, two professional organizations with similar goals "would rather ignore each other." While I am sorry that impression has arisen, I am pleased to report that the concern is unfounded. There is, and has been for many years a close, and mutually beneficial working relationship between SBE and NARTE on state registration issues.

My good friend Ray Thrower, the longtime President of NARTE (and the author of a mighty fine cookbook) was, early on, the "Paul Revere" on the state licensing issue, and devoted many of his own dollars and hundreds of hours battling state registration boards. He and I participated on several panels together at SBE and NAB conventions over the years. We shared information on submissions to the United States General Accounting Office in 1989 and 1990 which formed the basis for the report entitled "Issues Concerning Licensing of Telecommunications Engineers and Technicians," GAO/RCED-90-106FS.

Ray has attended an SBE Board meeting by invitation, and used the opportunity to discuss ways in which NARTE and SBE can work together on certain projects. SBE Executive Director John Poray has corresponded with Ray on the same subject very recently. Ray and I have had recent discussions, and have exchanged ideas on protection of SBE's and NARTE's respective members from overzealous state licensing boards, both at the Federal and state levels. SBE's strategy has resulted in some notable successes in this respect, working at the state level, over the past few years. There has been no hesitation in sharing our arguments and approach on this subject with NARTE. Though the two associations each have a somewhat different engineering emphasis, there is absolute identity of interest in this respect.

As to the Novell litigation, Ray and I discussed NARTE's participation as an additional *amicus curiae* (friend of the Court), but ultimately, and particularly due to the short timetable for coordinating the filing with Novell and drafting, redrafting and filing the brief, it was logistically almost impossible to bring NARTE into the brief. SBE's officers felt that SBE was able to sufficiently address each of the issues in the case, and we already had the benefit of Ray Thrower's experience and wisdom.

Your reader mentioned "several" professional associations. Building coalitions is a good strategy for professional associations, but SBE's efforts to build bridges with United States engineering associations other than NARTE on the state licensing issue have been singularly unsuccessful so far. NSPE, as expected, when we met with them, offered no willingness to even try to reach a meeting of the minds: they informed us that their policy was that if one calls oneself an engineer, there had better be a PE certificate on the wall, and SBE had better change its name and its certification program. We thanked them for their time.

NARTE and SBE don't ignore each other; we work together on common goals and will do so in the future, without doubt, on issues in addition to state licensing.

Christopher D. Imlay
SBE General Counsel
Washington, DC

Engineer certification

Dear Chriss:

I read with interest Mr. Keith's letter about who should be able to use the "engineer" term in the April issue of *BE Radio*. As both a Registered Professional Engineer and an SBE Certified Senior Radio and Senior Television Engineer, I am responding to your request for input.

I fully support SBE's and Novell's efforts for the right to use the "engineer" term, and I second Mr. Keith's urging that the National Association of Radio and Telecommunications Engineers (NARTE) also support Novell's right to use the term "Certified Netware Engineer," or CNE, designator. No reasonable person is going to confuse the "registered professional engineer" or the "professional engineer" (PE) title with the NARTE Certified Engineer (NCE), or the Certified Netware Engineer (CNE) acronyms or titles, and I believe that is why Novell prevailed in its dispute with the Illinois Department of Professional Regulation.

As far as I am concerned, the decision whether to hire only PEs, as opposed to a CPBE, NCE, or CNE, should be left to the person or entity purchasing those services, just as a person desiring accounting services has the option of hiring, or not hiring, a Certified Public Accountant (CPA).

In California there are sixteen types of PE exams besides the well-known civil, mechanical, and electrical PEs, such as nuclear, safety, manufacturing, soils, and traffic, but no 'telecommunications' or 'computer' PE exams. When I took the electrical PE examination I had to answer totally irrelevant questions about multi-horsepower induction motors, high-voltage power grids, and parking lot lighting design, none of which were pertinent to my practice as a consulting engineer in the broadcasting field. By contrast, the SBE Senior Radio and Senior Television engineer examinations did ask pertinent questions, and I value those certifications just as much as my PE license; however, because I not only use the 'E' word in my title, but also offer engineering services to the general public, I need to maintain my PE registration, even though the only requirement for renewing that registration is the payment of a renewal fee. By contrast, I have to demonstrate continuing education and continuing industry involvement to renew my SBE certification.

The National Society of Professional Engineers (NSPE), and state registration boards, might be in a better position to insist on professional registration for engineers working in the broadcasting and computer fields if they created examinations covering those areas. Until then, organizations like SBE and NARTE, and even equipment manufacturers, fill a valid need by creating certifications for specialized areas. Persons meeting those requirements have earned the right to use the word 'engineer' in their title, as far as I am concerned.

Dane E. Ericksen, PE, CSRTE
SBE Board of Directors, SBE Certification Committee
San Francisco, CA

Taking a breath...

Dear Skip:

Wonderful editorial ("The crystal and the flame") in the April *BE Radio*! I highly approve whenever anyone in the radio community writes something that jerks our heads out of the sand and forces some fresh air down our throats, reminding us that we are part of something larger.

Keep up the good work!

John Covell
Executive Producer - City Visions
KALW-FM, San Francisco

Business/People

BUSINESS

IBM, New York City, and **Pacific Research and Engineering**, Carlsbad, CA, (PR&E) announced an agreement to provide radio broadcasters and audio content providers with integrated, end-to-end solutions to help them generate new revenue and reduce costs. PR&E has agreed to market an array of IBM services and products, including *eWave* automation software for its StarTrax solution. In addition, PR&E will provide systems integration and worldwide data communications through IBM Global Services.

In other news from PR&E, the company recently celebrated the 20th anniversary of its BMX console. The occasion was marked by a small ceremony at KDON-FM in Salinas, CA, where the first BMX, a 12-input model bearing serial number 0001, is still on the air in daily, 24-hour service.

Orban, San Leandro, CA, announced that its Audicy 2.0 has gone online at facilities for KGB, KKLQ and KIOZ in San Diego, CA. The Jacor facility is the first radio operation in the country to install the updated workstation.

Lucent Technologies, Murray Hill, NJ, and **CD Radio**, New York, announced that Lucent will develop and supply DSP and radio-frequency chips for CD Radio's satellite-to-car radio system. The agreement marks the first move by Lucent into digital satellite radio.

Leitch, Chesapeake, VA, announced an expansion of its service presence by the addition of two new service centers. The company already services products at its Chesapeake facility and will also provide service in northern New Jersey and Burbank, CA. Each of the centers will provide a full range of product support services to meet customer needs and complement Leitch's sales team.

Harris Broadcast, Richmond, IN, has been appointed as an authorized warranty service center for Sony, Panasonic and Marantz. The addition of these services allows Harris further on-site capabilities for maintenance and regular service of its full product ranges.

Comstream has recently completed a move to. 6350 Sequence Drive, San Diego, CA, 92121-2724. The company can be reached at 619-458-1800, fax 619-657-5400.

PEOPLE

David Molinaro has joined Crown International, Elkhart, IN, as director of sales and marketing for satellite broadcast equipment.

Molinaro

Gabriel Caunt has joined the design team at Russ Berger Design Group, Inc., Dallas, TX.

Don Bird has been appointed vice president, sales and marketing, for 360 Systems, Westlake Village, CA.

Blain Albright has joined the customer service integration team at Broadcast Electronics, Quincy, IL.

Albright

Eaves

Also at Broadcast Electronics, **Brian Eaves** has been named to the studio systems customer service department.

Greg Noack has been named vice president of affiliate marketing/talk division for Premiere Radio Networks, Sherman Oaks, CA.

Online survey: DAB

IBOC and S-DARS were both hot topics at NAB98. We asked for your opinions on the subject.

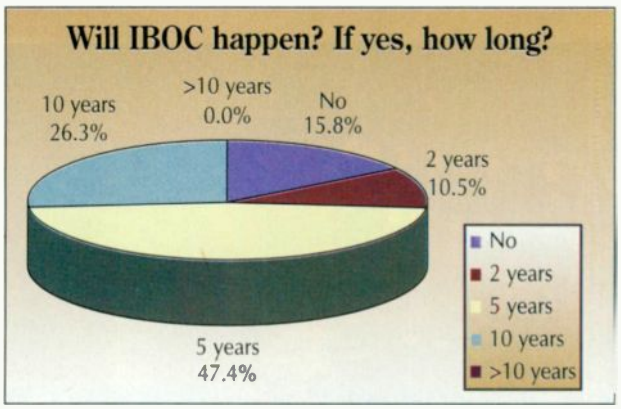
By Chriss Scherer, editor

The progress on DAB in the United States is working in two different areas: IBOC and S-DARS. This month's survey asked about the realities and the effects of these services.

IBOC has been in the works for several years now and there have been multiple proponents at various times. There are currently two companies working to develop a system, USA Digital Radio and Digital Radio Express. Both of these companies have formed alliances with other firms to develop the technology.

Survey question:

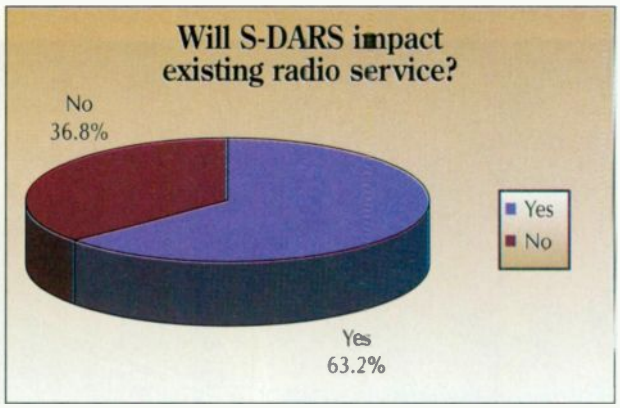
Do you expect IBOC (In-Band, On-Channel) DAB to become a reality in the United States? If yes, when do you expect it to be fully functional?



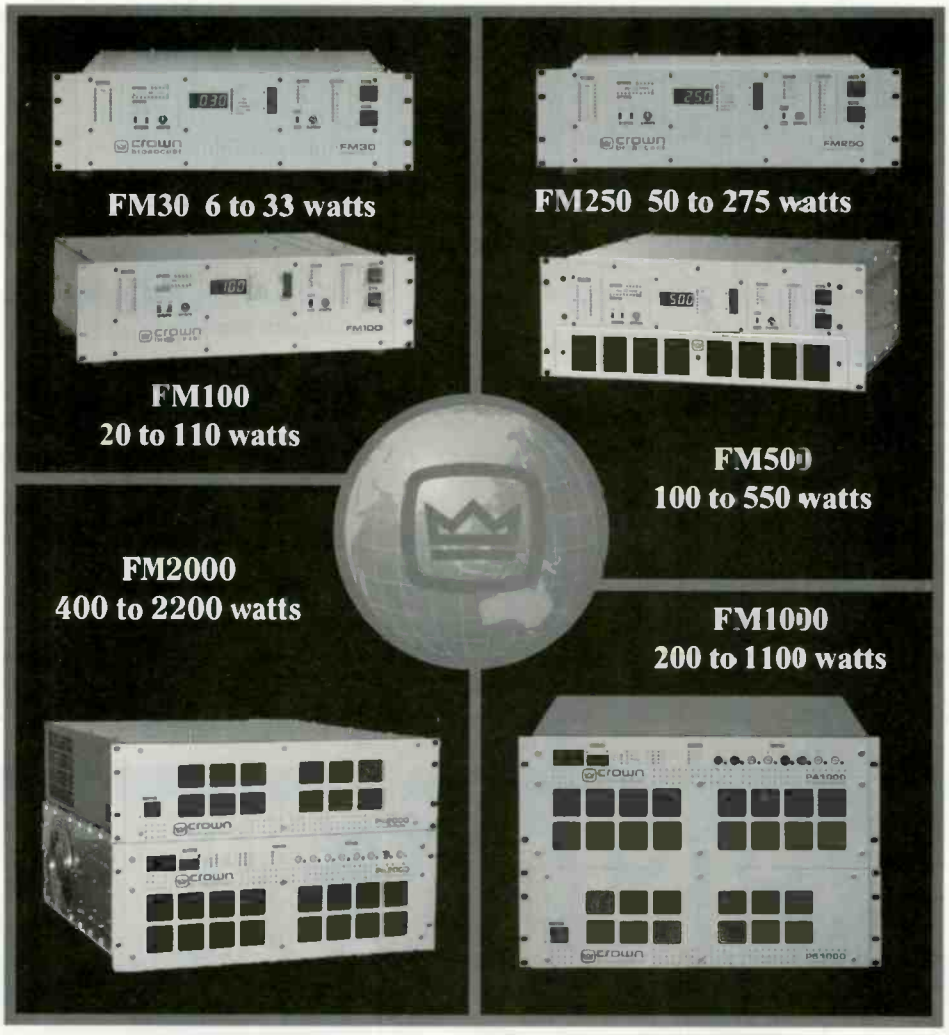
Last year, the FCC awarded licenses for S-DARS service to CD Radio and American Mobile Radio Corporation. Both companies are working to have satellites launched by next year and to begin service in 2000. S-DARS will offer a new service to mobile consumers that already have choices while driving in their cars.

Survey question:

Do you think mobile DBS radio (Satellite Digital Audio Radio Service) will have a significant impact on the existing radio industry?



A World of Possibilities. . .



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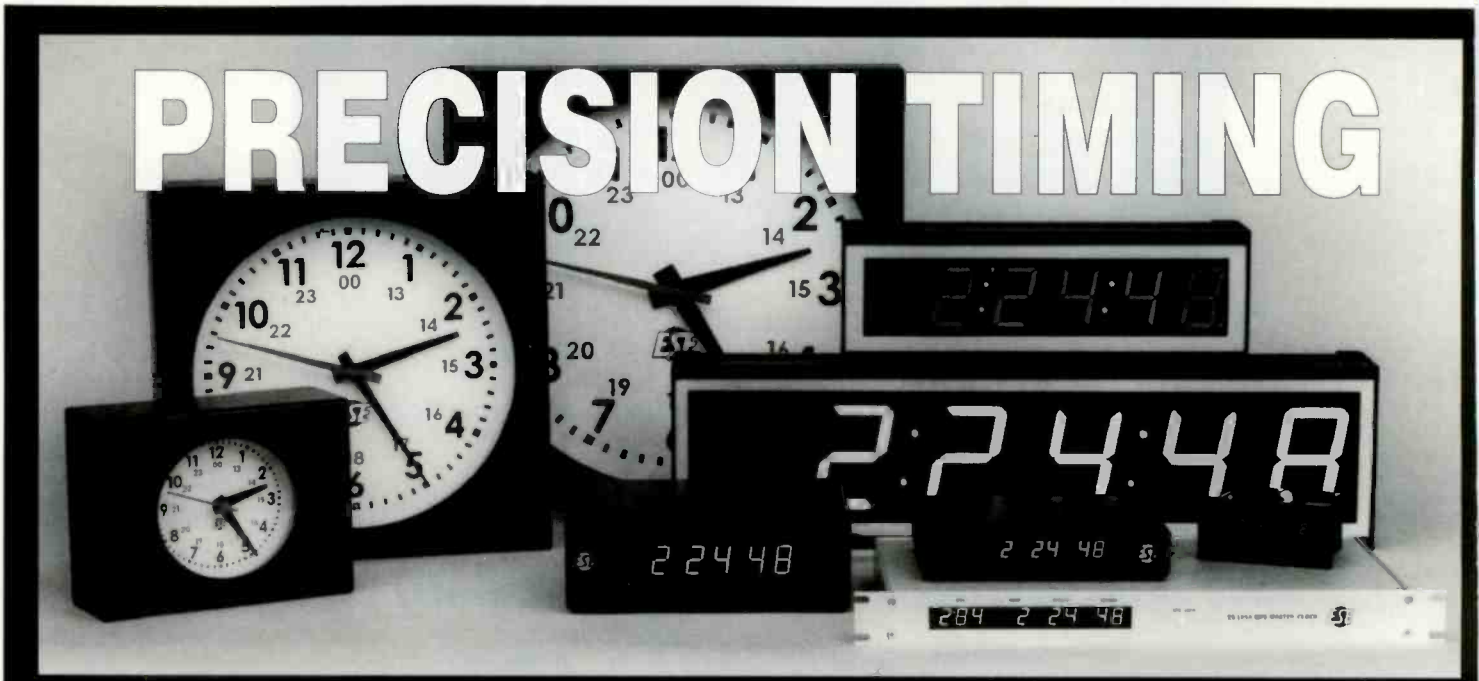

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BE RADIO (ISSN 1081-3357) is published monthly (except bimonthly in May/June and November/December) and mailed free to qualified recipients by Intertec Publishing Corporation, 9800 Metcalf, Overland Park, KS 66212-2215. Non-qualified persons may subscribe at the following rates: USA and Canada, one year, $30.00; all other countries, one year, $35.00 (surface mail), $70.00 (air mail). Single copy price, $10.00. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canada Post International Publications Mail (Canadian Distribution) Sales Agreement No. 0956244.
POSTMASTER: Send address changes to *BE Radio*, P.O. Box 12937, Overland Park, KS 66282-2937.
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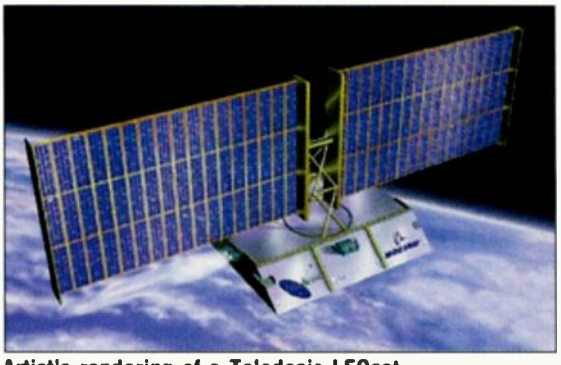
The LEOs are coming

By Skip Pizzi, editor-in-chief

Stand by for another important consumer electronics technology launch: direct satellite two-way communications on handheld and mobile terminals via *low-earth orbit* (LEO) satellites. A number of different, proprietary systems are planned, each using multiple satellites orbiting at altitudes of approximately 700 to 1400km (300 to 600mi).

Although the dozens of satellites required for each system are expensive, LEOsats provide several benefits over today's geostationary (GEO) satellites. These advantages include lower power requirements and latencies — due to the relatively short RF paths to/from the earth's surface — and good coverage, because a satellite is always close to being directly overhead.



Artist's rendering of a Teledesic LEOsat.

LEOsats can be divided into three basic service categories: "Little LEOs" such as the *Orbcomm* and *VITA* systems, which provide paging and messaging; "Big LEOs" like *Iridium*, *Globalstar* and *ICO*, offering real-time voice and low-speed data; and "Broadband LEOs," to date only represented by the *Teledesic* and *Celestri* systems, intended for high-speed data communications.

Two system profiles

The most sophisticated systems at present are *Iridium* (from Motorola) and *Teledesic* (a joint venture of McCaw Cellular, AT&T, Microsoft and Boeing), primarily due to their usage of intersatellite communication links. Other LEO systems generally emulate the more traditional "bent-pipe" transponders, using the LEOsat purely for first- and last-mile communication with the remote terminals, while the remainder of the path travels via terrestrial gateways through the existing telecom infrastructure.

Iridium and Teledesic also exhibit significant differences from each other, however. For example, Iridium is close to completion, with service scheduled to begin in September 1998. Nearly all of its 72 satellites (66 active units and 6 in-orbit spares) have already been launched. Teledesic, on the other hand, has only launched one prototype satellite, and will not begin deployment of production-model spacecraft until 2001, with service beginning the following year. It will ultimately use 288 satellites plus spares, by far the largest of any proposed LEOsat system.

The two companies' service profiles are also divergent. Iridium will act like a cellular telephone service, using handheld phones that access both GSM terrestrial systems and LEOsats. Teledesic portrays itself as the "Internet in the sky," providing wireless broadband data connectivity to both mobile and fixed terminals of approximately laptop size. This strategy has engendered an asymmetrical design for Teledesic. Most terminals will provide bandwidth of up to 2Mb/s on uplink and 64Mb/s on downlink. (Some terminals will offer bidirectional 64Mb/s capacity.) Iridium uses 2.4 or 4.8kb/s symmetrical channel bandwidth architecture.

Both Iridium and Teledesic place their satellites in multiple, near-polar, circular orbits, with several satellites chasing each other in the same orbital "plane." Think of each plane as positioned over a time-zone-like slice of the earth, with the satellites proceeding (approximately) from south to north over one hemisphere and from north to south over the other. (Note that this visual model only applies in a static sense, because the earth rotates beneath the satellites.) Iridium uses six orbital planes with 11 active satellites each, while Teledesic will have 12 planes with 24 satellites in each. (See www.teledesic.com, www.iridium.com and www.ee.surrey.ac.uk/Personal/L.Wood/constellations/ for some helpful animations and other details.)

Meaning for broadcasters

Teledesic's extension of the Internet to the mobile and portable platform could have direct impact on broadcasters, providing Internet radio services with nearly the same user-accessibility as traditional radio. This might make Internet-only radio channels commercially viable. Broadcasters should monitor developments in this area, along with the closely related hardware market for handheld and automotive PCs — the likely "receivers" for such services.

Behind the scenes, LEOsat voice communication can provide broadcasters with another means of communicating with staff in the field, including the cost-effective transport of remote audio broadcasts and feeds from literally anywhere on the planet. Wherever you are, the new millennium is likely to bring you another mode of communication that will profoundly affect your personal and professional life.

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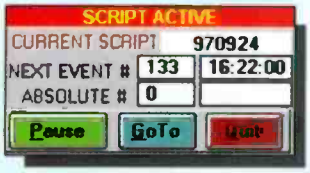

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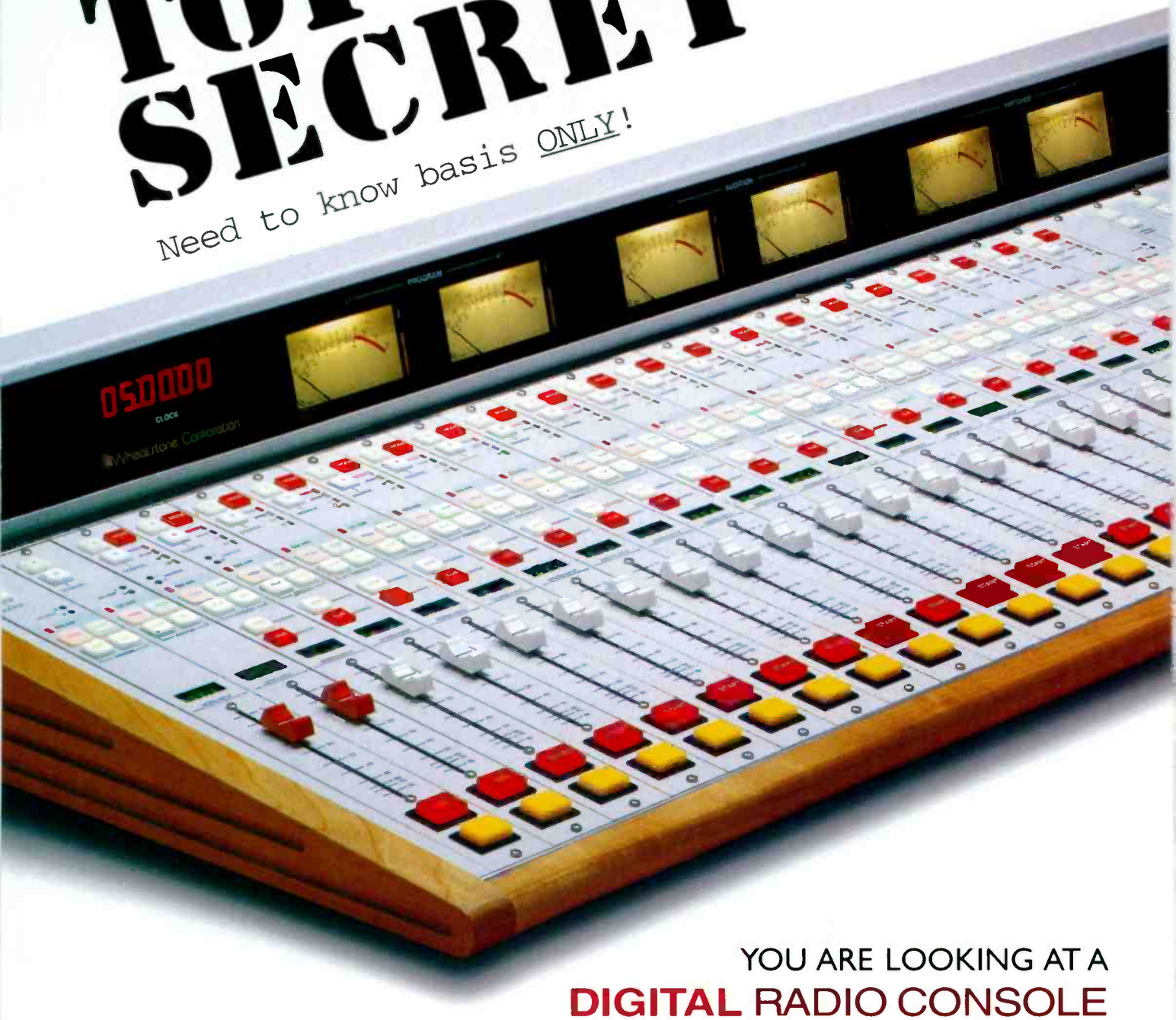

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