

Tech Tips

Avoid common pitfalls when designing your station remote control system.

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Radio's Other Dimension

Falcon Picture Group brings 'Twilight Zone' to affiliates.



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Radio World

\$2.50

The Newspaper for Radio Managers and Engineers

September 27, 2006

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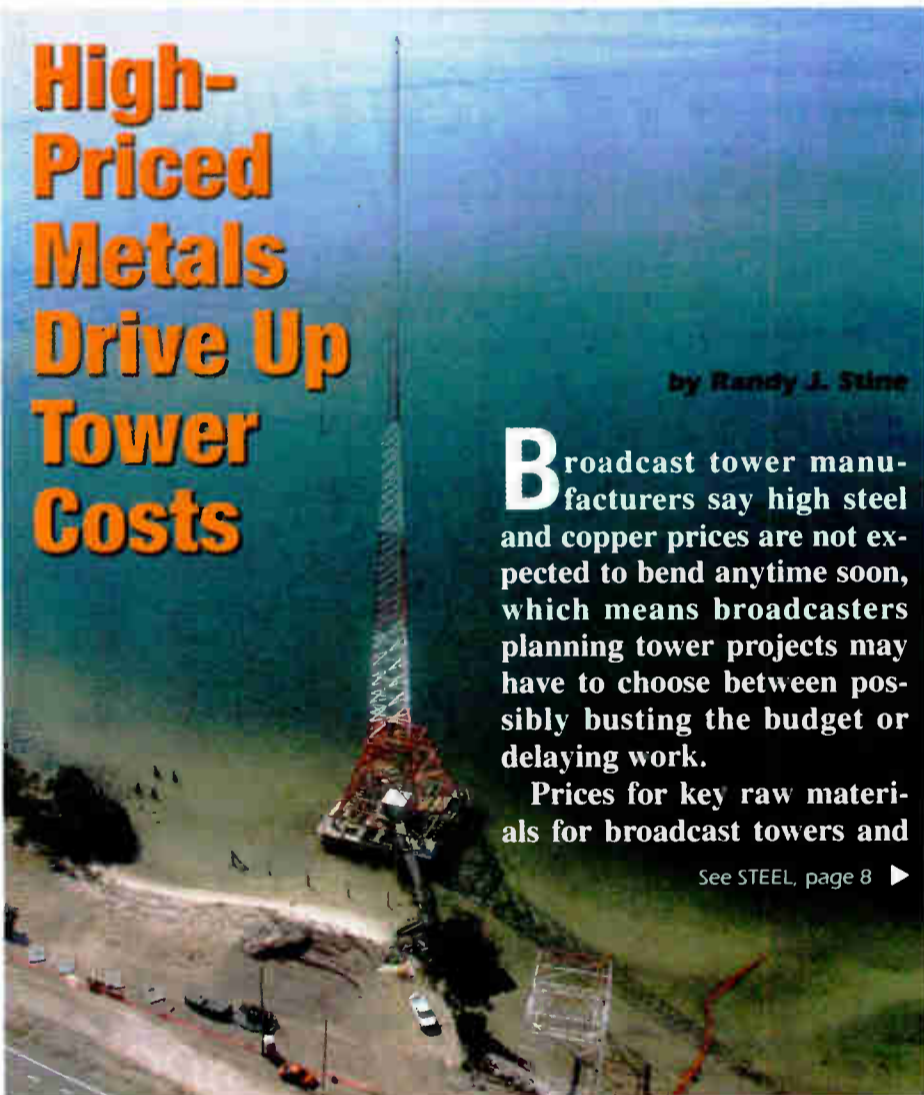
High-Priced Metals Drive Up Tower Costs

by Randy J. Stine

Broadcast tower manufacturers say high steel and copper prices are not expected to bend anytime soon, which means broadcasters planning tower projects may have to choose between possibly busting the budget or delaying work.

Prices for key raw materials for broadcast towers and

See STEEL, page 8 ▶



The new south tower for Clear Channel station WDAE(AM), St. Petersburg, Fla. Two 360-foot towers were designed, fabricated and installed by ERI. They are located in a bay and adjacent to a highway.

Why AM Stations Want FM Translators

NAB Seeks Better Coverage for AMs As Man-Made Noise Increases

The FCC is considering comments it received about NAB's Petition for Rulemaking asking the commission to permit AM stations to license and/or use FM translators. Various agency rules would need to be modified to accommodate this proposal.

If there is sufficient interest in the petition, the FCC is likely to begin a proceeding to amend its rules and would seek comment on specific proposed changes.

The following are excerpts from NAB's petition, RM-11338:

Specifically, NAB requests that AM stations be permitted to license and/or use FM translators to retransmit their AM service as a fill-in service, so long as no portion of the 60 dBu contour of the FM translator exceeds the lesser of either the 2 mV/m daytime contour of the AM station or a circle with its center at the AM trans-

See TRANSLATORS, page 5 ▶

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◆ NEWS WATCH ◆

Public Wants MP3s, Surround In New Cars

WESTLAKE VILLAGE, Calif. More than half of consumers surveyed said they want to play non-standard audio files in their next new car as well as have a premium surround sound system.

That's according to a study by J.D. Power and Associates.

Among iPod owners, 60 percent report that they would be willing to pay \$150 to be able to connect their iPod into their

next vehicle's audio system, according to the "2006 U.S. Automotive Emerging Technologies Study."

Premium surround sound continues to be the most desired entertainment feature after a market price of \$400 is revealed. Additionally, more than 75 percent of those interested in surround sound at \$400 say they would pay double for a branded premium surround sound system.

The study finds that at a price point of \$100, 54 percent of consumers express interest in using a USB memory key to listen to their own formats of music in their next new car.

Additionally, for the same price point, 58 percent of consumers would like to

have an in-vehicle computer hard drive, which would allow them to burn and store their music files in their vehicle's audio system.

The study is based on responses from approximately 17,000 consumers.

Shapiro: CE Growth Continues

ARLINGTON, Va. The CEA forecasts that consumer electronics factory-to-dealer sales will reach \$140 billion in 2006, an 8 percent growth over 2005, in its semi-annual "U.S. Consumer

Electronics Sales and Forecasts Report."

According to CEA Market Research, year-end totals reached \$128 billion in 2005, for 11 percent growth over 2004.

MP3 players remain the leader in the audio market, forecasted to ship 33 million units in 2006 and reach \$5 billion in sales.

"The mid-year numbers show continued robust growth in the CE industry, category to category," said CEA President/CEO Gary Shapiro. "Consumers are embracing new technologies in this digital age, as they make new or upgrade purchases for the home, the car, the office or anywhere."

The report is free to CEA member companies. Non-members may purchase it for \$499 at www.ebrain.org.

Bryant Leaves ABC To Run Pet Photo Firm

DALLAS/FT. WORTH After pursuing a pet photography business part-time for five years, Margaret Bryant, director of engineering and technical operations for ABC Radio, has left radio to devote her energies to her photographic firm.

She is one of the few high-profile female engineering executives in U.S. radio.

Bryant has been in her position 12 years and in radio for 30. She came to ABC after a chief engineer stint at the former WMAQ(AM), Chicago.

She said the timing of her departure is not related to Citadel's purchase of ABC. The demands of two jobs during the previous holiday season convinced her it

See NEWSWATCH, page 6 ▶

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GUEST COMMENTARY

DRM Moves Rapidly to Market

Consortium Tests in United States and Explores Broadcasting in FM Band

by H. Donald Messer

The author is chairman of the Digital Radio Mondiale Technical Committee.

Digital Radio Mondiale is an all-purpose, digital terrestrial broadcasting system. It has been developed, tested and standardized for use in all the broadcasting bands below 30 MHz, and is being augmented for use in the VHF broadcasting bands below 108 MHz, such as the traditional FM radio band between 88 and 108 MHz.

Thus, what is currently available is a capability in long-wave, the broadcasting bands between 100 and 300 kHz; medium-wave, the traditional AM band; and shortwave, a collection of broadcasting bands between 3 and 26 MHz.

The total bandwidth allocated is roughly 5 MHz. Considering that the frequency assignments in all these bands are mainly 9 or 10 kHz channels, there are several hundred channels available for this type of digital broadcasting.

The applications that have been successfully tested (RW, Sept. 13, page 6) and are now regularly broadcast include "local broadcasts," meaning coverage

country, a listener can listen to long-range DRM from other countries targeting America. When local DRM broadcasting comes to the U.S., the same receiver will be able to decode these signals.

Since the radio frequencies used are the same as those normally employed for AM and FM broadcasts, much of the receiver implementation, such as antenna and front end will be the same technology as what currently goes into a receiver.

Applications, test results

1) "Local" broadcasting, with and without "simulcast": DRM can be used practically for local broadcasting in two frequency bands — the traditional AM band and the uppermost shortwave band around 26 MHz. In the AM band, an existing transmitter station or a new one conforming to an unused but existing assignment in the regional assignment plan can be used.

In the latter case, this is a new, very exciting possibility where a low-power transmitter and a simple antenna can be set up to cover a metropolitan area, or any smaller territorial portion, in an uncluttered band.

The 26 MHz band is 430 kHz wide,

This is a new, very exciting possibility where a low-power transmitter and a simple antenna can be set up to cover a metropolitan area, or any smaller territorial portion, in an uncluttered band.

much like that of an FM station, and "long-range/wide-area coverage" going to planned coverage areas of up to thousands of kilometers away from the transmitting station — the usual application for international shortwave broadcasting.

Since the DRM system was conceived as a means for any country in the world to adapt the system's capability to its need, the system includes a myriad of options, such as audio quality depending on the use of any of several codecs; error protection levels; and channel bandwidths, ranging from 9 kHz to 20 kHz at the levels approved by the ITU for the particular country and region.

Market progress

Consumer receivers at starter production levels are available in Europe. Mass production of these and other models is expected in the coming months.

All have standard AM and FM reception capability, and for Europe in particular there is a Eureka-147 digital companion that uses radio frequencies around 230 MHz with 1.5 MHz channel bandwidths for program multiplexing.

Receiver decoding of a DRM signal in any of these receivers covers all the broadcasting bands mentioned above. For example, even if at the moment there are no U.S. broadcasters using shortwave frequencies for local broadcasting in this

providing many potential 10 kHz channels. It turns out that this portion of the shortwave broadcasting band is not used by the international broadcasters for reasons of unreliable sky wave propagation for long-range targeting.

DRM's digital technique, however, provides "FM-like" quality, with robust signals over short ranges using ground-wave/line-of-sight propagation. Therefore, DRM has exploited this opportunity.

Tests have been conducted and reports are available through DRM for tests recently conducted in Mexico, Brazil and several European countries. Typically, signal-to-noise ratios of 15 to 20 dB are all that are needed for perfect reception.

This compares with 30 dB or so for a decent AM signal. Very generally, average power required ranges from tens of watts to a kilowatt or so, depending on the coverage desired and the local noise environment.

Medium-wave tests for local application have been done for a DRM 9 kHz signal by itself and for a 9 or 10 kHz DRM signal "simulcast" with an existing AM signal at the same location with a common transmitter/antenna. The DRM signal frequency portion is either immediately above or immediately below the AM portion.

In all cases, the DRM signal produces "FM-like" quality, and is robust within a

coverage area that is dictated by the choice of DRM average power and the local noise level. For the simulcast cases, the test results show that the DRM signal did not interfere with its accompanying AM signal, nor does it interfere with any nearby AM broadcast within the local assignment plan.

As in the case of 26 MHz use, required minimum signal-to-noise ratios are around 15-20 dB.

These tests have been conducted in Mexico, Brazil, the United States, New Zealand, China, Russia and many European countries.

2) Long-distance and medium-wave skywave broadcasts: DRM test and regular broadcasts are continuously conducted for the traditional use of cross border broad-

See DRM, page 8 ▶



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You Can 'See the Voice' in Washington

Last year about 2,000 people strolled through the tour at Voice of America headquarters, a small number considering its location close to the U.S. Capitol.

VOA topped that in four months after opening an improved studio tour this spring. I took a noontime tour to see how the Voice is presenting itself to the taxpayer public and visitors from abroad.

Officials promote the tour as a behind-the-scenes look at a 24-hour, international multimedia news broadcast facility, featuring live broadcasting in radio, television and the Internet.

"The Tour project was prompted by the design of the VOA Newscenter, which included the public spaces with views of the studios, control rooms and Newsroom," said Letitia King, chief of media relations for the International Broadcasting Bureau, which provides administrative and engineering support for U.S. government-funded non-military international broadcast services. She hopes more people will come as word gets out.

Our guide met us in the beautiful Cohen lobby, which features a pre-VOA

headsets so we could hear a recorded presentation as well as her live comments.

In a "historic hallway," we paused beside a series of photographs about the history of VOA, including its Cold War mission and brief clips of notable broadcasts. JFK is heard on the 20th anniversary, saluting the Voice of "Ameri-ker." and our audio commentary mentions the massive global audience for the first moon landing.

eral times. The Voice charter, drafted in 1960 and made law in 1976, is inscribed on a wall; a large map shows the many languages heard on VOA, and biographical tablets provide background on employees with dramatic personal stories.



Noreen Kinnavy takes visitors through a hallway on the Cohen Building's main floor where VOA history is encapsulated in picture panels. This one notes VOA's broadcast of jazz — 'the music of freedom' — to Cold War audiences.



From the Editor



Paul J. McLane

square foot.

"We worked with C&G Parters — formerly Chermayeff and Geismar — of New York City on the design, and with Exhibitology of Patterson, N.J., on the exhibit fabrication," King said. She called the project a "wonderful collaborative effort."

Broadcast technical types are likely to be left hungry for more; the tour is 45 minutes long and barely breaks the surface of all there is to know about U.S. government broadcasting and the technology behind it. As a history buff, I also would have liked the chance to hear a lot more historic radio clips.

But for general audiences and students, like the ones from George Washington University who joined me on the tour, it's an educational introduction into VOA's mission and scope. As our tour guide reminded us, VOA generally isn't heard in this country, and many Americans know nothing about it.

The tour is worth a visit. If you're in Washington with your family and want to impress them with an interesting slice of broadcasting, give it a try. The experience is recommended for ages 7 and above, and families are welcome. "We have some fun surprises for our 'junior journalists' to engage them in the tour," King said.

The Cohen Building is at 330 Independence Ave., S.W. Tours are offered weekdays at noon and 3 p.m., except federal holidays; if you wish to bring a large group, special tour times can be arranged. Reservations are recommended and can be made at www.voatour.com or call (202) 203-4990.



Visitors peer into one of several TV studios, beyond which is the newsroom, one of the world's largest.

Ben Shahn mural, "The Meaning of Social Security," commissioned by the Works Progress Administration/Federal Arts Program in 1940. She explained that her native tongue is Croatian and pointed out the word "Welcome" written on glass in 44 languages; then she handed us wireless

Despite the fall of the Berlin Wall, we're told, VOA's mission has continued through Balkan conflicts, ethnic strife in Africa, danger in the Middle East, regional flash-points and the war on terror. "Balanced, objective news where it's needed most" is the organization's creed, emphasized sev-

A globe-shaped monitor explains "today's multimedia VOA" and makes reference to the changing nature of its distribution infrastructure: satellite, local radio/TV and the Internet, while also noting short-wave's continuing if diminished role. The guide mentions a current priority: dodging Internet censors and filters in China.

We're then shown to windows that overlook several work areas: a TV studio and control room; the 36,000-square-foot newsroom; one of VOA's numerous radio studios; and an intake center where content is ingested. Journalists and producers work behind the glass beneath signs noting their functions, aware that we're watching them and looking a bit like NASA technicians on launch day.

The tour concludes with a video presentation on the role of VOA and anecdotes that demonstrate its reach and impact.

The cost to design the tour, create the exhibits and build out the space was around \$125 per square foot, or \$620,000 total. By comparison, King said, the cost in nearby museums is closer to \$1,000 per

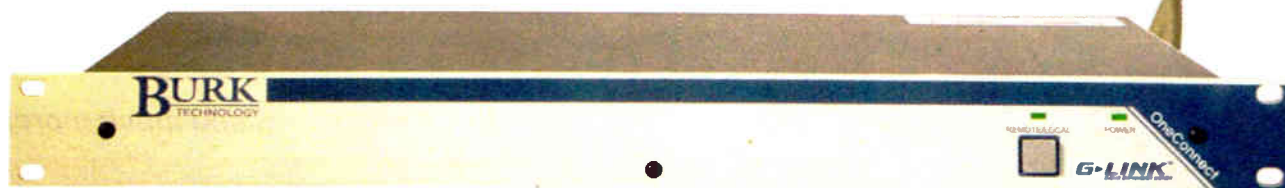
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V10 FM Transmitter

Translators

► Continued from page 1

mitter site and a radius of 25 miles. This relief would help AM stations to provide consistent service throughout their daytime operating contour. ...

Because of the propagation characteristics of the AM band, which cause substantially increased interference among AM broadcasts at night, many AM stations are required by the FCC to reduce their operating power during nighttime hours, while some (daytime-only stations) are prohibited from broadcasting at all. As a result, at night many AM stations lose coverage at various locations within their regular daytime coverage area, listeners lose reception, and AM broadcasters are left to hope that their audience remembers to turn the radio dial back to their station in the morning.

Stations that are not able to take advantage of power reduction or directional signal patterns must sign off at local sunset and remain off the air until local sunrise. ... Several NAB members with AM stations report coverage area losses of 80 percent to 95 percent during the nighttime hours because they must protect clear channels often located hundreds of miles away.

Others indicate that while the directional patterns they must utilize at night might reach certain portions of their daytime service area, at night they lose the large swaths of their audience that are not located in the directions in which their nighttime signals must be beamed to minimize interference to other co-channel or adjacent channel stations.

'AM broadcasters are left to hope that their audience remembers to turn the radio dial back to their station in the morning.'

This predicament will become worse starting in 2007, when recent actions by Congress to extend Daylight Saving Time (DST) become effective. ... DST will begin three weeks earlier starting the second Sunday of March 2007 and end one week later starting the first Sunday in November 2007. ...

Increasing technical challenges

Permitting AM broadcast stations to operate FM translator stations as a fill-in service will mitigate many AM coverage problems. A translator station would allow an AM station to translate its signal to the FM band where skywave propagation and its potential to cause harmful interference do not exist. ...

(A)n FM translator can be used only for the purpose of retransmitting the signals of a primary FM radio broadcast station to areas in which direct reception is unsatisfactory due to distance or intervening terrain barriers. These subsections would need to be modified to include AM broadcast stations as authorized primary signals that could be retransmitted via FM translators.

Also, to reflect NAB's proposal that AM stations be able to operate FM translators to provide consistent service only over their 2 mV/m daytime contour, Section 74.1231 would need to specify that any such translator operated by an authorized AM radio station must be

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)
)
Petition for Rulemaking of the)
National Association of Broadcasters to Permit)
AM Radio Stations' Use of FM Translators)

RM- _____
MB Docket No. _____

**PETITION FOR RULEMAKING OF THE
NATIONAL ASSOCIATION OF BROADCASTERS**

The National Association of Broadcasters ("NAB"), pursuant to Section 1.401(a) of the Commission's rules, 47 C.F.R. § 1.401(a), hereby petitions the Commission to initiate a rulemaking proceeding to amend its rules to allow AM broadcast stations to operate FM translator stations. Specifically, NAB requests that AM stations be permitted to license and/or use FM translators to retransmit their AM service as a fill-in service, so long as no portion of the 60 dBu contour of the FM translator exceeds the lesser of either the 2 mV/m daytime contour of the AM station or a circle with its center at the AM transmitter site and a radius of 25 miles. This relief would help AM stations to provide consistent service throughout their daytime operating contour.

NAB requests that the Commission modify 47 C.F.R. §§ 74.1231, 74.1232, 74.1233, 74.1263,

located so that its predicted 60 dBu contour falls within the lesser of either the 2 mV/m daytime coverage area of that AM station or a circle with its center at the AM transmitter site and a radius of 25 miles. ...

NAB supports a clarification that the maximum power of a translator operated by an AM licensee may not exceed a level that would place the 60 dBu contour beyond the daytime 2 mV/m contour, as defined by the AM station's license.

Finally, because this request seeks relief for all AM radio stations, daytime-only AM stations will need the ability to

operate FM translators during nighttime hours without running afoul of the commission's program origination rules. Since 1970, FM translators have been restricted to retransmitting the signals of other FM stations, and not permitted to originate their own programming except to acknowledge or solicit financial support and to provide emergency warnings of imminent danger.

NAB supports these limitations, and has no desire to disturb this approach by expanding or creating program origination rights for AM stations operating translators, or any stations for that matter. ... NAB opposed a Petition for Rulemaking in which Miller Communications, *et al.* requested that FM translator stations be allowed to originate programming. ... We stated that granting this request essentially would turn a supplemental service — FM translator service — into a new full-service broadcasting class, in direct conflict with the commission's original purpose for translators. ...

Replicating/completing daytime coverage

Under NAB's proposal, AM broadcasters would be allowed to operate FM translators to the extent needed to complete their daytime coverage areas and/or replicate their daytime coverage at night.

Currently, approximately 1,120 of the

200 stations per channel, the interference-free nighttime coverage of these stations is often limited to only a few miles from their transmitter. AM stations (Class Cs in particular) often suffer interference from other stations on the same channel that are located hundreds of miles away, even when the local AM station's nighttime power level (e.g., one kilowatt) is the same as it employs during the day. ...

NAB recognizes that the commission has previously considered whether to permit AM stations to license or operate FM translators, and chosen not to do so. In 1981, the commission rejected a request by a group of rural AM broadcasters to amend its rules to allow AM stations to retransmit their signals on FM translators in areas beyond the predicted 1 mV/m contour of existing stations.

The Rocky Mountain Broadcasters stated that granting their request would enable rural communities where there is no local service to obtain a primary reception service. The commission was not persuaded, however, finding that the propagation characteristics of AM signals "normally do not leave service voids" similar to those in the FM band. The commission therefore concluded that there is "generally no reason for AM licensees to establish FM translators to provide 'fill-in' service," and declined to devote any of its limited resources to regulating such a scheme.

In 1990, the commission rejected another proposal to allow AM stations to operate FM translators. ...

NAB respectfully submits that the out-

See TRANSLATORS, page 6 ►

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Translators

► Continued from page 5

come of the instant petition should be different. First, it is our experience that the propagation characteristics of AM radio signals often do result in service voids. As described above, many AM stations lose significant portions of their coverage areas, both during the daytime and at night.

Daytime interference is caused by both geological and man-made conditions, including mountains, buildings, power lines and utility poles, computers and fluorescent lighting. During nighttime hours, the situation is even worse.

For example, KNCO(AM), Nevada County, Calif., estimates that it loses

roughly 25 percent of its coverage area and 15 percent of its potential audience at night due to a directional pattern that nulls its signal to the east. KFMO(AM), Flat River, Mo., experiences interference and power restrictions that shrink its territory by about 66 percent.

WKPT(AM), Kingsport, Tenn., at 1,000 watts, can be heard up to 50 miles away during the day; however, its nighttime interference-free signal at the same power level covers a radius of less than three miles at night. In fact, WKPT's nighttime interference-free signal falls short of covering its community of license, Kingsport, Tenn. ...

Time to reexamine AM help

In this request, NAB proposes rules and constraints to ensure that AM stations may not employ FM translators to

expand their service coverage areas, including the restriction of such translators to locations inside the 2 mV/m daytime contour of the primary AM station, instead of the 1 mV/m contour proposed in the Rocky Mountain Petition or the 0.5 mV/m contour that ACAMBA [the American Community AM Broadcasters Association] suggested. Moreover, NAB proposes that no portion of the 60 dBu contour of the FM translator may exceed the lesser of either the 2 mV/m daytime contour of the AM station or a circle with its center at the AM transmitter site and a radius of 25 miles.

Under NAB's proposal, AM stations will be able to restore service in any holes in their coverage areas, but nothing more.

NAB also submits that in the seven years since the ACAMBA Petition, not to mention the 16 years since the Part 74

proceeding and the 26 years since the Rocky Mountain Broadcasters' request, the continued pressures on AM radio warrant reexamination of this issue. ...

We also note that commission authorization of AM stations to use FM translators is not unprecedented. For instance, the commission sometimes authorizes AM radio stations in Alaska to operate FM translators as a means of helping these stations provide service in white areas.

The commission also has allowed WAMB(AM), Donelson, Tenn., to operate an FM translator during nighttime hours because the station had experienced substantial interference from an AM station in Cuba. ●

Newswatch

► Continued from page 2

was the time to make a change.

Asked how the industry can attract more women to engineering, she said there are no easy answers, but that good salaries, respect and good benefits factor into the solution.

As they implement HD Radio, Bryant also said, stations must keep content compelling and not become distracted by a particular delivery method.

Bryant's photos are displayed at her studio and also at The Pooch Patio, 3811 Fairmount St., in Dallas (info@thepooch-patio.com.)

FCC Okays 3 XM Mods

WASHINGTON XM Satellite Radio hopes to have enough of three recently approved FM modulator products on store shelves this holiday season.

The FCC okayed changes for the Audiovox Xpress, Delphi RoadyXT, and XM Sportscaster and issued new grants of authority for these products. The satcaster notified manufacturers to resume production of these devices.

The commission flagged the three FM modulated products in its review of products thought to exceed Part 15 emission limits.

The satcaster has not said specifically whether the products or their installation instructions, or both, needed to be redesigned.

Radio World has reported that XM says shipments of five other products were suspended earlier as it complies with the FCC probe: the MyFi, Airware, Tao, Roady 2 and Delphi SkyFi2.

GM Cuts XM To \$199

DETROIT General Motors lowered the price of factory-installed XM Satellite Radios to \$199 for most of its model-year 2007 vehicles, a 39 percent reduction. The original price for the option was \$325.

An executive cited economies of scale and engineering efficiencies brought by the pace of XM installations across the automaker's product lineup for the price decrease. More than 90 percent of GM's model-year 2006 and 2007 vehicles offer factory XM radios as an option or standard equipment.

GM has built about 4 million XM-equipped vehicles since 2001. ●

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Peter Greenberg—Host of the syndicated radio program Travel Today

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<http://remotebroadcasts.blogspot.com>

➔ Radio Free Asia—Live from the Himalayas



"The results [with ACCESS] were especially reliable considering that Dharamsala has one of most "problematic" Internet infrastructures that we have come across." — David Raden, Chief Technology Officer Radio Free Asia

For the complete story visit
<http://remotebroadcasts.blogspot.com>

➔ Ski Mountain Remote



This picture, really demonstrates what ACCESS is about. This product truly has the ability to cut the wires.

For the complete story visit
<http://remotebroadcasts.blogspot.com>

➔ JAMN 94.5—Walk for Hunger



"ACCESS was used on the air exclusively for JAMN945 at this one. It was all over EVDO with a tremendous amount of active cell phones in the area. The ACCESS was connected to the Verizon wireless Broadband...

For the complete story visit
<http://remotebroadcasts.blogspot.com>

Put Comrex On The Line.

Steel

► Continued from page 1

transmission lines — especially copper and zinc for galvanizing — are affecting capital project figures. Add in higher transportation costs, and broadcasters are faced with paying much more for new tower construction, possibly tens of thousands of dollars more.

Despite the higher costs, the consensus among some major broadcasters, at least, appears to be that building towers, even more expensive towers, is just the cost of doing business.

Steel is now being priced at the time of delivery, something industry observers say hasn't happened much in three decades. Angle iron and steel tubing have all seen substantial price increases.

Steel, copper prices spike

Specifically, zinc, the main component of galvanized steel, has dramatically increased in price. Zinc was 57 cents per pound in July 2005 on the London Metal Exchange, the world center for non-ferrous metal trading. It was \$1.60 a pound one year later.

Copper prices have nearly doubled since 2005 and quintupled since 2001; this has led several telecommunications companies to add a copper surcharge to the price of transmission lines and cable products. Other suppliers have simply announced price hikes.

Tower companies are struggling to keep their prices stable. As with other commodities, like oil and gold, much of the spike in metals prices is a consequence of rising global demand due to economic growth, particularly in places like China and India, according to those close to the issue.

Suppliers say they are looking for ways to lower costs to customers, but when it comes to broadcast towers, there is no substitute for steel.

"We are seeing huge price fluctuations in steel and other metals. Solid round bar steel stock hasn't been as volatile, but steel pipe products have been," said Dave

Davies, director of structural products and services for Electronics Research Inc. "I'm hoping for some stability in prices, but I'm not sure if it will be a price point everyone will be happy with."

Andrew Corp. announced a surcharge program in the spring to counteract dramatic increases in the cost of raw materials, specifically copper, in its cable products and grounding kits.



A Valmont 700-foot guyed tower in Mishawaka, Ind.

"As copper soars, we are taking aggressive steps in pricing and product development to continue to cost-effectively provide products to our customers," said John DeSana, group president of its Antenna and Cable Products Group.

Andrew is not alone in adding surcharges to protect margins. Dielectric Communications placed a 12 percent surcharge on all transmission line components in early June, citing higher copper costs. Jay Martin, VP of sales for Dielectric Communications said copper has nearly tripled in price since early 2004.

"We are losing our margin on products very quickly. What we thought was a good margin eight weeks prior to delivery might

Metal Prices Prompt Alleged Theft

RAYMOND, Maine Scrap metal prices are going up almost as fast as new steel and copper; the situation has created a market for stolen metal. Telecommunications equipment manufacturers are often targets.

According to reports in the Portland Press Herald, a former Dielectric Communications employee was accused of stealing almost \$10,000 worth of copper from the company. Ralph Whalen, 50, was implicated after police in Mexico charged him with stealing copper scraps from outside a commercial building in that country.

Two other Dielectric employees were charged this summer with stealing copper from Dielectric's sprawling manufacturing facility, according to the Press Herald.

According to another published report, a female employee was charged in August with allegedly stealing a half-ton copper rod. She is accused of using a company forklift to load it in the back of her pickup truck and then leaving company property. Another Dielectric employee was charged with theft after he was found in possession of 100 pounds of allegedly stolen copper.

Authorities are continuing their investigation into the thefts.

Dielectric officials declined to discuss specifics of the incidents.

— Randy J. Stine

have been cut in half by the time we build and deliver it," said Rollie Horton, vice president/general manager of Rohn Products Division.

Rohn, a division of Radian Communication Services, has to be "much safer" with its quotes, Horton said, and has begun tying tower prices directly to the price of zinc.

Meanwhile, broadcast tower projects are being requoted more often to reflect the true cost of materials. "We are telling customers the materials price can fluctuate right up until the time you place the order," Horton said.

Jeff Laudin, director of investor relations for Valmont Structures, said, "We as manufacturers have had to add the inflation of steel to the cost of our products. We haven't seen inflation like this since the 1970s."

Valmont announced an increase of 5 to 7 percent for most of its products in May, depending on material and finish.

Budgeting for 2007

The rapid runup in the price of raw steel began in 2004 and the level has risen approximately 25 percent since, Laudin said; those higher costs have cycled through the products Valmont produces.

Laudin said the rate of price increases

for steel has slowed, "but it has stabilized at a higher plateau."

Several broadcasters said they are still budgeting now for 2007 tower projects regardless of higher costs.

"Towers are a necessity and we continue to be aggressive about realizing signal upgrade opportunities. It's just a cost of doing business," said Steve Davis, Clear Channel Radio senior vice president of engineering. "We have not made any adjustments in project schedules or timing."

Sterling Davis, vice president of engineering for Cox Radio, said, "We do have projects needing copper transmission line and that has gone through the roof. However, we have not delayed any projects because of that."

Price shopping has become more important than ever, some broadcasters say, though price alone is not the deciding factor when choosing products and distributors.

"That doesn't mean we don't seek the best pricing on any project. However, we would never say 'No' to a tower project with a significant upside because of the cost of materials," said Milford Smith, vice president of engineering for Greater Media.

"Although we certainly do not wish to pay any more than absolutely necessary, generally we see the incremental costs as part of doing business." ●

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DRM

► Continued from page 3

casting. This skywave broadcasting presents the greatest challenge to broadcasting because of the very difficult propagation conditions for reception, one of the major drawbacks of "short wave AM broadcasting" over the last several decades.

The original DRM technical challenge was to overcome, as much as possible, these difficulties. This has been done.

There is an ever-growing body of transmission/reception data collected by DRM monitoring networks that show, when properly managed by selecting DRM coding options, etc., that the same "FM-like" quality and robustness as DRM provides for local broadcasting can be attained for the wide-area, long-distance coverage of millions of square kilometers that skywave propagation can provide. Signal-to-noise ratio requirements are higher than for local coverage. As a rule of thumb, they are several dBs higher.

VHF bands under 108 MHz

There are two broadcasting bands between 30 and 108 MHz. They are

slightly different in the Western and Eastern Hemispheres. The more familiar one for radio broadcasting is the standard FM band from 88–108 MHz. The other spans 47–72 MHz, which, in the United States, includes the old lower channels for analog TV.

The augmentation of the DRM system is designed for use in both of these bands. The major modification underway is to expand the channel width to a choice of a 50 kHz or a 100 kHz channel. This is a reduction from the need of FM in these bands, although even the 50 kHz is adequate for CD-like quality reception.

Anticipated usage is similar to that of DRM in the medium-wave band — that is, (a) for DRM by itself in places where there is a demand for more programming and where there are adequate holes in the use of the assigned and used spectrum and (b) for simulcast with a FM signal.

For more information visit the DRM Web site: www.drm.org.

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Radio World, September 27, 2006

Past columns are archived at www.rwonline.com/reference-room

Component Heat at the Transmitter

by John Bisset

Crawford's Cris Alexander was reading the Aug. 16 *Workbench*, which brought to mind another AM system maintenance tip. His tip will help you spot problems before they turn into disasters.

Immediately after shutting down the transmitter after it has been operating into the antenna system for a while, disable the transmitter and remove the tower J-plugs.

This inspection will be both visual and tactile. You will visually inspect the components of the phasor and antenna tuning unit, as shown in Fig. 1. First, look for any discolored silver plating on coils and interconnecting tubing, especially at junction points that are bolted together. Then, *carefully* feel all the capacitors and coils in the

phasor and ATUs.

Any that are much above the ambient temperature are dissipating power, reducing the efficiency of the system and possibly indicating an imminent failure. Hot capacitors can indicate that the cap is undersized for the amount of current, or signal a loose or bad connection or that there is something wrong with the cap.

Heat in a coil can indicate an undersized component, but more often it indicates a bad connection. The discolored silver plating is another indicator of heating. Either condition in a cap or coil is a problem and should be addressed before a failure (or fire) occurs.

It is, of course, safer to use an infrared thermometer to check component temperatures, but the old "feel test" is just as reli-

able. Be careful and just use one finger *lightly*, in case you encounter a surface hot enough to burn.

This test is best performed at night. Sun shining on tower ATUs can heat the components inside, and give a false indication of failure if the ATU box is hot.

So you don't want to stick your hand into an ATU, even with the j-plugs pulled? Then consider temperature indicator strips. There are a variety of them on the Web. A favorite is found at www.sanitationtools.com; search there for "180F Thermolabel."

A strip of this treated paper is applied to the side of a capacitor. The paper turns black when the temperature reaches 180 degrees. There are several temperature ranges to choose from. At \$13.49 for a

package of 24, it's a good investment. These strips are sold to verify wash temperatures in commercial dishwashers! Head to Ask.com and type in "temperature indicator strips" for a variety of choices.

Cris adds that this same "heat inspection" test can be used in solid-state transmitters, particularly those with low voltage and high current. Your first step is to make the transmitter safe by removing primary power, and opening the RF output connection. Then look and carefully feel the B- (or B+) busses, conductors and connections. Any hot spots point to a problem.

Since many of these connections are usually insulated wire, look for darkened or burned wire insulation or terminal lugs. Whether you find indications of heating or not, it's a good idea to tighten all of these connections during this down time.

Cris Alexander is the director of engineering of Crawford Broadcasting, head- See *WORKBENCH*, page 12 ▶



Fig. 1: Make a visual inspection of the site's phasor and ATU.



Fig. 2: The umbrella increases an air conditioner's efficiency.

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Desperately Seeking Portable HD

Anyone in the radio business knows that one of the medium's chief assets is its portability. Radio broadcasts can originate from and be listened to almost anywhere. This immediacy and near-ubiquity differentiates radio from other mass media, and is largely responsible for its resilience and sustained popularity.

Most of us can remember our first "transistor radio," which the solid-state revolution first enabled during the 1960s. Radio was already well established in the home and car by then, and this trend added a third axis of use — the handheld, pocket-sized, portable receiver. These devices further leveraged the value of radio's wireless delivery, and made radio's popularity even stronger among the key constituency of young listeners. This not only fortified radio's current audiences of the day but ensured its future success, particularly for the then-fledgling FM service, by capturing the hearts and minds of future prime demographics.



The big, bright screens on the latest handheld digital receivers may not consume as much power as their OFDM tuners do.

Shown, a Siemens concept image.

Portable receivers back then were not without their challenges, though. Antenna design (particularly for AM) was tricky, and audio quality was well below what radio listeners were used to

at home or even in the car. Battery life was also an issue, but the newly popular 9V brick battery provided a reasonable and affordable solution. Headphone (or "earplug") listening was not much in

loss of efficiency in his air conditioner. Although the transmitter building is well insulated, the "hole" in the canopy was literally letting the sun shine in, more than before.

Greg was advised of a substantial delivery delay in an awning to shield the air conditioner from the sun, so he mounted the umbrella as a stopgap measure, shown in Fig. 2. It worked so well that he's rethinking the awning idea.

Greg has been innovative inside the transmitter building, too. Needing a shelf, he modified a plastic bracket from a hardware store, drilling the bracket to fit 10x32 rack bolts. The result, shown in Fig. 3, holds his remote control keyboard and mouse — and at a fraction of the cost of a pull-out drawer.

In the previous column, we reported about vandalism and theft at transmitter sites. Although there are a variety of security measures available to you, sometimes the simplest are the best — and also least expensive.

Loud and Clean's Grady Moates notes that when subcontractors are working at the sites he manages, he insists they close the property gate's combination lock after entering, and reset the combo dials to 0-0-0.

Not only can someone steal an unlocked gate lock, but in the case of combination locks, if the opening combination is not changed a "smart" thief can simply write down the combination and return later. Grady admits the tips are simple, but the object is to make access to your site difficult. Open gates are inviting entry — especially at "out of the way" transmitter sites.

John Bisset is northeast regional sales manager for Broadcast Electronics. Reach him at (571) 217-9386, or jbis-set@bdcast.com. Faxed submissions can be sent to (603) 472-4944.

Workbench

► Continued from page 10

quartered in Colorado, and a fellow RW contributor. You can reach him at crisa@crawfordbroadcasting.com.

★ ★ ★

After a crew thinned some of the trees around his transmitter building, Greg Lynam of WNSH(AM) in Beverly, Mass., saw a

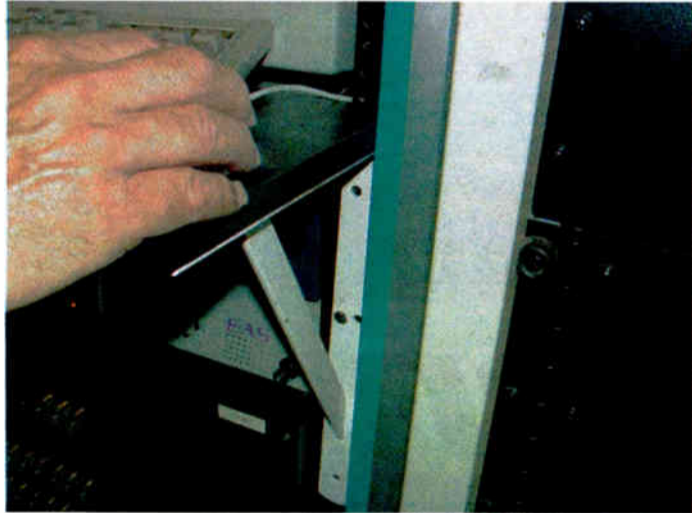


Fig. 3: Drill a plastic shelf bracket to match rack bolt spacing for an inexpensive shelf.

★ ★ ★

The Big Picture



Photo: Gary Hoyer, BBC

by Skip Pizzi

vogue back then, so all portable radios had a small speaker, and given both speaker-size and amplifier-power constraints, fidelity was not impressive. Nevertheless, portability was so important to consumers that the devices quickly became popular, and the handheld audio device movement was born.

This form factor remained a radio-only device until the late 1970s, when the Sony Walkman added cassette playback. After that, a sequence of other storage formats — analog and digital — followed, but radio (usually AM/FM stereo) often remained coupled to the device.

In the last few years, of course, the computer-peripheral RAM device has taken over this category, allowing cheap, random-access high-fidelity storage of a huge number of compressed digital audio files, for playback on speakerless handhelds equipped with low-power, high-quality amplifiers and efficient, high-fidelity headphones.

While these devices' electronics consume somewhat more power than their predecessors, optimized chip design and advances in rechargeable battery technology such as nickel metal-hydride and lithium-ion (driven mostly by the needs of concurrently popular laptop computers) again provided viable solutions. Their lack of motors or speakers also helps moderate their power consumption.

But something was lost in translation: the radio tuner. Very few among the current crop of RAM audio players include a radio receiver of any kind. So just as the transistor radios of the 1960s brought new, young listeners into the radio camp, broadcasters may rightly fear that trends in today's handheld audio devices may be pushing potential future listeners away from the medium.

See PORTABLE, page 14 ►

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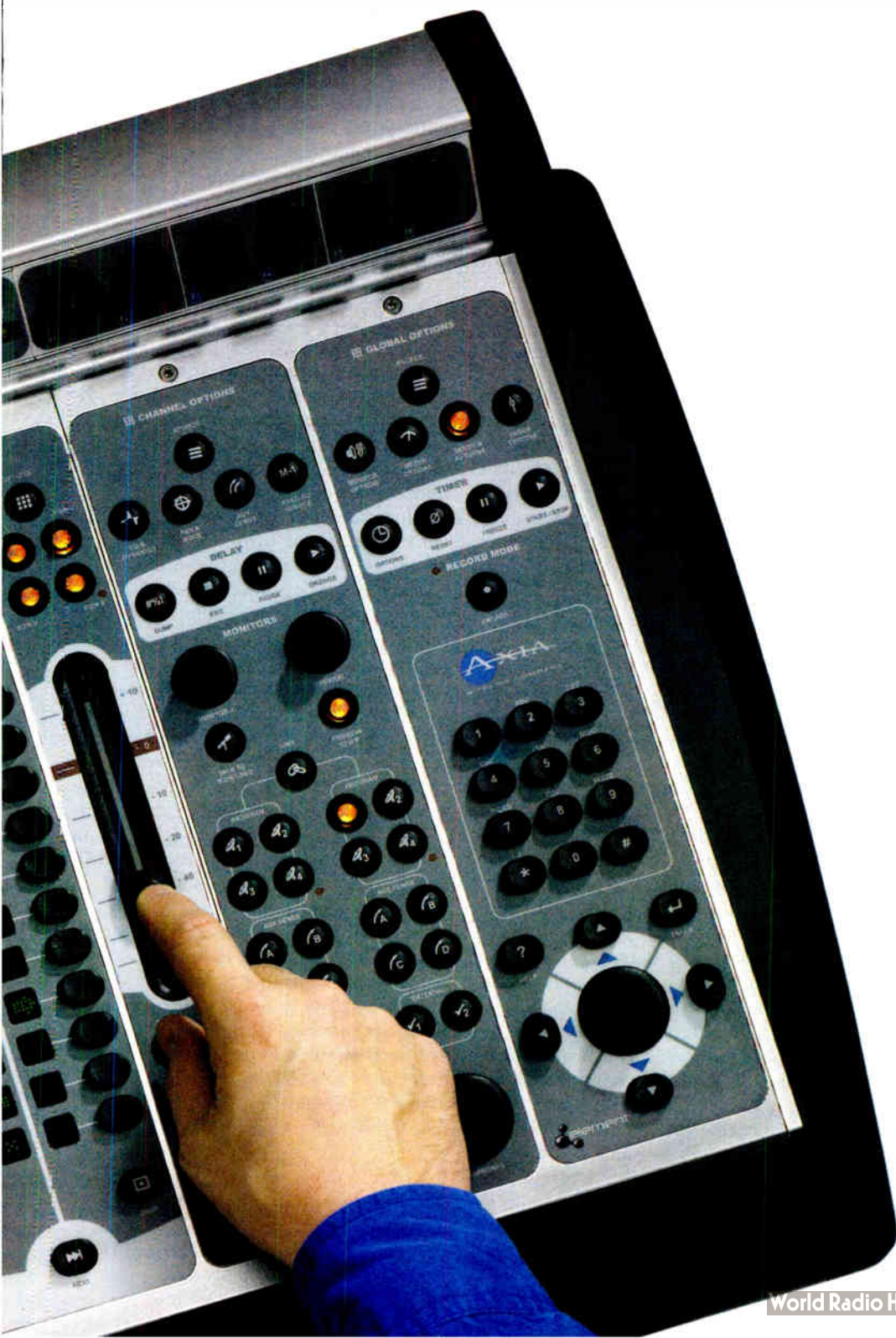
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Okay, back to work now. (Consoles don't build themselves, you know.)



www.AxiaAudio.com

Portable

► Continued from page 12

Although the common wisdom among consumer electronics manufacturers holds that tired old analog radio has no place in slick new digital handhelds, a recent survey of handheld users found that radio was their most wanted additional feature. So it would make perfect sense that next-gen handhelds incorporate new digital radio formats, and thus they could find their way into the hearts and minds of future audiences. It all sounded great — except for one big, and largely unforeseen problem: the heavy power consumption of digital tuners.

This dirty little secret is simultaneously being discovered in the terrestrial digital broadcast, satellite radio and wireless telecom/mobile TV environments. The broadband OFDM receivers that virtually all of these devices use are current hogs — at least in their current implementations.

Put in its simplest terms, this is the price paid for robustness in OFDM, which achieves its magic by spreading payload data across of hundreds or thousands of separate, narrowband, closely spaced individual carriers within a broadcast channel. The receiver necessarily requires significant parallel processing to demodulate and decode these many separate small streams all at the same time. There are plenty of available microprocessor platforms that can handle this today, but it's difficult to get them to do it without sucking down a lot of power in the bargain. It's simply a function of the MIPS involved, and the need for low latency in a real-time broadcast receiver (i.e., you can't really serialize your way around the process).

Initially OFDM tuners were developed on generalized DSP platforms, which of course weren't usable for battery-powered application, and were never intended to be. But even the subsequently developed application-specific (and format-optimized) OFDM tuner chips are relatively power hungry. Naturally, this only becomes an issue in handheld receivers, but these are becoming an ever more important sector of today's consumer electronics business — particularly for audio-only devices.

Solutions remain elusive

This is actually not a new discovery to everyone. Several years ago it influenced the development of new digital broadcast standards, such as DVB-H, the handheld variant of the European digital terrestrial TV format known as DVB-T. Even though DVB-T was from the start designed for mobile reception, it required an OFDM tuner with very high current drain. So the DVB-H variant was created with its primary design parameter being the reduction in processing demands on the receiver (accomplished by reducing bandwidth, optimizing video for small-screen display and "time-slicing," which substantially reduces the duty cycle of the receiver's operations).

Even with this effort, however, the first generation of DVB-H receivers is not getting particularly high marks for battery life.

Of course, most digital handhelds include display screens, always known to be prime battery killers. Some of these screens are relatively large, bright, high-resolution and full-color capable, so it's

expected that they would put significant strain on battery life.

However, given the huge marketplace for such technologies (the billions of wireless phones sold each year now include them), development of power-efficient screens has come a long way lately, and technologies like the white LED show even greater promise for the near future. Also, these screens can be set to shut off their backlights or turn off entirely after a few seconds when not in use (particularly in an audio-only device, where the screen is used only for navigation/control), whereas the OFDM tuner needs to stay on at essentially full power whenever the radio is in use.

Power-efficient screen technology has already progressed to the point that the OFDM tuner is the highest power-consuming component in the most recent handhelds. The screen is still up there, but generally in second place (sometimes a distant second, and trending lower still). In any case, these two components together make it difficult for a handheld digital broadcast receiver to provide much more than a couple of hours of continuous use between charges.

One interesting result has been the quoting of *two* different typical battery-life specs for multipurpose devices (such as satellite radio + MP3 players) — one with the tuner in use, and one without. So far, the latter number has ranged to about twice the former.

Naturally it can be assumed that this problem will be reduced over time, as more efficient and portable-optimized OFDM receiver designs are developed. But as screens also continue to drop in current drain, the OFDM tuner is likely to remain at the top of the current budget for these devices, which will do little to entice consumer electronics manufacturers to include a lot of digital broadcast receivers in their handheld products.

Moreover, the relatively small number of developers working on HD Radio tuner chipsets implies that a handheld receiver in this format remains many years away.

Not a pretty picture

This is tough to swallow for radio, a medium that has touted its ubiquity via easy portability of its receivers.

In recent years, this trend has accelerated, with ever smaller and cheaper portable analog radios becoming available. These AM/FM receivers are quite power efficient, as well, but the handheld form factor is arguably the worst case for multipath interference, given the increased audibility of its distortion and stereo image instability when wearing headphones, and the typical use of an often wildly moving headphone cord as the FM antenna.

So it is with great irony that while the handheld receiver provides perhaps the strongest argument for the value of HD Radio's multipath immunity, such a device remains just out of reach due to battery-life constraints.

As a result, the lack of handheld HD Radio receivers — at least for the next few years — will keep the fledgling technology from becoming a player in the increasingly important portable audio industry. Given the strength and projected growth of that sector, this absence could have significant impact on HD Radio's success, as well as to the radio industry's overall relevance to future audiences.

Skip Pizzi is contributing editor of Radio World.

Comment on this or any article. Write to radioworld@imaspub.com.

TECHNOLOGY FOR MANAGERS

T1 for the Broadcaster

Avoid Common Pitfalls When Designing Your Station Remote Control System

by Ted Nahil

The author is broadcast channel sales manager for Harris Networking Solutions.

In the first installment of this series on T1 service (RW, Sept. 13), we focused on T1 basics. We compared T1 and E1 services and discussed different methods of implementing a T1 circuit using the telephone company, private microwave links, spread spectrum radio links or fiber.

This installment will concentrate on the advantages a T1-based STL offers to broadcasters.

Not your father's STL

The bidirectional nature of T1 links means that, for a fixed cost, the broadcaster can utilize many different types of services between each end of a T1 circuit that are not possible with simplex STL links. This gives the broadcaster increased flexibility for moving information between ends of a T1 link. The choice of an audio algorithm usually determines the predominant amount of bandwidth used, but with the right choice, there is room for many other services on a link.

Type of Audio	Bandwidth Use	Latency	Cost
Linear	High	Very Low	Low
MPEG	Low to Moderate	High	Moderate
Enhanced apt-X	Low to Moderate	Low	High

Fig. 1: Comparison of Audio Types

The most common broadcast use for a T1 link is to connect a studio to a transmitter site. Another powerful implementation of a T1 link is to connect two studio sites together, whether they're in the same city, the same state or separated by hundreds or thousands of miles. A carefully planned system can yield incredible flexibility, all across the same circuit.

Audio

Since a T1 link is bidirectional, duplex audio circuits are a snap. Not only can we send audio from the studio to the transmitter site, we can send audio back to the studio from the transmitter site. Now, instead of separate circuits to bring satellite or RPU audio back to the studio, we use the T1 circuit to provide high-quality return audio.

Choosing an appropriate audio algorithm determines how much bandwidth remains on a circuit for other uses. Linear audio card sets use the most bandwidth but deliver uncompressed audio. In the Harris Intraplex STL systems, 15 kHz stereo linear audio uses 17 (out of 24) time slots in one direction. There is still plenty of room on the circuit for other services.

Remembering that the link is bidirectional, we can use the same cards in the reverse direction to provide high-quality, linear audio from the transmitter site to the studio, and still have seven bidirectional time slots left for other use.

Compressed audio algorithms use much less bandwidth, with the trade-off usually being cost. Harris Intraplex STL systems can also utilize Enhanced apt-X audio cards that allow the user to choose between 16-, 20- or 24-bit audio at 15, 20 or 22.5 kHz frequency response. Bandwidth consumption varies, but a set of these cards never use more than nine time slots (24-bit stereo audio at 22.5 kHz response). Typically, Enhanced apt-X cards are used to provide high-quality, 20 kHz, 16-bit stereo audio to a transmitter site using only six time slots.

Almost all system manufacturers offer MPEG audio cards as well. These cards tend to be in the middle price range and are usually bandwidth-efficient. They suffer from long coding delays (latency) and are usually not suitable for use in real-time (live) audio situations. See Fig. 1 for a comparison of audio card types.

Data

Remote control systems require bidirectional communication between the studio and the transmitter to send commands to the transmitter site, and get readings and status back from the transmitter site. The use of either RS-232 or

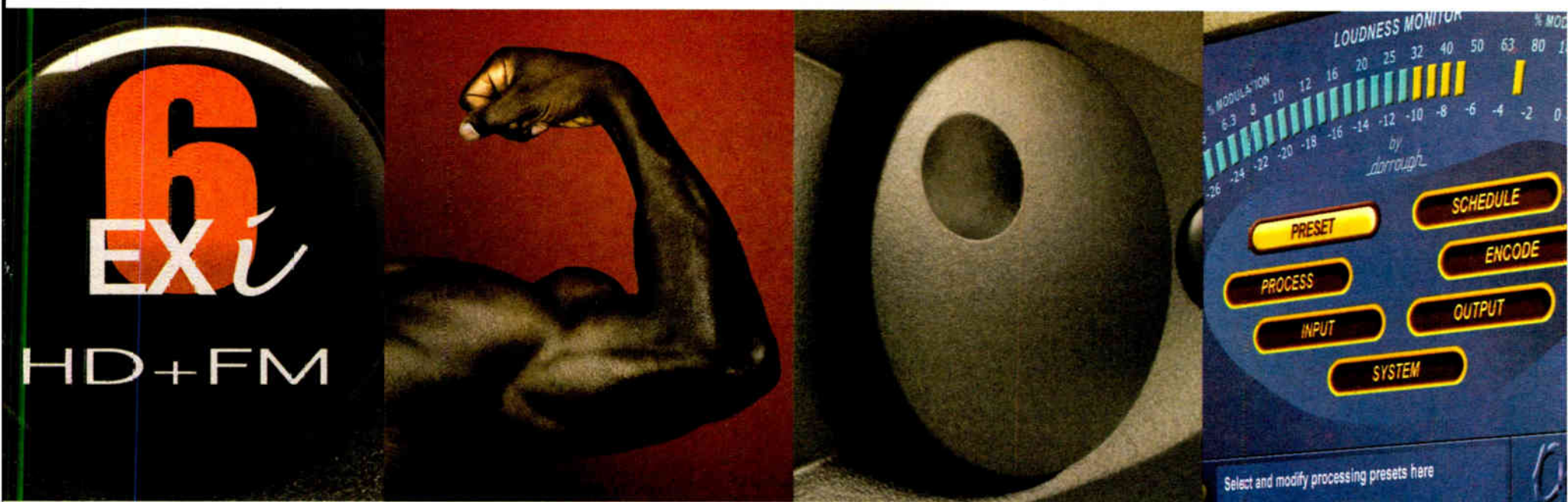
four-wire (duplex, low-quality FSK audio) cards — the most common methods of remote control communication — provides a reliable and bandwidth-efficient means to connect each end of a remote control system.

Since remote control systems like the Burk ARC-16 or Moseley 1620 run at relatively slow data rates (9600 baud is typical), they consume little bandwidth — one time slot, or 64 kilobits — to give the broadcaster a full-time connection between the studio and transmitter.

RS-232 links and inexpensive external interfaces (like the Broadcast Tools SRC-8III) are also used to move contact closures from a satellite receiver at the transmitter site back to a decoder at the studio. Other uses for RS-232 communications include transporting RBDS data to a transmitter site and controlling external devices at the transmitter site — for example, an audio processor.

In addition to FSK-based remote control systems, four-wire card sets — full-duplex telco cards that support E&M signaling — serve other useful, non-telco functions in a broadcast T1 system. They are perfect for moving IFB audio to a transmitter site to feed a sub-carrier generator for remotes; moving transmit and receive as well as push-to-talk functions to a two-way radio system; returning EAS audio from a remote receiver; or for confidence monitoring of other audio circuits.

See T1, page 16 ►



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Omnia-6 is the standard by which all other processors are measured. In the last few years, thousands of leading stations in the world's top markets have upgraded to Omnia. In fact, Omnia-6 has been so successful that some competitors have just given up; others are mere shadows of their former selves.

So why do broadcasters love Omnia-6? The *sound*. The clean, pure, crystal-clear sound (bone-shakingly loud, if you want) that's become the choice of #1-rated stations in New York, Los Angeles, Tokyo, Paris, London, Rome, Sydney and Beijing. The other guys tried to match its winning sound... and failed. So they've settled instead for trying to copy its innovative features.

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Which is why the **new Omnia-6-EXi** makes perfect sense. With **integral HD Radio Diversity Delay** that helps digital broadcasters eliminate analog connections to the HD exciter, ensuring independent analog and digital program streams. And the exclusive new **LoIMD Clipper** that actually **suppresses intermodulation distortion** to deliver audio that's cleaner, clearer and more detailed than ever — no matter how aggressive your processing. (If you already own an Omnia-6, don't worry — there's a low-cost upgrade to give your processor full-fledged Omnia-6EXi power.)

A lot of muscle? You bet. No wonder the competition is running scared.



OmniaAudio.com

TECH TIPS

'You Have Three Minutes to Sign Off'

Avoid Common Pitfalls When Designing Your Station Remote Control System

by Charles S. Fitch

In a discussion of compliance in these pages a year ago, we addressed our industry's regulatory complexity. Readers asked us to expand on this. Most of the requests addressed radio station transmitter control systems.

In basic terms, remote control systems are viewed as *attended* or *unattended*.

Attended control systems are operator-supervised. They are described as semi-automated (the system does some of the work) or not automated at all (you make all decisions). Control points are fixed. Other than the main studio and the transmitter, you have to notify the commission where they are.

Fully automated, unattended transmission systems are, under normal conditions, monitored, adjusted and status-reported by their supervisory controller, typically a computer. No human involvement is called for moment to moment, other than a log for EAS operations and a chronology log of when the station is radiating.

In one of those "Catch 22" situations for which the federal government is so legendary, you can legally operate your station in completely automated unattended mode without any automation control equipment at all, with the following stipulations:

✓ One, the system has to be stable such that it meets all parameters for legal operating limits reliably. At the present state of the art (and as recognized by the commission), broadcast transmission systems when properly designed and installed are stable and reliable, the reason we can run unattended;

✓ Two, you have to have "control" of the system such that you can turn off the transmitter if needed;

✓ Three, you are not exempted from EAS compliance, legal IDs, main studio requirement, public file, local telephone number, management presence etc. These are separate issues not related to remote control;

✓ Four, you must have a plan (best be written to CYA) and implement that plan to maintain technical compliance. It is wise that your plan include items like making and keeping a record of periodic system checks, an annotated responsible person (such as a contract engineer), organized copies of required equipment testing and proofs, etc.;

✓ Five, you'd best be compliant if you are ever inspected.

Simple yet reliable

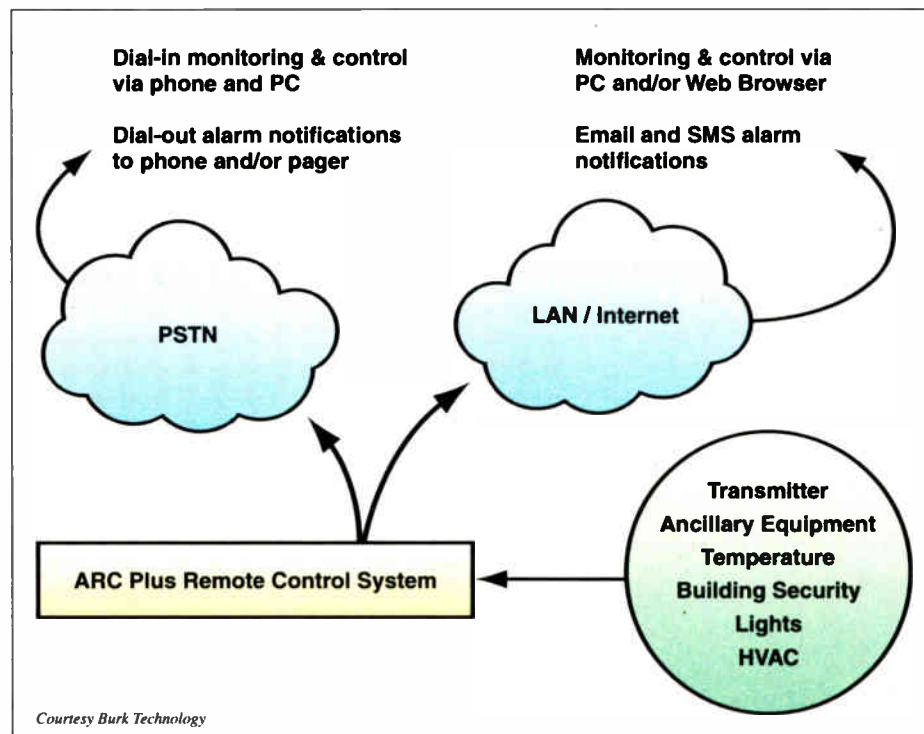
An example of a simple installation: One of my clients has a Class A FM. Its solid-state transmitter has sat exactly at 100 percent output 24/7 for 10 years now. If the main exciter breaks lock — it never has, but if it does — it toggles automatically to the backup. Radiation is controlled by the STL squelch.

On the complicated side of the ledger, another client has 64 channels of teleme-

try, status and control in their unattended, automated control system. The system does a great job of maintaining parameters and will page every technocrat associated with the station if there is an out-of-tolerance situation. Beyond assuring legal operation, the system will page the

HVAC company if the building temperature gets too high or the LP folks if the generator fuel gets low.

From a regulatory standpoint, your station has little to gain by not running unattended. Regulatory complexity, the manpower distraction and complications of operations are less onerous. Having less paperwork, in the present inspection climate, translates into fewer potential Notices of Apparent Liability.



Conceptual diagram of the ins and outs of a remote control system — here, a Burk ARC Plus.

T1

▶ Continued from page 14

Telco service

Since T1 comes from the telephone industry, what would a T1 system be if it couldn't move telephone service from one end to the other?

OPX extensions from the studio to the transmitter site mean that recurring costs for a dial-up phone at a site can be eliminated and that service run over the T1 link.

IP connectivity

The need to move LAN data to and from a transmitter site is more prevalent now than ever before. We'll discuss this further in the final installment when we concentrate on HD Radio requirements;

but regardless of that need, the ability to move IP data between the studio and transmitter means that the transmitter is no longer shut off from the rest of the world.

With IP functionality, broadcasters can extend their station LAN to the transmitter site. Access to e-mail, network administration functions and the Internet are a click away. If you need a manual from a manufacturer during an overnight maintenance program, having LAN access at the transmitter site saves time and a possible trip to get it.

Off-site back-ups are now easy to implement as well. Place an unused computer at the transmitter site and, with the appropriate software, perform incremental or differential backups of critical station files during the overnight and off-peak times. Disaster recovery can be much less painful if critical station information has been preserved at an off-site location.

Card Type	Time Slot Use Out	Time Slot Use In	Function
Linear Audio	17	0	Program audio to Tx
Linear Audio	0	17	RPU audio from Tx
RS-232	1	1	2-9600 RS-232 ports
Telco OPX	1	1	Extend 1 line to Tx
LAN Extension	5	5	320 kilobit LAN circuit

Fig. 2: Single FM Station STL with ancillary functions

Card Type	Time Slot Use Out	Time Slot Use In	Function
Linear Audio	17	0	FM Program audio to Tx
Linear Audio	0	17	Satellite audio from Tx
Enhanced apt-X Audio	2	0	Mono AM Program to Tx
RS-232	1	1	2-9600 RS-232 ports
Telco OPX	1	1	Extend 1 line to Tx
LAN Extension	3	3	192 kilobit LAN circuit

Fig. 3: Combo FM/AM Station STL with ancillary functions

However, the trick is in achieving the correct functionality of that unattended, automatic system for compliance purposes and for your station's unique circumstances.

Many manufacturers make remote control systems that are up to the task. Personal taste and the best match to your individual station needs usually motivate the choice of system. Best for our purposes is to address generally the functional and regulatory issues and some integration solutions.

Minimize failures

Because the system is programmed for the unique needs of your station, special instructions usually are kept in the micro-computer's memory. Protect that memory with appropriate surge protectors; and control electrical noise in the power that supports your system.

Probably the best investment for your remote control system is a dedicated, high-end UPS with at least a few hours of run time. The uninterruptible power supply also will provide site information during power failures, whether expected (such as utility work) or unexpected (your generator fails to start).

The UPS also will keep the clock running. The clock's accuracy is critical when the remote control changes powers and/or antenna modes on a time basis.

Do not forget to put surge suppression on the phone line as well.

Glitches, box failures and inadvertent keystrokes can disrupt the system's programming. Keep a complete and accurate hard copy of the programming required to keep your system functional. You'll need that data often — usually at the worst possible moment.

See CONTROL, page 19 ▶

Putting it together

T1 STL links can move high-quality program audio, serial data, four-wire low-quality audio, telephone service and IP data between ends. A typical STL system will perform almost all these functions.

The chart in Fig. 2 shows a typical bidirectional linear audio system used to feed program audio to an FM site, operate a remote control, feed RPU audio back to the studio, extend a single telephone line to the transmitter site and extend the station LAN, at 320 kilobits, to the transmitter site.

Fig. 3 shows a typical multi-station, bidirectional combination STL system. This system feeds stereo program audio for an FM and mono program audio for an AM, brings return audio from a satellite receiver back to the studio, moves RS-232 data for a remote control and the satellite contact closures, extends a single telephone line to the transmitter, and still extends the station LAN, at 192 kilobits, to the transmitter site.

Looking forward

The flexibility of T1 systems means that they are suited for use in the simplest or most complex scenario. We've illustrated only a few possible configurations of more typical STL systems, but the power of a T1 system is limited only by your imagination.

In the final installment of this series, we'll concentrate on what's required to move all the HD Radio information from the studio to the transmitter. We'll show why a T1 STL link is ideal for this critical station function. ●

“Showcase studios take time, right? Not this time.”

“Challenging’ didn’t begin to cover it. Our **showcase studios** were to be located in the high-visibility West Edmonton Mall. With only six



weeks ‘til our on-air date, our challenge was finding a manufacturer we could trust to deliver on our timeline.

“We’d almost decided on one of the traditional console/router companies; working 25/7, we could *barely* make our deadline.



Then we found out about Axia IP-Audio networks.

“Axia gear goes together with RJ-45 connectors, so adding sources to the network takes almost no time. A few clicks and you’re done! That produces a **substantial cost reduction** in terms of wiring from room to room.



“And because the Axia system routes audio using **ordinary Ethernet** instead of expensive mainframes, the ease of adding to the network allows it to grow and change dynamically with our operations.

“When we decided to go with Axia, the router guys had a fit. They actually tried to tell us that the IP-Audio network would catch viruses! We laughed for days about that one.



“Our studios were finished **with time to spare**. The installation came together really well, and since going on the air we’ve been trouble-free.

“We’ve had several announcers tell us how much they **love working with the Axia surfaces** and how easy they are to operate. It’s great to be able to setup and **save multiple configurations** that can be **recalled at a moment’s notice**.



“Our experience with Axia has been all positive; we’ve had no audio glitches or dropouts whatsoever. I don’t know why we hadn’t gone this route earlier. Where we’re installing new equipment, **we’re onboard with Axia.**”



— Owen Martin, Director of Engineering,
Newcap Radio, Alberta, Canada



www.AxiaAudio.com

Amari Brings

by Ken R.

"You're traveling through another dimension, a dimension not only of sight and sound, but of mind; a journey into a wondrous land whose boundaries are that of the imagination. Next stop, the Twilight Zone."

Well, that part is easy enough to translate to the radio. But how do you show a gremlin on the wings of an airplane as depicted in the original TV drama "Nightmare at 20,000 Feet?" That's the kind of weekly challenge faced by Carl Amari, CEO of Falcon Picture Group, and his team of actors and audio professionals.

"My favorite TV show was always 'The Twilight Zone,' which I knew was owned by CBS," said Amari. "I had a good relationship with the executives there from my previous career syndicating classic radio shows, including some of theirs. I asked them if I could license the rights to 'The Twilight Zone' and create new radio dramas from the old scripts."

CBS gave him the go-ahead as well as the original musical background scores, which had been recorded over 40 years ago by top film composers such as Jerry Goldsmith and Bernard Herrmann. Digital recording studios were built in Schaumburg, Ill., to record the actors. Amari contacted a casting director in nearby Chicago who could grab big stars as they hit town to appear in theatre locally. And in 2002, before you could say, "Submitted for your approval," a classic TV show was reborn on the radio.

People in the zone

Creator Rod Serling narrated the original TV version of "The Twilight Zone" in a distinctive low-key but oddly clenched manner during its run from 1959-1964. Amari's first task was to hire a host who could bring the same quiet intensity to the radio version. His choice was Stacy Keach Jr.

"I knew his father, who had created an old radio show called 'Tales of the Texas Rangers,' which I had syndicated," said Amari. "When I was visiting him in Los Angeles I met his son, and that great, deep voice stuck in my head. When I got this opportunity Stacy Keach Jr. was the first guy I thought of."

Keach described his approach to Radio World.

"Serling's unique style of delivery was fodder for impressionists and actors for the duration of its success and afterwards," said Keach. "And quite frankly every time I said, 'The Twilight Zone,' I could hear a little voice in the back of my head that sounded kind of twangy and terse, like the man himself."

"Even though I have established my own style over the years, I wanted to pay homage to Mr. Serling so I opted for a similar rhythm at certain intervals. When something is as identifiable as Rod Serling's delivery, it would be folly to try and completely avoid it."

A Twilight Actor Then and Now

H.M. Wynant is the only man to have acted in the original TV version of "The Twilight Zone" as well as the current radio series. He shared his thoughts from his home in California.

"I starred in three of the radio dramas, 'Of Late I Think of Cliffordville,' 'The Trade Ins' and 'Death's Head Revisited,'" he said. "Amari and company did amazing work. The transfer from a TV script to a radio script was absolutely first-rate. I had to put a lot of faith in the postproduction team as I recorded my roles in a vacuum about 2,000 miles away. They knew what they were doing because the end result was nothing short of brilliant."

Wynant's "Twilight Zone" TV episode was "The Howling Man," which aired Nov. 4, 1960. In it he played the part of David Ellington, a man who gets caught in a storm and takes refuge in a monastery. There he inadvertently unleashes the devil, whom he spends the rest of his life trying to recapture.



Stacy Keach and Carl Amari

Also appearing in the radio series are actors like Jason Alexander, Jane Seymour, Morgan Brittany, Blair Underwood, Ed Begley Jr. and comedy veteran Stan Freberg. When the desired actors are not available in the Chicago area, they are recorded at Pacific Ocean Post, a studio in Santa Monica, Calif. Their voice tracks are shipped to Amari on CD for mixing those of the rest of the cast.

Writing and recording

All-new episodes are based on the original teleplays, which makes the adapting a bit tricky. Each radio show runs 43 minutes so that stations can fill out the hour with commercials and news. This means dialog has to be creatively extended or invented.

"The key was hiring a great writer," said Amari. "We were lucky to get Dennis Etchison, an award-winning sci-fi writer with a long list of credits including working with Stephen King. Of course some stories work better than others on the radio, but everything starts with the written word."

While Amari has his own staff record the actors in Schaumburg, a Chicago firm, Cerny American Creative, assembles each show.

"We edit and mix on Pro Tools and use several Sound Ideas sound effects libraries," said Michael Slaboch, an engineer at Cerny. "Bob Benson, Craig Lee and myself each work on one aspect of the show, dialogue, music or effects. Then we bring our sessions together for the final mix and radio edit."

"Foley," the Hollywood term for live sound effects such as walking and door slams, is also done at Cerny. The studio is equipped with several different Foley pits including linoleum/wood, ceramic tiles, gravel/dirt and cement as well as an arsenal of various objects to sonically suspend audience disbelief.

"It takes about two weeks to put a show together," said Slaboch. "Editing music has been the most challenging aspect. We use the tremendous themes from the TV show, which was post-scored and tends to take dramatic turns in mood and tempo. We spend quite a bit of

time editing and looping the tracks, trying out various pieces until we establish a few musical motifs throughout the show."

Slaboch said that audio processing and microphone choice depend on the dramatic content.

"We typically use a Sennheiser 416 (mic) for Foley, but occasionally a Neumann U 87 if we are looking for a warmer sound," he said. "Some shows have sound design that is reliant on reverb, pitch shift and EQ."

But no matter what technical methods are used, the key to bringing these scripts to life is the ability to help the listener create a mental image.

"'Twilight Zone' and radio are perfectly suited to one another in that they both inhabit the world of imagina-



Sarah Wayne Callies works the mic in the episode 'Ring-A-Ding Girl.'

tion," said Keach. "In a sense, they both speak to the subconscious in the course of unfolding a story."

"One of my primary responsibilities as narrator is to direct the listener to the unseen surprises that lie ahead, to establish a tone or mood that helps to frame the events that will follow."

Numbers behind the zone

"The Twilight Zone" is heard on about 125 stations that air the show on a barter basis. It is also heard on XM and Sirius. Each episode has slots for local commercials; there are national commercials for clients such as Sears and Bayer Aspirin which are inserted into the programs. The latter are sold by Jones Media America, a New York media broker.

The Twilight Zone radio show is owned by CBS and Falcon Picture Group, Amari's company. The budget on paper for each show is about \$30,000, but as Amari does not pay himself for his time involved in the show and his studios are already paid for, the actual weekly cost is less than that. Besides the revenue from national spots, Amari sells CDs of the show through his Web site, www.twilightzoneradio.com.

"The actors love doing the show," he adds. "On radio they don't have to wear make-up or memorize lines."

Ken R. was 10 when he first saw that guy in the diner with the third eye, May 26, 1961. The episode was "Will the Real Martian Please Stand Up." 🌟

Control

► Continued from page 16

Do not let anyone make an industry out of programming your remote system or let them place your station in jeopardy by not supplying you with a copy of the programming data or keeping it current. Without this data, you'll have to start from scratch every time problems erupt. And they will.

Change entry codes at least every year; whenever you acquire a station; and immediately if anything "funny" happens involving the remote control system.

Avoid "cute" station-related pass codes. Recently I noted a remote control phone number on a wall telco punch-down; just for curiosity I called the system on my cell. Upon entering the station frequency, I was into that system. I had control! Dumb to be that simple.

Monitor and control

What should you monitor and control?

Foremost, you have to be able to turn off the transmitter.

One way of turning it off could be simply to shut off the STL transmitter. The squelch relay contacts should activate a timer so that, a minute or two later, the timer turns off the transmitter. This avoids carrier bounce if the squelch stutters.

As noted, if your system is stable enough in critical parameters, strictly speaking you do not need automatic cor-

rection in place. However, most modern remote control equipment has tremendous capability; it can regulate output power, turn off HDAM at sundown, even turn on backup air conditioning if the building gets too hot. Why not use it?

Most folks elect to use a POTS line to access transmitter controls. One of the clearest directives from the FCC is that if the remote control system is accessed by telephone for control, a dedicated phone line must be connected to it.

This POTS line can be the only phone in the transmitter building, and you can use the phone when you're in the building for other purposes (like ordering a pizza) because you are then in local command. Otherwise, however, the verdict is that each remote control system box has its own POTS line, and no other non-station personnel or device can use it even to order a pizza.

Problems in your transmission system can be divided into two universes: those that affect other stations and those that affect only yours. Loss of automatic frequency control (AFC) in your FM exciter with the station walking up the dial onto other station channels is an example of

the former. A drop below 90 percent output from a slow output tube failure is an example of the latter.

Roughly speaking, you have three minutes to correct the first, three hours to correct the second.

For AM stations, daypart change in output power or antenna configuration requires immediate correction. For this category of fault, set up your system to respond automatically.

Most modern exciters use a reference oscillator and AFC to set the output frequency. When AFC lock is lost, most exciters issue an error signal (many use this to mute output as well). A simple logic circuit to bring on the standby exciter (assumed to be on frequency) is an automatic solution that takes seconds.

Required tower lighting is a little more complicated, as both the FCC and the

FAA have an oar in the water on this one. In far northern winter locations, the tower lights will come on and go off all day long during overcast weather. However, the requirement to check the lights is only for nighttime periods.

Might I suggest this simple automatic differentiating system: Enable your alarms with a sensor that will activate when the outside light falls below 5 foot-candle. Such a change normally occurs within the 20-minute time window after darkness falls, during which you must check your tower lights by rule.


With a light failure status input, most remote control systems can be programmed to start notifying the appropriate personnel; those station folks can notify the FAA and get the repairs scheduled.

By the way, please do not wire any voltage higher than 24 volts through your

control systems. Those little relays usually can't handle the fault current and none of us like the shock when we unexpectedly encounter these lethal voltages.

Let us know your tips and questions about compliance. If readers are interested, we can explore specific programming (alarm windows, action sequences, etc.) and related circuits (if and when needed) in a future article to address the requirements we've covered.

Comment on this or any article to radioworld@imaspub.com.

Charles S. Fitch, W2IPI, is a registered professional consultant engineer, member of the AFCCE, senior member of the SBE, lifetime CPBE with AMD, licensed electrical contractor, former station owner and former director of engineering of WTIC(TV) in Hartford, Conn., and WSHS(TV) in Marlborough, Mass. 

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Radio World's HD Radio™ Scoreboard

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AM STATIONS ON WITH HD RADIO (by frequency)

Call Sign	Market	Freq.	Owner	Call Sign	Market	Freq.	Owner	Call Sign	Market	Freq.	Owner
KTSA	San Antonio, TX	550	CBS	KRKE	Los Angeles, CA	830	Radiovisa	WRYO	Chicago, IL	1200	Univision Radio
KFYI	Phoenix, AZ	550	Clear Channel	KKNT	Las Vegas, NV	840	CBS	KLVZ	Denver-Boulder, CO	1220	Crawford
WGAM	Miami-Ft. Lau.-Hollywood, FL	560	Beasley	WHAS	Louisville, KY	840	Clear Channel	WZBK	Keene, NH	1220	Saga
WHYN	Springfield, MA	560	Clear Channel	KOA	Denver-Boulder, CO	850	Clear Channel	WECC	Buffalo-Niagara Falls, NY	1230	CBS
KLZ	Denver-Boulder, CO	560	Crawford	KHMO	Seattle-Tacoma, WA	850	Clear Channel	WTPG	Columbus, OH	1230	Clear Channel
WRDT	Detroit, MI	560	Crawford	WKUC	Birmingham, AL	850	Crawford	WJOI	Norfolk-Va Beach-W'port News, VA	1230	Saga
KLAC	Los Angeles, CA	570	Clear Channel	KFUO	St. Louis, MO	850	Lutheran Church	WBUR	Cape Cod, MA	1240	Boston University
WTNT	Washington, DC	570	Clear Channel	MAEC	Atlanta, GA	860	Beasley	KMZX	Billings, MT	1240	Elenbaas Media, Inc.
WGAC	Augusta, GA	580	Beasley	KMVP	Phoenix, AZ	860	Bonneville	WKFI	Boston, MA	1260	ABC Radio
KMJ	Fresno, CA	580	CBS	WKAR	Lansing-E. Lansing, MI	870	Michigan State Univ.	WNDE	Indianapolis, IN	1260	Clear Channel
WTAG	Worcester, MA	580	Clear Channel	WCBS	New York, NY	880	CBS	WYDE	Birmingham, AL	1260	Crawford
WCAO	Baltimore, MD	600	Clear Channel	WDFP	Detroit, MI	910	ABC Radio	WVMT	New River Valley, VA	1260	Virginia Tech
WREC	Memphis, TN	600	Clear Channel	WRNL	Richmond, VA	910	Clear Channel	WXYT	Detroit, MI	1270	CBS
KOGO	San Diego, CA	600	Clear Channel	KNEW	San Francisco, CA	910	Clear Channel	WHTK	Rochester, NY	1270	Clear Channel
WIP	Philadelphia, PA	610	CBS	KPOF	Denver-Boulder, CO	910	Pillar of Fire	KWSX	Stockton, CA	1280	Clear Channel
WTNH	Columbus, OH	610	Clear Channel	WSUI	Iowa City, IA	910	University of Iowa	WABO	New York, NY	1280	Univision Radio
KOJH	Havre, MT	610	New Media	WKYV	Milwaukee-Racine, WI	920	Clear Channel	WTHI	Hartford-New Britain-H'town, CT	1290	Marlin Broadcasting
KMKI	Dallas-Ft. Worth, TX	620	ABC Radio	WVJ	Providence-Warwick-Paw't, RI	920	Clear Channel	KAKC	Tulsa, OK	1300	Clear Channel
KTAR	Phoenix, AZ	620	Bonneville	WVJ	Detroit, MI	950	CBS	KTKC	Dallas-Ft. Worth, TX	1310	Quavus Media
WTHJ	Milwaukee-Racine, WI	620	Journal	WPEN	Philadelphia, PA	950	Greater Media	WIZE	Dayton, OH	1340	Clear Channel
WPRO	Providence-Warwick-Paw't, RI	630	Citadel	KCFN	Denver-Boulder, CO	950	Lincoln Financial Media	KCFR	Denver-Boulder, CO	1340	Colorado Public Radio
KHOM	Denver-Boulder, CO	630	Clear Channel	KGKE	San Francisco, CA	960	Clear Channel	WEXL	Detroit, MI	1340	Crawford
WVJZ	Philadelphia, PA	640	ABC Radio	WFLA	Tampa-St. Pete-Clearwater, FL	970	Clear Channel	WJVI	Milwaukee-Racine, WI	1340	Saga
WMLS	Oklahoma City, OK	640	Citadel	WHA	Madison, WI	970	Wis. Public Radio	KABQ	Albuquerque, NM	1350	Clear Channel
WJNA	W. Palm Beach-Boca, FL	640	Crystal Boynton Bch	WHSR	Miami-Ft. Lau.-Hollywood, FL	980	Beasley	WSAI	Cincinnati, OH	1360	Clear Channel
KENI	Anchorage, AK	650	Clear Channel	WOFX	Albany-Schenectady-Troy, NY	980	Clear Channel	KRUS	Tulsa, OK	1360	ABC Radio
WFAN	New York, NY	660	CBS	WTEN	Washington, DC	980	Clear Channel	KHEY	El Paso, TX	1380	Clear Channel
WSCR	Chicago, IL	670	CBS	WYZZ	Miami-Ft. Lau.-Hollywood, FL	990	ABC Radio	WGRB	Chicago, IL	1390	Clear Channel
KLTT	Denver-Boulder, CO	670	Crawford	WBYZ	Orlando, FL	990	ABC Radio	WCOS	Columbia, SC	1400	Clear Channel
WJOX	Birmingham, AL	690	Citadel	WLGZ	Rochester, NY	990	Crawford	WJLD	Birmingham, AL	1400	Richardson Broadcasting
WLW	Cincinnati, OH	700	Clear Channel	KTNG	Los Angeles, CA	1020	Univision Radio	WVAE	Bliddeford, ME	1400	Saga
KSPN	Los Angeles, CA	710	ABC Radio	WBZ	Boston, MA	1030	CBS	WKKS	Boston, MA	1430	Clear Channel
WOR	New York, NY	710	Buckley	WHO	Des Moines, IA	1040	Clear Channel	KTZB	Tulsa, OK	1430	Clear Channel
WGN	Chicago, IL	720	WGN Continental	KCBR	Colorado Springs, CO	1040	DRJ Broadcasting, LLC	WBYU	New Orleans, LA	1450	ABC Radio
KURL	Billings, MT	730	Elenbaas Media, Inc.	KMK	Los Angeles, CA	1070	CBS	KMRY	Cedar Rapids, IA	1450	Sellers Brdct - KMRY
WKDL	Washington, DC	730	Mega Communications	WJIA	Memphis, TN	1070	Clear Channel	KIID	Sacramento, CA	1470	ABC Radio
WVBR	W. Palm Beach-Boca, FL	740	Beasley	WIBC	Indianapolis, IN	1070	Emis	WUNN	Miami-Ft. Lau.-Hollywood, FL	1470	Beasley
KCBS	San Francisco, CA	740	CBS	KRLD	Dallas-Ft. Worth, TX	1080	CBS	WKAP	Allentown-Bethlehem, PA	1470	Clear Channel
KBRT	Los Angeles, CA	740	Crawford	KRXA	Denver-Boulder, CO	1090	Entravision	WDAS	Philadelphia, PA	1480	Clear Channel
KOAL	Price, UT	750	Eastern Utah	WILD	Boston, MA	1090	Radio One Inc.	KCFE	Denver-Boulder, CO	1490	Colorado Public Radio
WJR	Detroit, MI	760	ABC Radio	WWE	Atlanta, GA	1100	Beasley	WJMO	Cleveland, OH	1490	Radio One Inc.
KKZN	Denver-Boulder, CO	760	Clear Channel	KJIS	Los Angeles, CA	1110	ABC Radio	WBAE	Portland, ME	1490	Saga
WABC	New York, NY	770	ABC Radio	KFAB	Omaha-Council Bluffs, NE-IA	1110	Clear Channel	WOLF	Syracuse, NY	1490	WOLF Radio
WMCN	Ft. Myers-Naples-Marco Isl, FL	770	Beasley	KMOX	St. Louis, MO	1120	CBS	WTWP	Washington, DC	1500	Bonneville
KAAM	Dallas-Ft. Worth, TX	770	Crawford	WDFN	Detroit, MI	1130	Clear Channel	WLAC	Nashville, TN	1510	Clear Channel
KCBC	Modesto, CA	770	Crawford	KFAY	Minneapolis-St. Paul, MN	1130	Clear Channel	WCKY	Cincinnati, OH	1530	Clear Channel
WBBW	Chicago, IL	780	CBS	WRVA	Richmond, VA	1140	Clear Channel	KCMN	Colorado Springs, CO	1530	DRJ Broadcasting
KABC	Los Angeles, CA	790	ABC Radio	WBA	Miami-Ft. Lau.-Hollywood, FL	1140	Univision Radio	WDCB	Albany-Schenectady-Troy, NY	1540	Crawford
WGY	Albany-Schenectady-Troy, NY	810	Clear Channel	WMLB	Atlanta, GA	1160	Atlanta Area Brdct	KCVR	Stockton, CA	1540	Entravision
KLDC	Denver-Boulder, CO	810	Crawford	KSL	Salt Lake City-Ogden-Provo, UT	1160	Bonneville	WJLO	Frankfort, IN	1570	Kaspar Broadcasting
KUTP	Salt Lake City-Ogden-Provo, UT	820	Bonneville	KNGS	Dallas-Ft. Worth, TX	1160	First Broadcasting	KMIC	Houston-Galveston, TX	1590	ABC Radio
WGGG	Tampa-St. Pete-Clearwater, FL	820	Mega Communications	WNAH	Rochester, NY	1160	Clear Channel	WRDW	Augusta, GA	1630	Beasley
WOSU	Columbus, OH	820	Ohio State Univ.	KEX	Portland, OR	1170	Clear Channel	WCSH	Milwaukee-Racine, WI	1640	ABC Radio
WNYC	New York, NY	820	WNYC Radio	WMO	Ft. Wayne, IN	1170	Federated Media	KDDZ	Denver-Boulder, CO	1640	ABC Radio
WCCO	Minneapolis-St. Paul, MN	830	CBS	WQAI	San Antonio, TX	1200	Clear Channel	WRLI	Chicago, IL	1640	Clear Channel

The HD Radio Bottom Line
Total Licensed On the Air

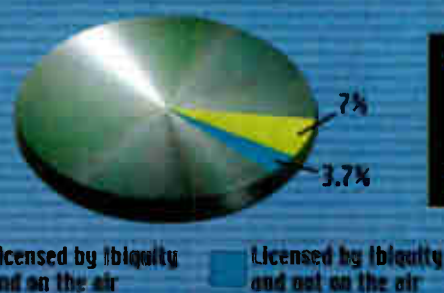
1,475 963

Last Month
Total Licensed On the Air

1,469 917

Market Penetration
United States
13,748 AM & FM Stations
(excludes LPFMs)

Number of
FM Stations
Multicasting:



355

Delay

► Continued from page 20 inserted prior to the transmission system, where you can control it.

RDS & PAD

RDS and program-associated data generally take a few seconds to transmit. Consider that if your RDS and PAD propagate quickly to the transmission system, the text of a song title, for example, may be displayed on the receiver before the corresponding audio.

In this case, you may want to consider delaying the data by software control for a few seconds to better match the audio.

Remotes

Live remote broadcasts need to be thought out differently if your station broadcasts with a delay. At the remote site, it is no longer practical to listen to an off-the-air source such as a tuner.

Remember that the delay associated with HD Radio cannot be used in place of a profanity delay.

Instead, a pre-delay mix-minus feed needs to be sent to the remote site so that the talent can hear the commercials, music or callers in real time. In addition, this mix-minus feed needs to be one that has a minimal delay, so that real-time interaction and cuing is possible.

In some cases, two discrete return feeds are required going back to the remote site. One feed for the mix-minus/IFB to the talent, and a second

feed without the IFB cuing audio to drive a public address system at the venue.

All of this requires resources — in some cases, more resources than we may be accustomed to.

One popular solution for remote broadcasts has been the use of ISDN codecs at the studio and the remote end. ISDN can provide multiple channels of broadcast quality audio in both directions, making it a good choice for radio stations doing remotes, and requiring two discrete return feeds as described above. Another method includes the use of POTS codecs.

Many stations have invested in small radio transmitters commonly on VHF or UHF frequencies to get the audio back to the studio from a remote site. Commonly referred to as Marti or RPU units, these devices operate within a limited range and the audio paths are unidirectional.

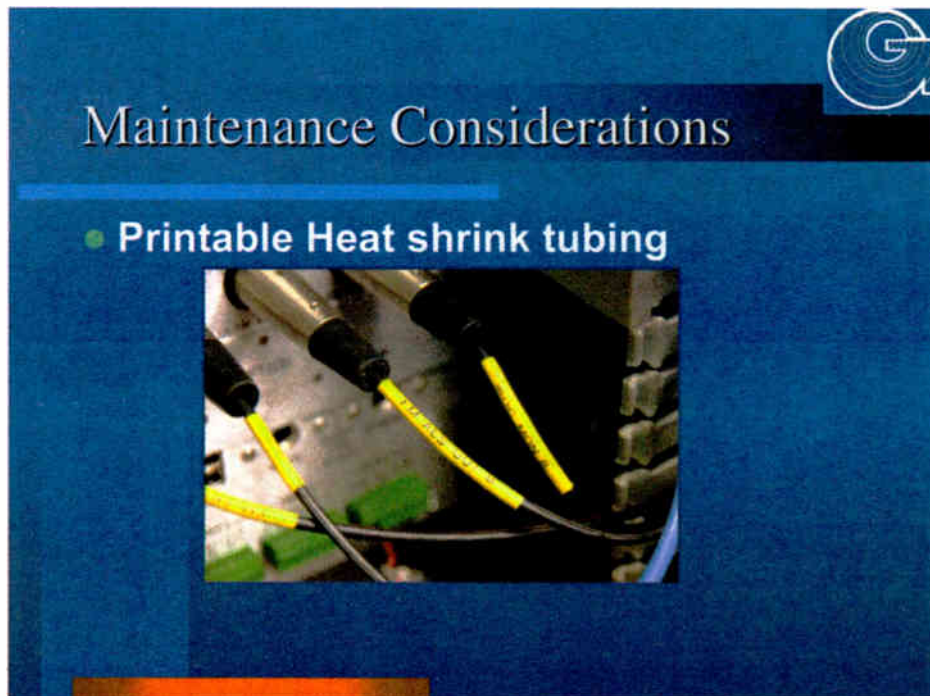
This usually leaves no resources available to get a mix-minus IFB or PA feed back to the remote site. In this case, the engineer must identify a method to get one or two return paths back to the remote site.

Some solutions might include traditional analog subcarriers; additional RPU feeds in the opposite direction; cellular phone links; POTS or ISDN codecs; or traditional telephone toll lines. There is a new breed of digital SCA generators for the analog FM signal on the market that seem promising; these can handle up to 10 audio feeds.

Limited spectrum

In the cases where the stations elect to use UHF or VHF transmitters to get the main feed from the remote broadcast back to the studio, and also the reverse feed(s) from the studio to the remote venue, up to three different RF frequencies may be used. In congested markets, these frequencies may not be available to the broadcaster due to the increased demand, and because in some markets, certain stations may have exclusive rights to use certain UHF and VHF frequencies.

One solution that we have begun to implement in Boston is a voluntary RPU



With Greater Media's five FM stations transmitting both analog and digital signals, there are 25 elements to monitor: FM analog signal, HD primary signal, HD2 data, Internet streaming for primary analog and primary HD program and Internet streaming for HD2 data. To keep his patch cords straight for all 25, Shulins uses printable heat shrink tubing available from Hawk Label. He says it keeps him from pulling a patch cord, only to find out 8 seconds later it was the wrong one.

Frequency Coordination System. Due to the higher demand for the spectrum because of HD Radio, stations in this market have started to make more efficient use of the spectrum, by using a telephone system and Web-based coordination system to inform other broadcasters where and when certain VHF and UHF frequencies are being used.

The blend

Another aspect of the delay associated with HD Radio is the blend of the analog signal to digital after the receiver has acquired the HD-R signal. The old analog signal and the new digital signal will need to be carefully time-aligned at the transmitter, so the blend at the receive end will be seamless.

With equipment just now showing up

on the market within the last few months, the broadcaster finally has some precision tools to allow time alignment to within a digital frame, and amplitude matching to within a tenth of a decibel. This is fortunate and necessary because while an occasional "imperfect" blend may not be noticeable to the casual listener, in a mobile environment where the signal is variable, the receiver may "vote" between the two signals more than a dozen times in a one minute period.

The best way to delay

Many of the first stations to embrace HD Radio did not have many options when it came to generating the delay on the analog side in order to match the digital. Many of the HD-R RF equipment manufacturers produced gear not only to generate the IBOC signal, but also to delay the analog.

This meant running the "precious analog" through a brand-new computer-based unit that had the potential to take both the analog and digital off the air if it failed. Suddenly, facilities that had spent so much effort on redundancy had a single point of failure that could affect both signals.

In some cases careful thought went into a way around this potential problem that could be implemented remotely, or better yet automatically.

As newer analog audio processors were designed with HD-R in mind, many included the ability to add a delay of up to eight seconds that was precisely adjustable down to the frame. This new feature allowed stations to start keeping the analog and digital signals completely independent with little chance of one failing and having an impact on the other.

This article has been adapted with permission of the author and NAB. The original was published by the NAB Broadcast Engineering Conference, 2006.

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HD CONVERSION DIGEST

Generators Need Extra Rack Space

by **W.C. Alexander**

This is the third in a series of hands-on tips about HD Radio implementation. Past tips are archived at radioworld.com.

Many engineers who find themselves faced with either an FM or AM HD Radio conversion process are more than a little surprised when the IBOC generator arrives.

These folks have no doubt done a great job of planning the installation, right down to the number of rack spaces needed for the IBOC generator, HD audio processor and other equipment. The surprise comes when they realize that the *depth* of the IBOC generator exceeds the depth of the transmitter site equipment rack.

That leaves them faced with two choices: leave the back door off the rack and let the unit hang out the back if there is enough side clearance in the back of the rack to permit that option, or replace the equipment rack with one that has sufficient depth.

The issue is that the IBOC generator is really an industrial computer, complete with motherboard, CPU, RAM, hard drive, CD-ROM drive and several plug-in boards. The generator/computer also includes sound cards and the all-important, Ibiqity-made digital up-converter called the DUC and pronounced "duck."

That DUC is long, and I mean *long*;

and to accommodate it, the chassis has to, likewise, be long.

Easier up front

Another rack depth question is the UPS that you will need to keep the IBOC generator, audio processor, GPS receiver and other ancillary items humming along.

Most stations are using 1,000 kVA rack-mount UPS units, which are about 2 RU high, but, like the IBOC generator, are *long*. The weight of these units really requires some sort of rear support as well.

Knowing all this in advance, you can

I have found that a rack with a 32-inch depth and adjustable rear rails works great for HD Radio installations.

address the equipment rack issue right up front, long before the IBOC generator arrives and the pressure is on to get the HD Radio signal on the air. I have found that a rack with a 32-inch depth and adjustable rear rails works great for HD Radio installations.

Changing out an equipment rack, particularly in an older installation, can be more painful than a quad wisdom tooth extraction, so careful planning is a must. Of course a better option, if you have the

floor space, is to simply *add* a deep equipment rack rather than replacing the existing rack, but in most installations, there simply isn't room.

When the new rack is in place, check the manufacturer's specifications for the number of rack units the IBOC generator and any ancillary rack-mount items will require. Plan your rack layout so that the IBOC generator and audio processor are at a comfortable viewing height, at or around eye level. You will control the IBOC generator with its LCD touch screen.

Even though none of the IBOC gener-



Rack equipment for a typical HD Radio installation, including IBOC generator and audio processor.

erator operation is much easier if you use a keyboard and mouse to communicate with the unit.

While you're ordering your new deep rack, order a keyboard shelf. Either a fixed unit that mounts to the front of the rack or a sliding drawer that mounts inside the rack will work.

The fixed unit will be less expensive but it may shadow equipment mounted below it.

Got a suggestion for a future topic? E-mail crisa@crawfordbroadcasting.com.

Cris Alexander is director of engineering for Crawford Broadcasting.

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85 More Pubcasters Awarded IBOC Grants

WASHINGTON More noncommercial stations can now buy HD Radio equipment.

The Corporation for Public Broadcasting awarded \$7.74 million in grants to the noncoms to help those stations convert to IBOC. The total includes 49 that serve rural and minority audiences.

The grants are the latest in a series. Since 2002, CPB has distributed digital transition grants to 540 public radio and 324 public TV stations.

These conversion grants are funded through \$220 million Congress has provided to CPB.

To see the list of stations, go to www.cpb.org.

Directed to Acquire Polk For \$136 Million

VISTA, Calif. The \$136 million cash acquisition of Polk Audio by Directed Electronics is expected to close in the third quarter.

Baltimore-based Polk is the maker of the I-Sonic tabletop HD Radio that began shipping to Tweeter locations in August. The I-Sonic product also receives XM; Polk is touting the product as the first that can receive both HD-R and satellite radio.

The acquisition would not affect Polk's broadcaster affiliate program for the I-Sonic (RW Sept. 13, page 20), a spokesman told Radio World.

Directed also sells several Sirius FM modulated products recently flagged by the FCC in its emissions probe.

Polk management and staff will join the Directed staff after the acquisition, DE President/CEO Jim Minarik told investors in announcing the deal in August. Co-founders Matthew Polk and George Klopfer will serve in consultant roles.

Minarik said the companies are a good fit and the acquisition complements DE's product line. Directed has what it considers a solid position in the satellite radio aftermarket niche because of its Sirius products, while Polk has expanded its home audio speaker line to complement home theaters. The deal will allow DE to expand its home audio business and create shareholder value, he said.

Founded in 1972, Polk sells to customers such as Circuit City, Tweeter, Fry's Electronics, Crutchfield and AVAD Distributors.

Including Polk Audio's approximately \$86 million in net sales for year ended June 30, Directed's net sales would have been approximately \$435 million for the period.

— Leslie Stimson

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The NEW D-75N is an enhanced version of Audioarts' established D-75 digital audio console that permits integration with the Audioarts NET Digital Router, as well as the Audioarts IOC-16 Digital Audio I/O Center. It allows the D-75 (normally a standalone audio console) to access a digital audio network system on six of its input faders (other inputs continue to operate independently) thus providing considerable networked flexibility to an individual studio (the "best of both worlds"). Where standalone input channels have an A/B dual source select switch, networked inputs have eight character Source displays, a Source Select encoder knob and a Take button, which allow selection of any source made available to the D-75N console via its Cat-5 network connector cable.

The NET Digital Router is a high-speed central switch that links multiple studios (via Cat-5 cable) with your technical operations center. Each of its eight links can handle 64 secure bi-directional data paths with embedded control signals, allowing you to centralize shared audio resources and integrate eight separate D-75N digital audio consoles as a working network. An Ethernet link handles administrative tasks, and a Clock port allows synchronization to an external master clock.

The IOC-16 audio input/output center acts as a networked intermediate link between a D-75N digital audio console and the central NET router. THE IOC-16 chassis rear accepts plug-in card modules for a clean and easy wiring installation.

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Crown D-75A Power Amplifier

The Crown D-75A has been serving broadcast professionals since the 1970s. This amplifier is excellent for any kind of critical listening and it's built to last...there's nearly 30 years of proven performance behind this workhorse. The D-75A features 40 watts of power/channel into 8 ohms; level controls; power and distortion indicators; active balanced inputs with XLR-1/4" combination connectors; barrier strip output connectors; and <.001% harmonic distortion at full power.

D75A List \$925.00 **LowestPrice only \$439!**

CROWN



Mackie Onyx-Satellite Firewire Audio Interface

It's got killer mic pre's and a cool base station that keeps your wiring intact, but lets you take the pod with you in a second or less. Just grab it from its base station and go (leaving all your meticulous studio wiring fully intact!). Get it today at BSW for only \$399.99!

FEATURES

- Dual Onyx mic preamps for superior clarity, detail and dynamic range
- Satellite pod with 2 balanced combo Neutrik XLR/1/4" TRS inputs
- Satellite base station features 8 various inputs (2 active at any time)
- Functions include Talkback, with onboard mic, and A/B monitoring switching
- Includes Mackie Traktion2 software (PC and Mac compatible)

ONYX-SATELLITE List \$519.99 **LowestPrice only \$399.99!**

MACKIE



BSW Now Carries Heil Mics!!

Heil Dynamic Broadcast Mic

Get that signature sound you want for your broadcast. This dynamic microphones boast an innovative design along with top-shelf components to deliver a sound that rivals condenser microphones, but without that all-too-common background noise and need for external enhancements. The Heil PR-40 offers flat response from 28 Hz up through 18 kHz with a lush mid range rise for crystalline vocal articulation. The double-layered screens protect against breath blasts. It's ideal for vocals and broadcast voice-overs. Includes stand adaptor and cherry wood box.

FEATURES:

- Dynamic element with neodymium magnet structure
- End-fire cardioid pattern; large aluminum diaphragm
- Wide frequency response; natural articulation
- Anodized champagne matte finish

PR40 List \$375.00 **LowestPrice only \$325!**

Accessories:

HEIL-5M2 Champagne shockmount List \$115.00 ~~\$95.00~~

W5140 Foam windshield List \$25.00 ~~\$21.00~~



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Numark

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FEATURES:

- Buffered Instant Start
- Ability to create seamless loops from both CDs and MP3 discs
- Easy-to-read, backlit LCD that includes text display
- Pitch bend capability via the jog wheel
- Supports continuous playback and is track sequence programmable

MP102 List \$399.00 **LowestPrice only \$199⁹⁵!**



Sony Closed-Ear Headphones

Sony makes some of the most popular headphones in the world, and at these low prices now is the time to replace your old, battered set. All models include a miniplug connector with 1/4" screw-on adapter and low 24 ohm impedance. The Sony MDR-7506 headphone is a best-seller at BSW. It delivers a wide frequency response of 10 Hz-20 kHz in a comfortable, sealed-ear format that provides excellent isolation. The MDR-7502 is a favorite economy headphone with surprisingly rich sound. Frequency response is 60 Hz-16 kHz.

7506 List \$130.00 ~~\$99.00~~
7502 List \$65.00 ~~\$49.00~~ **LowestPrice from \$49!**



Behringer 2031P Passive Monitors

Amazing price! These great-sounding Behringer monitors feature large 8.75" woofers, 1" tweeters, 150 watts power handling and binding post inputs. Priced as a pair for only \$159.99!!!

B2031P List \$239.99

LowestPrice only \$159.99 pair!



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HD-R Car Converters Coming in Q4

Remember FM car converters? HD Radio proponents do, and they believe the devices were so successful in the rise of the FM band that they're betting on the devices doing the same for IBOC.

Several HD Radio car converters are expected to come on the market beginning in November.

They will be offered to consumers by auto dealerships and in radio promotions, according to Peter Ferrara, president/CEO of the HD Digital Radio Alliance.

The devices, made by DICE as previously reported here as well as by other manufacturers, are meant to bridge the gap between OEM factory-installed HD Radios and the automotive aftermarket IBOC radios. They allow most in-dash radios, whether analog AM/FM or satellite radio, to receive HD-R signals.

DICE ELECTRONICS

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HD-DICE
The world's first HD Radio integration kit for your OEM car radio system!

DICE Electronics exhibited its converter in January at CES.

HD Radio is now available in more BMWs as an option or standard equipment. In mid-2007, the industry will start to see HD Radios in more vehicles; proponents have said eight additional automakers have agreed to install HD Radios in some 49 models within the next 17 to 23 months.

Ferrara likens the new devices to the converters used during the emergence of FM.

"There was a lot of excitement and buzz about this great new, better-sounding and 'lots of new choices' medium by consumers," Ferrara told Radio World. "As soon as the automotive companies realized what a boon FM was, they accelerated their efforts to offer FM in their vehicles."

"HD Radio is all that and more, and we expect these HD Radio converters will do the same thing as they come to market."

Ferrara said the devices have been in the works for a while and are not a response to Apple's move to work with some U.S. automakers to install iPod adapters in cars.

As a prelude to the converter announcement, Ibiqity Digital has expanded its automotive team, based in Pontiac, Mich., to meet what it said are increasing demands for support of HD Radio implementation in new vehicles.

"We are working with virtually every OEM manufacturer doing business in North America," stated Ibiqity Digital President/CEO Robert Struble.

Ibiqity's automotive team is working with several other U.S., European and Japanese automakers besides BMW, including Volkswagen, Audi, Mercedes-Benz, Porsche, Volvo, and also European-based suppliers like Bosch and Siemens, which works with Chrysler, Hyundai, Honda, Toyota and Nissan.

OEM manufacturers making HD Radios are Alpine, BeckerHarman, Clarion, Daewoo Electric, Delphi, Fujitsu-Ten, Hyundai Autonet, Mitsubishi, Panasonic, Pioneer, Sanyo, Siemens VDO and Visteon.

— Leslie Stimson



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Niles Audio Brings HD-R to Entire Home

MIAMI Niles Audio Corp. introduced an HD Radio module for the company's whole-house distributed audio system at the Custom Electronic Design & Installation Association Expo in Denver. The module ships to Niles dealers in early 2007.

Called IntelliControl ICS, the module lets a user listen to HD Radio main and HD2 channels through a distributed audio system while viewing IBOC datacast information on the system's wireless iRemote, touchscreens and wall-mounted displays. Niles Audio says this is the first IBOC-enabled wireless product to display HD-R datacasting on a wireless user interface.

Using the IntelliControl ICS system, listeners can also hear their satellite radio programming, or programming from their iPods, CDs or IP-based music players.

Studio Sessions



**Product
Guide
Inside**

Radio World

Resource for Radio On-Air, Production and Recording

September 27, 2006

AES Addresses Audio's 'Transitional Time'

*Broadcast Events at the 121st
Convention Include Loudness,
5.1 Surround and Facility Design Panels*

photos courtesy of iStock/copyright Bill Storage



What:
121st AES
Convention

Where: Moscone
Convention Center,
San Francisco

When: Conference, Oct. 5-8;
Exhibits, Oct. 6-8

Who: The AES in 2005
attracted 20,260 attendees and
452 exhibitors to New York

How: www.aes.org

by Carl Lindemann

The Audio Engineering Society has been providing a forum for radio professionals to get together and assess the current state of the industry for 56 years via annual conventions in the United States and Europe. The U.S. show, Oct 5-8, returns to San Francisco's Moscone Convention Center for the fifth time and again promises ample opportunity for engineers and audiophiles to discuss the wash of new technologies that continue to reshape the soundscape.

This is the nineteenth year that David Bialik has organized sessions as Broadcast Events Chair. Bialik said this may prove to be a pivotal one as IBOC comes into its own while other competing audio media both enhance and fragment the traditional over-the-air broadcast business.

"When I first organized the AES broadcast symposium, IBOC [had just been] introduced. We've seen [its status] evolve over the course of the seminars at AES through the years along with many other innovations that are coming forward," Bialik said.

Bialik has gathered together an intriguing slate of sessions with a mix of participants from a range of industry segments to provide for lively discussion. Additionally, each session will include opportunities for attendees to join the discussion with panelists by way of a Q&A that follows presentations.

He feels AES offers broadcasters a "much more intimate atmosphere" than the annual NAB show. "And so it will be easy to address individual interests and ask questions. It is important at this transitional time to provide such opportunities."

Build-outs, loudness

Thursday's broadcast events include "Considerations for Facility Design," a session scheduled for 9-11:30 a.m. and featuring panelists David Prentice of VCA Fusion, John Storyk of Walters-Storyk Design Group, Bice C. Wilson of Meridian Design and XM Radio's Tony Masiello. Also, Thursday includes a

Loudness Workshop at 4:30 p.m.

"Tony has built XM's studios, and so will provide his insights about that process," said Bialik. "David [Prentiss]'s perspective from an equipment vendor gives a different take including the one of the most essential elements that people too often overlook: budgeting."

Emil Torrick is scheduled to moderate the Loudness Workshop. According to Torrick, the vast proliferation of new media for audio share the need for appreciating the role loudness plays.

"Loudness is common to all the mediums," said Torrick. "What sets broadcasting apart is concerns for modulation. There are legal limits, and so broadcasters have an implied competition to have the loudest signal. So they try to cram in as much loudness as they can."

The session will look at how best to "tweak" loudness and address special concerns for utilizing it most effectively. Industry experts including Frank Foti and Bob Orban will weigh in on the loudness discussion as well as the emerging guidelines for it.

Friday's broadcast sessions include "Innovations in Digital Radio," which Bialik will moderate. The panel is scheduled from 9 a.m. to noon. Topics are expected to include multicast, translators, watermarking, satellite transmissions, the introduction of recorders and a wealth of innovations surrounding IBOC.

"Everyone knows that IBOC is here now, and so we'll focus on how this is playing out. We're seeing a great deal of adoption in the U.S., and the receiver manufacturers are coming around," said Bialik.

After lunch, "Audio Transport for Broadcast Over Distance" takes place from 12:30-2:30 p.m. According to Bialik, this session has returned to the lineup after many years because of the vast changes in phone, Internet and satellite communications.

"How to get sound 'from there to here' was crucial when we first discussed this 15 years ago when analog audio was on its way out," he said. "Now, as digital audio is changing, we need to revisit this."

The session may — or may not — be a

requiem for ISDN. "Is it or isn't it defunct? It's getting very hard to get special services even in New York," said Bialik.

Friday broadcast sessions close with "Surround Sound for Digital Radio" from See AES, page 28 ▶

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AES

► Continued from page 27

3-6 p.m. The panel includes industry leaders Steve Lyman of Dolby Labs, Stefan Geyersberger of Fraunhofer, Alan Kraemer of SRS and Mike Lyons of Ibiquity.

The case study of 5.1 surround's arrival in commercial radio will give a look at what the radio soundscape may be in the near future. "WZLX is the first 24/7 surround service in the United States," said Denny Sanders, managing director for Telos.

"We're in the process of doing the conversion now, and it will not only be available on HD transmission using the MPEG system developed in part by Fraunhofer, but also online worldwide so engineers and station managers can get to hear what this sounds like," said Sanders.

Though WZLX's coverage area doesn't include San Francisco, AES attendees will be able to sample the new sound.

"It will be simulcast on the Internet in surround via Internet stream so that everyday listeners as well as engineers and radio managers can get a taste of what a major radio station sounds like in surround," said Sanders.

APRE takes off

On Saturday from noon to 2 p.m., the newly launched Association of Public Radio Engineers is gathering for a meeting to help organize the group, an effort to bring together engineering talent scattered throughout the larger pubcast community, from NPR affiliates to community radio stations.

According to Dan Mansergh, director of engineering for KQED(FM) Public Radio, the APRE consolidates and expands on previous efforts on the part of NPR and the National Federation of Community Broadcasters.

"We've needed to reach out beyond the NPR umbrella to include community stations to bring up the level of technical expertise and support as well as to look where next generation of engineers are coming from," said Mansergh. "We need all of public radio to share in public



NAB's David Layer will preside over Sunday's 'Broadcasting in the IP Age.' Layer said he hopes to explore how the Internet is changing the way broadcasters do business.



Emil Torrick will moderate Thursday's Loudness Workshop. 'Loudness is common to all the mediums,' he said. 'What sets broadcasting apart is concerns for modulation.'

radio's excellence to raise the level of engineering expertise across the system to a very high level." This event is open to all attendees.

Saturday also offers the 4:30 p.m. broadcast tutorial, "Introducing 5.1 in Commercial Radio," to be chaired by NRSC Chairman and Radio World Contributing Editor Skip Pizzi.

Internet is changing the way broadcasters do business as well as who they are competing with. Issues to be considered include streaming, automated playback, control and delivery.

"In some ways, this session will be the flip side of the 'Innovations in Digital Radio' session," said Layer. "[It] will be both about IP as a technology

How to get sound 'from there to here' was crucial when we first discussed this 15 years ago, when analog audio was on its way out. Now as digital audio is changing, we need to revisit this.

— David Bialik, on the return of 'Audio Transport for Broadcast Over Distance' session

NAB's David Layer will preside over Sunday's "Broadcasting in the IP Age," which features an assortment of panelists, such as Radio Systems President Dan Braverman, XM's Masiello and Axia President Michael "Catfish" Dosch, looking at IP technology as both a broadcast infrastructure and a mode of transport. Layer says he hopes to explore how the

supporting traditional broadcast as well as a new medium of transport that can both enhance and compete with traditional broadcast."

At press time, final details about AES broadcast sessions were still being finalized. For an updated listing and schedule, please visit: www.aes.org/events/121/broadcastevents/.

PRODUCT GUIDE

H3-D Has Five Multidirectional Elements

Toronto-based Holophone, a division of Rising Sun Productions Ltd., says its H3-D portable multichannel surround sound microphone is suitable for professional broadcast applications, and delivers 5.1 channels with no external mixing or signal manipulation required.

The H3-D supports surround sound recording devices, and has a multidirectional pickup pattern with 20 Hz-20 kHz frequency response on five perimeter channels and a discrete LFE microphone located inside. The microphone is phantom powered with an LED indicator.

Attached to the H3-D is a 15-foot Monster cable that terminates in a six-pin Neutrik XLR connector. A windscreen and pistol grip are optional accessories.

The H3-D retails for \$1,695.

For more information, contact Holophone in Toronto at (416) 362-7790 or visit www.holophone.com.



TG-X 48 Has Integrated Pop Shield



The TG-X 48 dynamic microphone from beyerdynamic features a supercardioid polar pattern and an integrated pop shield to reduce pop noise associated with close vocal miking. The company says it offers high gain-before-feedback characteristics, and its metal housing is coated with a soft lacquer on the barrel for optimal handling.

The TG-X 48 comes with a mic clamp and pouch. The retail price is \$124.

For more information, contact beyerdynamic in New York at (631) 293-3200 or visit www.beyerdynamic-usa.com.

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PRODUCT EVALUATION

'Audio: The Movie' Teaches With Humor

Tracer Technologies' Educational DVD Stresses Understanding of Concepts, Not Memorization

by Tom Vernon

Broadcast engineers need to be in a continuous state of learning to stay ahead of the curve. Sadly, there is no one-stop clearinghouse for relevant technical training materials, and an engineer's educational program must be stitched together one piece at a time.

Tracer Technologies' recent release of the DVD "Audio: The Movie" is an excellent "piece" from which to learn the fundamentals of audio and digital audio in a fun and non-threatening way.

The company is perhaps better known for its DC Six software and related audio restoration products. This DVD is the outgrowth of its Forensics Audio Course, which is presented yearly to law enforcement officials from local, state and national organizations, as well as private citizens.

"Audio: The Movie" is intended as an introduction to sound in the digital world, and includes chapters on amplitude, bit width, sample rate, frequency domain, aliasing, dithering, quantization and compression. The intent of the DVD is to further the understanding of these topics for anyone interested in audio, while bypassing much of the mathematical content, which some would find intimidating.

Learning curve

The DVD's introduction recommends avoiding information overload by viewing only one chapter at a time. After viewing, users can read a chapter summary in the test booklet, take the test and get an explanation of the correct answers. Most of the questions don't check for memorization of facts, rather they stress understanding of concepts.

For example, a question on how 0 dB is defined in the real world is correctly answered as the sound of a mosquito buzzing 10 feet away. This is presumably the threshold of human hearing for those whose auditory senses haven't been degraded by age or exposure to too many rock concerts.

"Audio: The Movie" succeeds in putting content across largely through the

use of graphics, humor and rather unusual analogies and examples. When the dB as a unit of measurement is introduced, logarithmic scales are compared to nautilus shells and the shape of the Milky Way. In a later chapter the concept of aliasing is explained by likening it to wagon wheels in old movies, where the spokes appear to stand still or rotate backwards.

Those who burn their own CDs may have wondered how 44.1 kHz was chosen as the sampling rate. The answer is in this

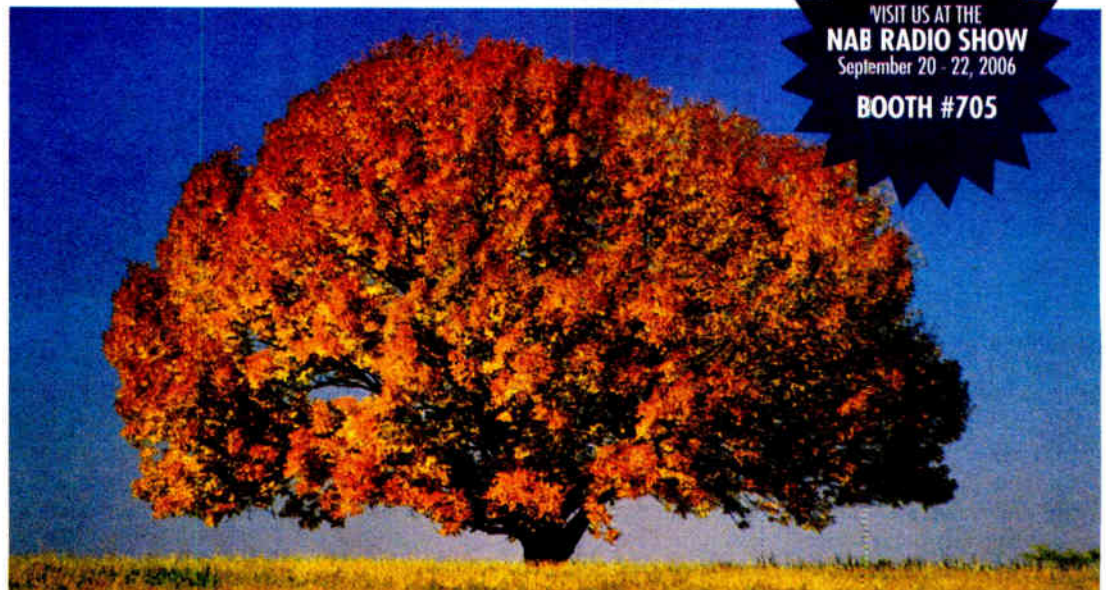
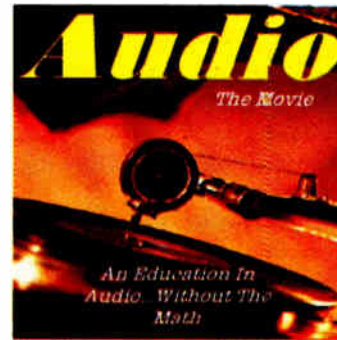
DVD, and it's related to computer memory limitations and broadcast television standards of the late '70s when Sony and Philips were developing the standards for CDs.

While the DVD purports to have no mathematics, a certain amount inevitably sneaks in when the topics of bit width and sampling rates are introduced. Anyone who survived high school math, however, should have no trouble following the explanations given.

The DVD's conclusion notes that the topics of digital audio and audio restoration are vast and deep, and the user is directed to Tracer Technologies' Web site for additional reading and references on these topics. The promotional materials suggest that users can view the DVD in about two hours, although most folks will probably take a bit longer.

Many educational multimedia products suffer from one of two maladies. Some have well-structured educational content, but kill off

See MOVIE, page 31 ▶



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Product Capsule:

Tracer Technologies'
"Audio: The Movie"

Thumbs Up

- ✓ Good balance of content and humor
- ✓ Avoids information overload
- ✓ No fuzzy math

Thumbs Down

- ✓ Some parts may be too basic
- ✓ Time estimate given for completion is optimistic

PRICE: \$39

CONTACT: Tracer Technologies in Pennsylvania at (866) 260-6376 or visit www.tracertek.com.

PRODUCT EVALUATION

Perception 100 Offers Tight Tolerances

by Ty Ford

In a move that follows Audio-Technica's last year, AKG has developed a relationship with a manufacturer in China.

Over the last eight years, cheaper labor there has resulted in entrepreneurs flooding the "prosumer" audio market here with small- and large-capsule condenser mics at increasingly lower prices. Because these smaller importers haven't been able to create the leverage required to maintain quality control, their offerings have been cheap, but erratic.

AKG is a major player in the audio marketplace. It has both the technology and leverage to ensure the quality control required to turn out a consistent product. It is a new era for the Chinese and for AKG.

The romantic vision of a cherished, bespectacled workman bent over a bench while hand-assembling a microphone that is both a precise technical instrument and a work of art is fading. New manufacturing techniques capable of equal or tighter tolerances have turned the tide. The AKG Perception 100 is an example of the second wave of this technology and it is formidable.

Specs

The AKG Perception 100 (\$199) is part of the Perception line that includes the 200 (\$319) and 400 (\$559), both of which include a metal case and spider mount. Both the 200 and 400 have a high-pass filter and pad. The 200 is a cardioid; the 400 is a three-pattern mic.

The Perception 100 cardioid comes with a simpler but rugged metal swivel clip and uses a one-inch, FET, externally polarized, center-tapped, pressure gradient condenser capsule. This is a 200-ohm microphone that requires 48 V DC phantom power. Sensitivity is listed at 18

response and less self-noise. The hefty Perception 100 body is mildly but not unusually resonant. For many applications the standard clip will do. An optional spider mount also is available.

In use

The Perception 100's more conservative low end will make it more easy to use for close mic voice work. I was able to get as close as two inches from it before



Photo by Ty Ford

the proximity effect began to cloud the audio. Serious mic huggers may require some EQ help. While it's not exceptionally pop-sensitive, a foam windscreen will trim down some of the high-frequency boost and reduce popping.

Unlike dynamic microphones found in so many radio stations that don't have much of a top end, condenser mics have enough to get you into trouble if the mic is operated in a highly reflective environment. If you're thinking of trading in your RE20, you have to consider the

defined, and with no need for EQ.

The data sheet's 16 dB-A self-noise figure seems a bit high for how quiet this mic actually is. While not as quiet as the more expensive Neumann TLM 103, it's certainly more than quiet enough for broadcast and studio work and quieter than a lot of the Chinese imports from other companies.

Knowing that different mics can sound noticeably different when connected to

different preamps, I went downscale and plugged the Perception 100 into my Mackie 1604 VLZ Pro mixer and fed that to the analog inputs of my Digi 002. This time the Perception 100 was even more aggressive, slightly too much for me even with the foam pop filter.

I could not help but compare the Perception 100 to its older and more

Product Capsule:
AKG Perception 100 Cardioid Condenser Microphone

Thumbs Up

- ✓ Bargain price
- ✓ Heavy-duty construction
- ✓ Conservative low end eases close mic voice work

Thumbs Down

- ✓ Slightly edgy
- ✓ No pad or EQ
- ✓ No suspension mount

PRICE: \$199

CONTACT: AKG Acoustics in Nashville
at (615) 620-3823 or visit
www.akgusa.com

reversed sibling, the AKG C414 B-ULS. Through the GML preamps, the 414 was much thicker, less edgy and not as bright as the Perception 100; no chance in confusing the two.

It's obvious that AKG has been reinventing its approach to microphones. With the three Perception mics, and at their price points, they have taken a decisive step to regrade the playing field. And the steps must be carefully taken. Were AKG to make a mic that sounds as good as one of their upscale mics, it would detract from their upscale market.

They probably would never have considered the Perception 100, 200 and 400 before forces in the market made that a wise move. They have, and in fine style.

Ty Ford is a frequent contributor to Radio World. He may be reached at www.tyford.com.

**The AKG Perception 100 is an example of
the second wave of manufacturing technology
and it is formidable.**

mV/Pa (-35 dBV). Maximum SPL is 135 dB (for k = 0.5 percent). Equivalent noise is 16 dB-A. Current consumption is less than 2 mA. Net weight is under two pounds. The body is just over six inches long and two inches in diameter.

The frequency response graph shows the mic to be relatively flat from 100 Hz to 4000 Hz. Below 100 Hz the response drops off to about -4 dB at 50 Hz. Above 4000 Hz the response rises slowly to about +3 dB at 10 kHz. Then it drops back to 0 dB at 15 kHz and continues downward to -6 dB at 20 kHz.

High frequency response-wise, the Perception 100 has a lot in common with the Neumann TLM 103. While both mics are relatively bright, the TLM 103 has slightly more low- and high-frequency

acoustical environment. Any good condenser will hear more room reflections. Not so much because of a wider pattern, but because it hears more high frequencies. If you go that way, you may have to budget for some acoustical treatment to absorb some of those reflections.

The Perception 100 through my GML studio preamps has a slight edge to it that brought my voice forward and sounded a bit too processed, although that may be what you like best about it. I use a moderate amount of compression and limiting in my work and that edge gets more pronounced with more processing.

The first-generation Chinese mics I've tried all have too much edge to survive my process. Over time the edge causes listening fatigue. Adding a foam pop filter smoothed the top edge and I resumed working at a distance of about two or three inches. While that edge was a still little too pronounced in my peaky Sony MDR-7506 headphones, playback from my Pro Tools system through my JBL L100 studio monitors was acceptable, clear and

HBE Is a Reseller of Prophet in India

Prophet Systems has entered into a business relationship with Horizon Broadcast Electronics, a provider of audio broadcast systems throughout India. HBE is now a reseller for Prophet in India.

Prophet says it is eager to expand its services in India stations are already using its products. For more information visit www.prophetsys.com.



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PRODUCT GUIDE

MXL.006 Connects To PC Without Mic Preamps

MXL Microphones debuted the MXL.006 USB/cardioid condenser mic, which features a large gold diaphragm. It is a USB instrument that connects to a computer without the need for external mic preamps, allowing broadcasters to record music or dialogue by connecting to a standard USB port.

The company says the mic is suitable for recording instruments or voice, as well as podcasting or adding dialogue to presentations and other multimedia projects.

In addition to the large gold diaphragm, the analog section of the MXL.006 features a 20 Hz–20 kHz frequency response, pressure-gradient condenser capsule and a three-position switchable attenuation pad with settings for Hi (0 dB), Medium (–5 dB) and Lo (–10 dB), which the company says eases configuration of the mic to the sound source.

The digital section features a 16-bit Delta Sigma A/D converter with a sampling rate of 44.1 kHz and 48 kHz. A wire mesh grille with an integrated pop filter protects the instrument's capsule.

The MXL.006 also has a red LED behind the grille that informs the user that the mic is active and correctly oriented toward the user. The mic ships with a travel case, desktop mic stand, 10 foot USB cable, windscreen and owner's manual.

The MXL.006 retails for \$169.95.

For more information, contact MXL in California at (800) 800-6608 or visit www.mxlms.com.



Movie

► Continued from page 29

the users with boredom, others try and make learning fun, yet offer little of educational value. "Audio: The Movie" strikes the right balance, giving a good understanding of audio, and the digital techniques related to audio while leaving viewers with a smile on their faces. It should make users eager for the next Tracer Technologies DVD, "Audio Restoration: The Movie," due for release towards the end of this year.

"Audio: The Movie" lists for \$39 and is available for purchase directly from Tracer Technologies. The package includes a binder, which holds the DVD and the test booklet. More information is available at www.tracertek.com.

Tom Vernon is a frequent contributor to Radio World.



A Screen Clip From 'Audio: The Movie'



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Radio World welcomes your point of view on any topic related to the U.S. radio broadcast industry.

Letters should be 100 to 300 words long; the shorter the letter, the better chance it will be published in full. We reserve the right to edit material for space. Longer commentaries are welcome but may not reach print as quickly.

Include your name, address and contact information, as well as your job title and company if appropriate.

Send letters via e-mail to radioworld@imaspub.com, with "Letter to the Editor" in the subject field; fax to (703) 820-3245; or mail to Reader's Forum, Radio World, P.O. Box 1214, Falls Church, VA 22041.

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PRODUCT GUIDE

ATM Offers 'Continuous' Recording, Playback

25-7 Systems says its Audio Time Manager time compression device also offers recording and playback functionality. The company says it is a "continuous" stereo recorder with the distinction of allowing broadcasters to playback audio faster than it comes in.

Users can pause a network or remote feed, insert content and then return to where the program left off, either catching up in real time or shifting a time deficit to the next local break. Time compression rates can be adjusted on the fly, or the user can adjust when the unit should rejoin real time according to the clock.

ATM says its time compression algorithms do not remove important content, change pitch, damage inflection or create artifacts. The unit continually records for up to one hour, so users can cue up playback to any point in the system's buffer.

The company says stations are using the ATM to solve problems such as controlling live events with no hard start time,



inserting severe weather statements or dropping IDs into continuous programs without losing content, extending breaks to create space or moving hard posts when local air requires.

The front panel offers two-button operation with a large display. Remote control is available through an 8x8 GPIO or RS-232.

For more information, contact 25-Seven Systems in Boston at (888) 257-2578 or visit www.25-seven.com.

Soundelux Features Switchable U99

Soundelux has debuted the U99S, a switchable version of the U99 microphone. It combines two high-grade tube condenser mics in a single unit, which gives users the choice of selecting Normal or Brite sonic signatures.



The company says recent modifications made to vintage mics remove the low-pass filter circuit in order to achieve a more open high-end sound, and that the U99S delivers that performance characteristic by switching to the Brite mode. In Normal mode, a high-frequency rolloff is introduced that replicates the performance of the original vintage mic.

The U99S uses the P99 linear power supply, which is derived from the original vintage technology. In addition, the unit features a handmade, 1-inch-diameter dual-symmetrical backplate and a dual-membrane kk67-type capsule tensioned for warmth and clarity. The company says it avoids the 5 kHz rise common to some vintage microphones to produce a less "peaky" mid-range response.

Other highlights include high gain, flat mids and a controlled proximity effect.

The U99S retails for \$3,250.

Soundelux Microphones are distributed by TransAudio Group in Nevada. For more information, visit www.transaudiogroup.com or call (702) 365-5155.

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The Exstreamer-100 decodes the audio at the receiving address. It is a network-based audio decoder that pulls digital audio from an IP network and converts it to music or voice.

The Exstreamer 100 retails for \$195, and the Instreamer 100 retails for \$395.

For more information, contact Barix Technology Inc. in Minnesota at (866) 815-0866 or visit www.barix.com.

Buyer's Guide

Radio World

Playback and Recording Hardware

September 27, 2006

Two-Track Recorders — Lest We Forget

by Mike Rivers

With most recording and mixing performed inside a computer these days, two-track recorders seem mundane or redundant. But at times, a dedicated recorder is just the ticket.

Engineers are still getting good mileage out of two-track recorders in the studio and in the field. Let's look at today's technology, and revisit recorders that have been forgotten and some we'd like to forget. This is a broad-brush survey and not a collection of detailed reviews.

Today we usually think first of location recording when we talk of two-track recorders. "What is best for location sound? Define location sound," said Klay Anderson of Klay Anderson Audio. "Stealthing at a rock show? Your limitations are budget and size. ENG? Again budget, but postproduction and speed are the criteria. Marantz seems to be taking it pretty seriously, but it has owned the reporters' market with cassettes for decades. All it has done [with its current solid-state media recorders] is upgraded that reliable concept, made it solid-state and good sounding."

Creative musicians are using portable stereo recorders to sample environmental and ambient sounds for use in their compositions and productions, and there's no simpler way to record band rehearsals or gigs than to set up a stereo mic and a pocket-sized recorder. While professional on-location productions are recorded multi-track today, small-budget local or noncommercial broadcast projects are often recorded straight to stereo, generally using a fairly "professional" quality recorder.

In the studio, it's not uncommon to find one or more two-track recorders for mixdown, backup and clients who want to take home a cassette for reference.

Categorizing the two-track recorder

With today's multitude of products, you can almost always find the right tool for the job, but what's the best choice? A tight budget usually dictates digital recording due to the minimal media cost, but there are several digital media options, as well as different levels of what we, with some reservation, call "professional features." Sometimes size matters, and that's another category. User interface is important and some of today's digital recorders can get pretty complex. Let's take a look at some of these issues in terms of what's available.

Flash memory media recorders

Flash memory recorders are all the rage, and for good reasons. Eliminating moving parts such as a tape transport or disk drive greatly increases the potential for reliability and ruggedness as well as

reducing size, weight and cost. But while a flash memory recorder can be remarkably inexpensive, the cost of the removable memory cards that most of these devices eat for lunch is still high enough so that media management must be considered in the project budget.



Fostex FR-2

A \$100 4 GB (gigabyte) Compact Flash card can hold an impressive 70 hours of audio at 64 kbps MP3 compression (rough speech quality), 14 hours at 320 kbps (good cassette quality), 6.5 hours at 16-bit/44.1 kHz uncompressed PCM (CD standard) or barely an hour at 24-bit/192 kHz. While even major broadcast networks today seem to accept the tizzy or phasey sound for news reporting that results from aggressive data compression, you really don't want to record your music masters in that mode.

The usual working mode with a flash memory recorder is to own a card large enough for your gig, transfer the recording to another medium as soon as you get back to home base, then re-use the card on the next project. With the concept of preserving (at least as long as the project is active) the first-generation recording gone out the window, we now rely on the "perfect digital copy" as our master.

It's interesting to note that there is no specialized storage system for flash memory cards, and there's barely enough clear space on the card's surface to write any identification data, so you really need to do something with the data as soon as possible after the session. Most flash memory recorders provide a USB or IEEE 1394 (FireWire) port for data transfer between the memory and a computer, although slipping the card into a reader attached to the computer is common because most models have removable memory cards.

The top shelf (\$3,000+) for professional flash memory field recorders includes the Nagra Ares and the Sound Devices 7 series. The Nagra Ares-C, a broadcast-oriented recorder, uses MPEG-2 data compression but no PCM uncompressed format. The Nagra Ares-BB+ records PCM with MPEG compression optional. Sound Devices answered the demand for a lower-cost version of their 722 hard-disk field recorder by leaving out the disk drive and offering the flash-

only 702. While the Sound Devices 702 utilizes common Compact Flash memory cards, the Nagra recorders use PCMCIA form factor memory cards. Both are available in SMPTE time code versions for working with film and video projects and both have XLR mic inputs with 48 V phantom power.

The Tascam HD-P2 and Fostex FR-2 (\$1,000 range) are typical mid-range professional flash memory field recorders. Both use the Compact Flash card format (presently available up to 8 GB) and record at all standard sample rates up to 192 kHz at 16 and 24-bit resolution, but offer no MP3 compressed formats. Both have XLR mic inputs with 48 V phantom power and are SMPTE timecode-capable.

In addition to its Compact Flash memory slot, the FR-2 accommodates a PCMCIA form factor hard disk. The hard disk alternative was a good idea when the recorder was first introduced and gigabyte-sized flash memory was barely on the horizon. But today, solid-state memory has left the PCMCIA disk in the dust.

The Sony PCM-D1 is far too nice to be considered a consumer model, but it lacks some features that are important for certain professional applications. For many situations, its built-in X-Y con-

denser microphone pair will suffice, but should you want to use external mics or a line level input from a mixer, you'll be dealing with unbalanced inputs on stereo mini phone jacks, and no phantom power. The PCM-D1 has 4 GB of flash memory built in, and accommodates a Sony Memory Stick Pro for additional memory. Recording is PCM-only, 16- or 24-bit, up to 96 kHz sample rate. The Nagra Ares-M is similar in concept — a one-hand quick recording solution, incorporating a microphone (an external tie-tack external mic also is supplied) and internal 1 GB memory for uncompressed 16-bit recording up to 48 kHz or MP3 compression up to 384 kbps.

The Marantz PMD670 and 671 are the 21st century replacements for the PMD200 series cassette recorders so popular with broadcast journalists through the 1990s. The 670 records 16 bits up to 48 kHz plus several levels of MP3 compression while the 671 extends resolution to 24-bit and sample rates up to 96 kHz. The 660 is a new small-budget family member in a smaller case. All models feature phantom powered XLR mic inputs and the classic cassette recorder controls.

The sub-\$500 M-Audio MicroTrack 24/96 and Edirol R-1 and R-09 straddle that wide fence between professional

See RECORDERS, page 35 ▶

Tech Updates



Inside

STATION/STUDIO SERVICES

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TECH UPDATES

PMD560 Records Directly to Compact Flash

Marantz Professional says its PMD560 is intended to replace media such as cassette decks and MiniDisc recorders in the broadcast studio. The solid-state recorder mounts into a 1 RU space and records audio directly to a Compact Flash card. It records uncompressed 16-bit PCM WAV files at 44.1 kHz or 48 kHz, mono MP3 files at 64 kbps and stereo MP3 files at 128 kbps.

Three programmable presets allow configuration of the recording format. The PMD560 can be configured to record mono or stereo in uncompressed and MP3 formats.

RS-232 is provided for machine control and automation. Editing and playlist creation can be done from the front panel. Additionally, the unit features a USB connector on the front panel to facilitate transfer of sound files to the PC.

The Virtual Track mode lets users make their edits and playlists directly on the PMD560. It allows the creation of up to 99 virtual tracks or internal playlists of audio segments without altering the original file or using more card memory.

The PMD560 retails for \$799.

For more information, contact D&M Professional in Illinois at (630) 741-0330 or visit www.d-mpro.com.



Numark MP102 Designed for Mobile DJs

Numark's MP102 rackmount MP3 CD player is suitable for mobile DJs, and plays standard CD audio and MP3 CDs. It provides buffered Anti-Shock memory protection, and includes looping, pitch



control with a pitch bend wheel, and stereo RCA and digital outputs among its features. Additionally, it has balanced outputs and an EQ section.

A large backlit LCD includes a text display for identifying song names, BPM counters and other pertinent information. The MP102 also offers +8/-16 percent pitch bend capability via its pitch bend/jog wheel. For programming music sets, it supports continuous playback and also is track sequence programmable.

The locating and identifying of tracks is eased by the unit's support for folders and ID3 tags.

The suggested retail price for the MP102 is \$399.

For more information, contact Numark in Rhode Island at (401) 658-3131 or visit www.numark.com.



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"Our Logitek installation included a Mosaic digital console in the WFLS studio. It was amazingly simple to install and all of our jocks loved it right away."

"Logitek's customer support is impeccable—it's the best customer support we have had from any company, bar none."

Chris Wilk
Engineer, WFLS
Fredericksburg, Virginia

MasterLink Features CD24 Technology, Editing Tools

The Alesis MasterLink ML-9600 is an integrated standalone system that combines hard-disk recording, digital signal processing, audio editing and compact disc creation/playback. The company



says it provides an affordable, all-inclusive solution for high-resolution mix-down, mastering and CD burning. It supports formats such as 16-bit, 44.1 kHz (standard Red Book format) to 24-bit, 96 kHz. The 4.3 GB hard drive stores up to five hours of digital audio.

MasterLink features CD24 technology, which allows users to record and play CDs with up to 24-bit, 96 kHz resolution using readily available CD-R media.

The unit's editing, mastering and finishing tools enable the setting of start and end points for each track, and let users apply real-time DSP functions such as compression, equalization, limiting and normalization. Additionally, users have control over song order, track gain, fades and fade-outs, and can compile 16 playlists with up to 99 songs each.


For more information, contact Alesis Corp. in California at (800) 5-ALESIS (525-3747) or visit www.alesis.com.

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Logitek
Console Router Systems

Recorders

► Continued from page 33

and consumer, built like mass-market consumer products while finding their way into some professional applications. Both are barely hand-sized with the corresponding pluses and minuses (fly-weight, limited battery life, cramped controls, miniature connectors to the outside world) but both are capable of making good quality recordings. Radio stations are starting to use these as replacements for MiniDisc field interview recorders, and both are popular among musicians for recording live shows.

While most of the flash memory action is in the portable area, the Marantz PMD560 and 570 are rack-mount units designed for installed sound and broadcast production rooms. These are the kind of units you'd look to as a replacement for a cassette deck when assembling or updating a rack for a theater or house of worship installation. Both can be controlled through an RS-232 port for programmed playback of prerecorded announcements, or for remote control.

Now that CD-R drives for computers cost less than twenty bucks, there isn't a lot of call for a dedicated CD recorder, but there are still some standalone CD recorders on the market.

Another player in the market is AEQ's PAW-120 handheld digital field recorder, which offers microphone cells and optional external stereo microphones, in addition to a speaker and 512 MB of flash memory. The Palm Audio Workstation lets the user record, playback and cut Musicam, BWF and WAV formats, and also can connect to a PC via USB interface to upload or download audio files. The 512 MB memory holds roughly nine hours of voice recording at 128 kbps of MPEG 1 Layer II in mono in FM quality, and about five hours of music recording at 256 kbps of MPEG 1 Layer II in stereo in FM quality.

I have to cheat a bit here (it's mono, hence not two-track), but the HHB FlashMic is just too cool not to include in a Flash memory recorder survey. It's a whole recorder built into the body of a Sennheiser omni mic — no cables, and up to eight hours of recording time on a pair of AA batteries. The internal (fixed) 1 GB flash memory provides up to three hours of 16-bit PCM recording, or extended recording times with MPEG compression. There are a lot of settings and a small built-in display, but once set up, recording is as simple as pressing a button. A 10-second prerecord buffer lets you catch those phrases when you're a bit slow on the button. There's a headphone jack for playback, and a USB port for data transfer.

Hard-disk recorders

For field recording, hard disks have almost completely been replaced by flash memory, but at the fully professional level, hard-disk recorders are still

alive. King of the currently available portable hard-disk two-track recorders is the Sound Devices 722, cousin of the 702 flash card recorder. The 722 records 16- or 24-bit PCM up to 192 kHz sample rate or MP3 compressed formats to either an internal 40 GB disk drive, Compact Flash memory or both. Either medium can be used to back up the other. Mic (XLR, phantom powered), line and AES/EBU inputs are provided.

Hand-sized units from Creative Labs, Archos and iRiver, while primarily designed for playback of MP3 files loaded from a computer, offered decent recording quality. These have almost entirely disappeared from the current marketplace but second-hand units are readily available. With 20 GB to 60 GB of disk space, there's plenty of recording time for a weekend gig without having to worry about when you'll run out of media. Mic preamps on these devices range from blah to barely functional, so it's best to feed them a line-level signal from an outboard preamp or mixer. The mini I/O jacks, a consequence of small size and low cost, are worrisome, but recording quality is surprisingly good. An open source development group to create completely new firmware for

several of these "Jukebox" recorders has sprung up. If you're into eBay-diving, check out the Rockbox Project at www.rockbox.org for models that can be upgraded.

The Alesis MasterLink ML-9600, still in production after seven years, is a dedicated tabletop hard-disk recorder with a built-in CD drive. Initially conceived as a studio mixdown recorder, the MasterLink records from line-level analog or AES/EBU digital inputs to its internal 40 GB hard disk at 16 or 24 bits, up to 96 kHz sample rate. A playlist from recordings can be assembled directly on the MasterLink, and it will create a Red Book CD, applying sample rate and word length conversion if required. While most of this work is routinely done on a computer today, the MasterLink is still a solid performer and a no-haywire solution for mixdown, backup or remote two-track recording.

CD and DVD recorders

Not too many years ago, Yamaha introduced the first standalone CD recorder for about \$20,000. Now that CD-R drives for computers cost less than twenty bucks, there isn't a lot of call for a dedicated CD recorder, but they still have some applications, and there are still some standalone CD recorders on the market.

Whether the gig is a remote music recording or a conference lecture, it's convenient to be able to hand the customer a CD immediately, with no intermediate steps. The market for dedicated CD recorders cooled off for a while, but

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DRM85

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Power comes from standard AA batteries and the included FlashMic Manager software makes it easy for individual users or news organizations to configure single or multiple FlashMics for particular applications and file naming protocols.

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www.flashmic.info



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Recorders

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there's a new interest with the growing practice of offering CDs of a show for sale while the band is signing autographs and packing up. Inexpensive multibay CD duplicators require a CD as a master, and there's no quicker way to make one than to record it directly. The Tascam CD RW402 and Marantz DN-C550R are both dual-transport models equipped with one recording and one playback transport, which can function as a duplicator as well as a recorder. Both companies offer several models of single-transport CD recorders optimized for various applications and budgets.

The Marantz CDR300 is the CD version of the company's venerable portable cassette recorder line. About the size and weight of a pack of printer paper, the CDR300 features direct recording to CD-R from mic (XLR, phantom powered) or line inputs. For lecture or conference recording, the CDR300 offers a handy mode that generates a track index each minute. The CDR420, similar in I/O and form factor to the CDR200, records either MP3 or 16-bit 44.1 kHz PCM to a 20 GB hard disk, from which one can burn a CD on its internal drive. Like the MasterLink, rudimentary editing is offered, so it's handy for field production.

The Tascam DV-RA1000 is the first, and so far only, standalone two-track DVD recorder. The DV-RA1000 offers a range of recording modes from CD up through 24-bit 196 kHz PCM on DVD, as well as DSD. In addition to making high-resolution stereo recordings, it's a good tool for delivering DSD masters for SACD audio replication.

MiniDisc

Sony introduced the MiniDisc over 10 years ago, intending to replace the consumer grade "Walkman" portable cassette recorder/player. The original design used a proprietary perceptual encoding data reduction technique known as ATRAC that offered 60 minutes of stereo recording on a tiny magneto-optical disk. The format became popular among those recording live shows and the MD started to creep into the broadcast industry for field work.

Over the years ATRAC compression has improved both in efficiency and perceived sound quality, resulting in wider acceptance for music applications. In 2004, Sony introduced the Hi-MD format, using a 1 GB disc to record 90 minutes of 16-bit, 44.1 kHz uncompressed PCM audio as well as up to 34 hours using ATRAC3plus data reduction. A Hi MD recorder also can reformat a standard MiniDisc to double its capacity.

The new Sony MZ-M200 Hi-MD recorder is aimed squarely at the professional market. While its tiny size precludes pro-style I/O connections, Sony has taken the user interface a step above other MD recorders currently on the market, providing larger and better spaced controls for us fumble-fingered users, and an uncluttered visual display with excellent record level metering. While



Tascam CD-RW402

it's still necessary to navigate through menus for setup, one-button recording is a snap. The MZ-M200 is supplied with a remote control and a T-style stereo mic that can be plugged directly into the recorder or used like a tie-tack with the provided accessory extension cable.

For the production room or installed sound applications, Tascam's rack-mount MD-350 standard MiniDisc recorder provides flexible interfacing, track editing and cueing.

While most MD recorders are equipped with a USB port, the original intent was to provide a way to load music from the computer to a disk. For many years, copying an original MD recording from recorder to computer was prohibited by special file transfer software, making the use of the MD recorder inconvenient in the production environment. This restriction has gone away with the current HiMD implementation.

There are far too many MD recorders to list here, but the fountainhead for information, models available and user reviews is the MiniDisc Community web page www.minidisc.org.

Compact cassette

This is the format we love to hate. There are so many reasons for it not to work very well — low speed, narrow tracks, minimal guiding — but the bottom line is that the cassette format is still alive and kicking, blank media is still in production, and with care and good equipment, recordings can sound quite good. The compact cassette format is about as bulletproof as it gets, and someone new to field recording, with just a little training, can always bring back a usable recording.

The Marantz PMD222 deserves mention even though it's mono, being the last of the professional-oriented portable cassette recorders that were the workhorses of field broadcast journalists for many years.

While out of production for several years, many good board tapes have been made with Sony's WM-D6 pocket-sized stereo cassette recorder and the company's larger but seriously professional-oriented TC-D5.

The rack-mount Tascam 112 MkII has been a workhorse standard in production rooms and studios, with the 102 being a lighter-duty lower-cost model. Tascam 202 MkIII and 322 are dual-transport cassette decks for copying or continuous recording. Marantz offers the DRM-555P, a single-transport rugged rack-mount cassette deck suitable for studio or installed sound use, as well as three dual-transport cassette decks differing mostly in control functions. The DRW-585 offers automatic bias adjustment, the PMD-505 offers variable pitch and wireless remote control (wired remote optional), and the DN-780R offers RS-232 remote control

and redundant recording to both decks simultaneously.

DAT

Like the cassette, Digital Audio Tape started out as a consumer format but it was embraced early on by the professional community as a cost-effective primary digital recording and mixdown medium.

With the exception of the Tascam DA-45HR, which offered an optional 24-bit interleaved double-speed format, DAT was limited to 16-bit 44.1 or 48 kHz recording. There are no longer any DAT recorders being made, though many remain in service, primarily for playback and backup recording. To obtain a DAT recorder today, you'll have to haunt the used market. They're

inexpensive to purchase but expensive (and sometimes impossible) to repair, so don't expect a long life, and be prepared to buy another one when yours dies. Major manufacturers were Sony, Tascam, Panasonic and Fostex, and they're all about equal in quality and functionality. Be aware, though, that Panasonic's implementation of the AES/EBU and S/PDIF digital inputs requires proper selection of DIP switches to get it working correctly. Get a manual.

Of particular note are the Sony TCD-D10, HHB PortaDAT and Tascam DA-PI portable DAT recorders, all solid performers offering professional I/O and battery operation. Sony offered several DATs in the Walkman series that were popular for (often stealth) concert recording.

Hybrids (some accessorizing needed)

The Core Sound PDAudio System is an S/PDIF input-only interface that plugs into the Compact Flash slot of a PDA. With the appropriate software and external A/D converter, the PDA can become a portable recorder capable of up to 24-bit 192 kHz operation. Recordings are stored on a CF memory card in the PDA's second card slot. As a companion to the PDAudio card, Core Sound offers the Mic2496 mic preamp with A/D converter, or you can use your own favorite.

The iKey Plus from Gemini (the DJ people) is a bridge between analog audio and a USB mass storage device. Connect it to a USB disk drive, an iPod or even a USB memory stick and you've got a PCM or MP3 recorder. This is new and evolving, but it's a pretty cool idea.

The good ol' days

In this digital age, people still crave "that warm analog sound" and are finding that there's nothing like tape to produce it.

Otari, a longtime supplier of analog recorders for studio and broadcast applications, has discontinued most of its analog product line, but the industry workhorse 1/4-inch two-track MX-5050BIII is still available. Tascam, another long-time recorder manufacturer for both the professional and project studio, just recently discontinued manufacture of its last stereo analog recorder, the BR-20, but there are still some new ones to be had. Although it's been many years since an analog tape recorder has been manufactured in the U.S., dumpster divers and eBay hunters can find great bargains in old-but-not-dead-yet, fully professional AG-440 and 350 models from Ampex and the JH-110 from MCI. Many are ready to roll while others need some work, or head refurbishment. They're large and heavy (beware of shipping costs if you're not buying local) but



Sony MZ-M200

they're glorious.

ATR Service specializes in complete overhaul of Ampex recorders, making them better than new with custom heads, custom electronics and precision mechanical parts and alignment. Its refurbished ATR-102 recorders are revered mastering machines. ATR Service owner Mike Spitz has so much faith in the future of analog recording as a professional medium that he's begun manufacturing a high-performance recording tape and teaches regularly scheduled analog recorder alignment seminars.

"The audio palette is so much greater with an analog recorder than with digital," said Spitz. "There's no one 'analog' sound, but you can get whatever sound you're after if you learn how to use and adjust your recorder."

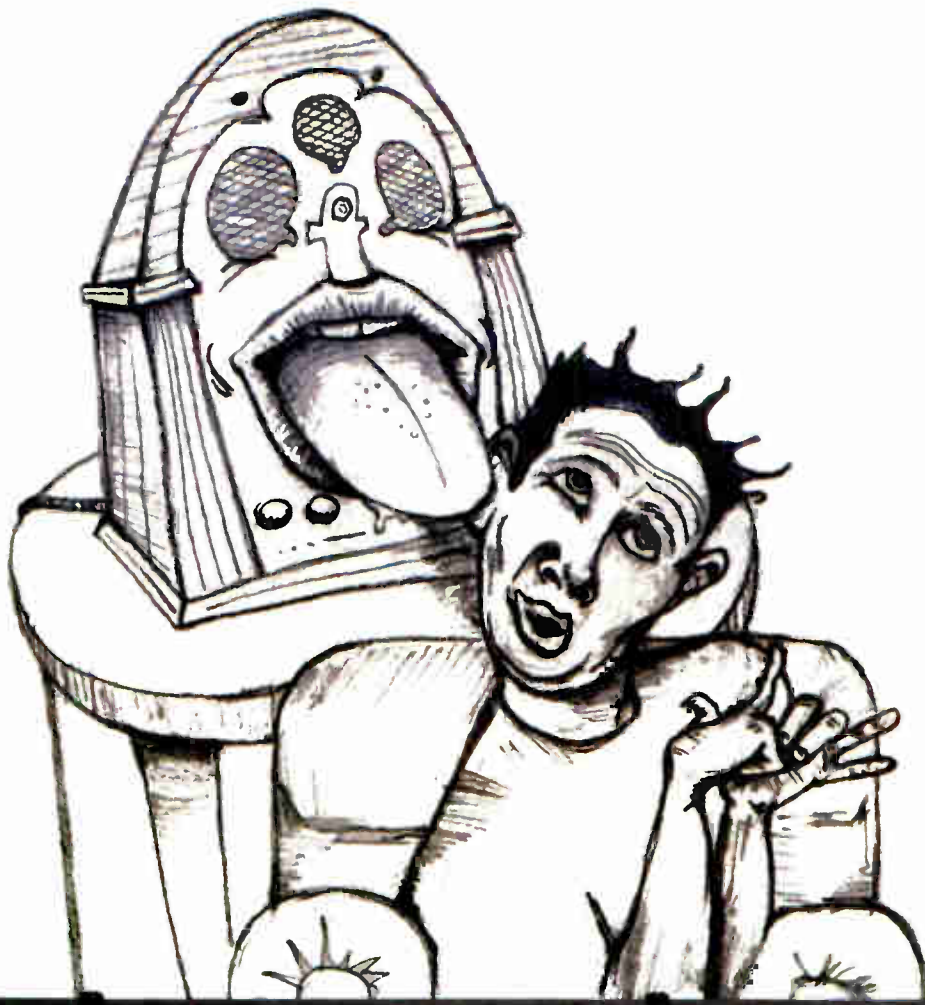
John French, proprietor of JRF Magnetic Sciences and frequent collaborator with Spitz, is the go-to guy for analog tape head refurbishment. A professional-grade recorder, built for many years of hard service, can almost always be put into first-class shape for just a few hundred dollars. And many a home studio experimenter is digging grandfather's Sony out of the attic and using it much in the same way as an effect processor.

In a universe where it's rare for audio to leave the computer in anything but finished "master" form, recording direct-to-stereo is becoming less common. But it's a quick setup, there are no hours of tweaking the mix and it's a challenge to get it right the first time. Try it. You might like it.

Mike Rivers has worked in and around audio and electronic engineering for over 40 years. 🌐

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TECH UPDATES

FlashMic Lets Journalists Interview On the Fly

HBB says its FlashMic DRM85 digital recording microphone is suitable for voice recording applications, in particular broadcast and press interviews. The unit combines a Sennheiser omnidirectional condenser capsule with 1 GB of flash recording memory, and uses no cables or connectors.

Either WAV linear or MPEG 1 Layer 2 encoded files can be transferred at up to 90 x real time via USB to Macintosh or PC computers and laptops for editing and onward transmission. A Date/Time stamp is stored along with the file, with the internal real-time clock set/synchronized by the host computer.

The FlashMic is powered for more than six hours by a pair of AA batteries, with the remaining battery power displayed along with time, level and status information in a backlit LCD on the microphone body. Additionally, a visual low battery warning alerts the user to the imminent need to change batteries.

Users can operate the FlashMic out of the box using default settings, or create and store nine custom configurations using the supplied FlashMic Manager software. Parameters include Audio Mode (six settings with a maximum record time of more than 18 hours), AGC on/off, Record Level, Pre-Record Buffer (0-10 seconds) and High-Pass Filter on/off, and can be individually adjusted.

Expert Mode allows variable parameters to be accessed directly from the FlashMic body.

FlashMic operates at 48 kHz/16-bit, which the company says enables quality recordings. Recordings can be played back under independent level control on headphones connected via a socket on the base of the unit.

For more information, contact HBB's distributor Sennheiser USA in Connecticut at (860) 434-9190 or visit www.sennheiserusa.com.



Portable, Quiet Event Is Suitable for Studio

Rain Recording released the Event digital media workstation, a portable media center with record, playback, edit, burn and transport functionality. Hardware includes an Intel Core Duo 1.83 GHz processor and a 100 GB internal SATA hard drive. The addition of a USB or FireWire sound card enables the production of professional audio projects.

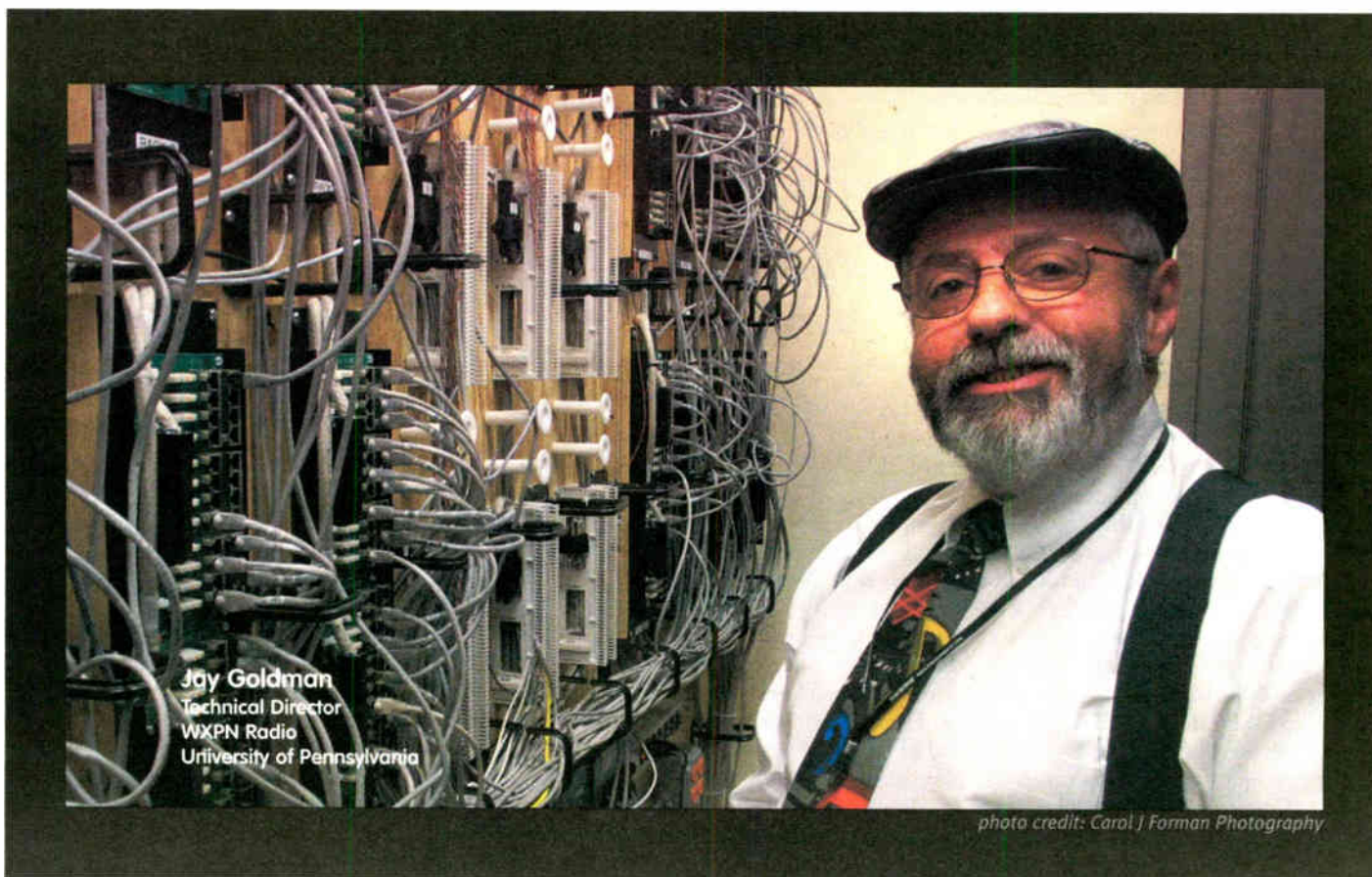
The company says Event's small footprint makes it suitable for use in a broadcast studio, and its quiet operation allows broadcasters to place it within three feet of a broadcast microphone without concern of computer noise leaking into the mic.

The company says being able to place Event within arm's length of engineers and DJs offers peace of mind to broadcasters, as it can be costly to cable and maintain a computer in a distant remote location, in addition to problems such as keeping the system cool or having to go back and forth to install software.

Other highlights include the ability to load and play sound bite WAV files; and the ability to create audio sequences via the included SONAR LE multitrack audio production software. Users also can create and play back MIDI controlled samples via a MIDI controller by way of software like Tascam's GigaStudio.

Event retails for \$1,595.

For more information, contact Rain Recording in New Jersey at (877) MIX RAIN (649-7246) or visit www.rainrecording.com.



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TECH UPDATES

Zaxcom Deva V Adds Variable Folder Sizes

Zaxcom added features to its Deva V hard-disk recorder including playback from the internal DVD-RAM drive, and variable folder sizes on the hard drive, which allows users to have a smaller folder if they have a shorter recording segment.

The Deva V is suitable for 24-bit, 10-track 192 kHz location recording, and offers direct-to-hard-disk recording with backup to DVD. It simultaneously records to multiple disks, which allows users to record all disk copies required by post at the same time as the original recordings.

Features include a 16-channel digital audio mixer, 10-second pre-record buffer, sample rate conversion and surround recording.

The Deva system lets users keep recorded audio on the set, allowing production to immediately reference previous recordings. The company points out that disputes with post regarding recording issues can be quickly cleared up and extra copies of recorded audio can be produced in the case of lost, damaged or stolen material.

For more information, contact Zaxcom in New Jersey at (973) 835-5000 or visit www.zaxcom.com.



Gemini CDT-05 Turntable Plays CDs, Vinyl

Gemini's CDT-05 hybrid turntable combines turntable functionality with the ability to play both CDs and vinyl. Additionally, the company says it plays CDs with the control of a full-size direct drive platter.

The CDT-05 features a skip-resistant straight tone-arm system and a CPU-controlled high-torque direct drive motor, which drives the unit's aluminum platter. A Mix mode allows users to simultaneously play CDs and vinyl records.

In both analog and digital modes, DJs have variable pitch control, with selectable ranges of 4, 8, 16 or 50 percent, along with pitch bend and master tempo functionality. Three DSP effects — Filter, Zoom and Echo — with variable parameter and a forward/reverse switch can be accessed in either mode.

The company says that during CD playback, the CDT-05 affords three hot starts, frame-accurate cue and seamless loop for digital flexibility. The motor can be disengaged for DJs who prefer CD decks with a passive, non-motor driven platter.

The CDT-05 also provides MP3 CD support and features independent outputs for the CD and turntable.

It retails for \$1,179.

For more information, contact Gemini in New Jersey at (732) 738-9003 or visit www.geminiidj.com.



Henry Adds InGenius to Matchbox, Match Plus

Henry Engineering has added THAT Corp.'s InGenius servo-balanced input stage to its USB Matchbox and USB Match Plus USB-to-XLR interface units, which are used in place of a PC soundcard.

The company says THAT Corp.'s InGenius servo-differential input amplifiers enhance the products by providing CMRR noise rejection performance that is equivalent to that of a transformer. This ensures that common-mode hum or noise does not affect recordings made with the USB Matchbox or USB Match Plus.

The units are suitable for use where the analog inputs are fed from a long cable run, such as a broadcast facility, as CMRR performance is not affected by the balance or symmetry of the source. CMRR performance remains constant over a wide frequency range and under cases of asymmetry, such as an accidental ground.

The USB Matchbox and USB Match Plus also offer Burr-Brown ADC/DAC audio performance. The analog filter design yields a transient response without the harshness the company says is typical of inexpensive sound cards.

The USB Matchbox is a basic unit; the USB Match Plus adds level metering and a reference-grade headphone amplifier for critical monitoring. Both units are USB-powered. The new versions are identified with the InGenius logo on the front panel.

For more information, contact Henry Engineering in California at (626) 355-3656 or visit www.henryeng.com.



USB MatchPlus

Tascam CD-RW901 Has Balanced XLR, Wired Remote

Tascam's CD-RW901 professional CD recorder has the features of its predecessor, the CD-RW900, and adds XLR balanced analog I/O and a wired

remote. Additionally, it features AES/EBU digital I/O, RS-232 serial control and a timed track increment, selectable from one to 10 minutes, for adding CD track ID markers during recording.

The balanced XLR and unbalanced RCA ins and outs have dedicated input level controls for instant changes. Digital inputs (AES/EBU and S/PDIF) are equipped with automatic sample rate conversion for compatibility with most signals. The CD-RW901 also plays back MP3 files with ID3 titles.

Pitch control is standard, and allows up to +/- 16 percent control over playback. The Key Original function changes the playback speed without affecting the pitch. The PS/2 keyboard input offers the ability to name tracks using CD text, and gives the user one-key access to frequently accessed menu functions.

Additional highlights include 2 RU design, Trim function, fade in/fade out and Power-on Play, which starts CD playback when power is applied for installed applications.

The CD-RW901 retails for \$1,125.

For more information, contact Tascam in California at (323) 726-0303 or visit www.tascam.com.



Sound Devices Expands 7-Series With 702, 702T

Sound Devices added two models to its 7-Series line of portable digital recorders, the 702 and 702T. The two-channel recorders share the chassis design of the 722 and 744T digital recorders, and are Compact Flash-only recorders.

The 702 is a file-based device that records and plays back audio to removable Compact Flash cards, which the company says eases field recording. It writes and reads uncompressed PCM audio at 16 or 24 bits with sampling rates between 32 kHz and 192 kHz. Compressed (MP3) audio playback also is supported.

The 702 implements an audio path that includes Sound Devices' next-generation microphone preamplifiers, which the company says are designed for high bandwidth and high bit rate digital recording.

Features include AES3 (XLR) or AES3id (unbalanced AES on BNC) digital inputs and AES3id outputs; programmable, sunlight-viewable LED level metering; and FireWire (IEEE-1394) port for high-speed computer access to the Compact Flash card.

The 702T recorder offers Time Code, which the company says is suitable for dual-system video or film production applications.

The 702 and 702T are available and have a suggested retail price of \$2,175 and \$2,650 respectively.

For more information, contact Sound Devices in Wisconsin at (608) 524-0625 or visit www.sounddevices.com.



WE GIVE YOU BISSET

<p>Name: John Bisset</p> <p>Occupation: Northeast regional sales manager for Broadcast Electronics</p> <p>Experience: Four decades in the industry. SBE Certification; presenter of NAB Transmitter Workshop; speaker at numerous conventions; contributor to NAB Radio Handbook</p> <p>Mentors: Lamar Newcomb, Ray Gill, Steve Dana, John Cunningham, Charlie Wright, John Mullaney Sr. and Jr., Mitch Montgomery, Morgan Burrow, Jim Weitzman, Alan Pendleton, Morris Blum, Milford Smith, Tom Giglio, Scott Beeler.</p> <p>Favorite memories: Early days of AM improvement; demonstrating the Splatter Monitor to the FCC with fellow Delta employee Tom Wright; development of Workbench into RW's most popular feature.</p> <p>Quote to live by: "Few things are more persistent and intimidating than our fears and our worries ... especially when we face them in our own strength." — Swindoll</p>	
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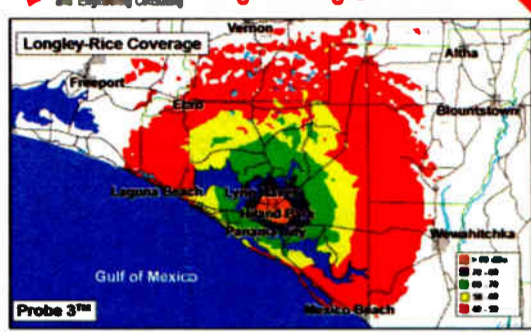
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◆ READER'S FORUM ◆

You Can't Have Just One

Thanks to all of you for helping me find the beautiful Collins 20V transmitter that now calls Urbana, Ohio home.

RW was nice enough to list my "want" recently (*Reader's Forum*, July 19), where Tom Scherer, W2KBW, saw the ad. Tom quickly contacted me, and we set up the sale for the end of July. Paul

Courson, WA3VJB, also helped me understand history of the Collins 20V.

My sons William, KC8KEE; Kenny, KD8DIW; and I drove up to see Tom, W2KBW, on Sunday, July 30. We spent the evening shooting the breeze and going through the tuning procedures for the 20V.

On Monday morning, we started removing doors, tubes and iron.

Tom removed a few doors, and we rolled the transmitter out and loaded it into the back of our truck.

After a very warm trip back to Urbana — the truck air conditioner went out on the way up to see Tom — the transmitter is safely in the back of my garage waiting for its trip into the basement radio room.

To top it off, my wife Karen, AA7PJ, loves the classic look of the new transmitter.

Thanks again, and please keep me in mind if you know of other BC transmitters needing a home. I think they're like potato chips; you can't have just one! We really mean that.

Ken Moak, WA2JQW/8
Urbana, Ohio



Ken Moak and Tom Scherer: Bonding Over a Collins 20V

promoted to a position managing a program authorized by the governor of the state.

Now I am retired from the state and help out a nonprofit radio station. No one sees me, but I still wear a tie almost every day. Even the guy at the convenience store treats me better.

William E. Bauer, Ph.D.

Program Director

KRNG(FM)/Renegade Radio 101.3

Wadsworth, Nev.

Naming Names

I worked at the first station George Marti built, KCLE(AM) in Cleburne, Texas ('Milestone' Archives, RW Online). There, I used prototype Marti units for several years before they were on the market. Marti just built up a few because he needed them. Then he realized that most everybody needed them, so he sold the station and built more Marti units. Way more!

Consumer Report

Where are all the HD Radio converter boxes to convert all home products and factory-installed car radios? I hope [Ibiquity] doesn't expect people to go out and buy new radios. That is a total waste of money to discard top-of-the-line analog receivers that people spent thousands of dollars on.

Domenic Gentile
Everett, Mass.

The Marti unit was a wonderful invention.

— Ed Craig

Dress the Part

I spent 14 years in radio as a DJ and then acquired an education ("Manager or Janitor? You Decide!," Aug. 2). I worked out of radio then, but carried with me several radio mindsets: 1) it does not matter how I dress; 2) my performance is unrelated to my eventual termination.

One day my supervisor told me to take my bicycle out of my office. I was upset and prayed about it. The answer was that I should "wear a tie." So I put a tie on and wore it for the next 23 years.

The results were measurable. The bicycle was not mentioned again, I received an outstanding evaluation within a month and within a year I was

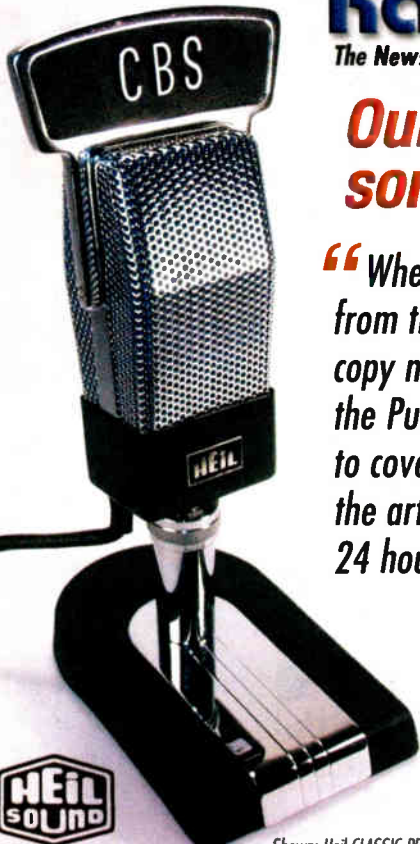
The strangest remote I ever did on a Marti unit was a beer-drinking contest at the Colony in Lafayette, La. We learned the downside of the Marti there; you can just walk into a place, plug it in and be on the air with no planning, no formalities and no permission from the boss. I guess it was Bill Besson, Skip Broussard, Tom Fowler, Sandy Kaplan and yours truly who got in *big* trouble that night. I haven't heard those names in a while.

For normal, responsible adults, however, the Marti unit was a wonderful invention.

I guess Marti is 85 this year. I still see him at the grocery store, now and again. And he's still doing just fine.

Thanks for remembering him.

Ed Craig
Fort Worth, Texas



Radio World
The Newspaper for Radio Managers and Engineers

Our readers have something to say

"When you deal with everything from transmitters, studios and the copy machine, to the PC LAN and the Public File, Radio World seems to cover it all. I'm still waiting for the article on how to get more than 24 hours out of the day though!"

Allan A. Augustyn
Director of Network Engineering
Radio Results Network
Escanaba, Mich.

Shown: Heil CLASSIC PRO offers a retro look of the '40s with the dynamic sound of today.

GUEST COMMENTARY

IBOC Has Been a Mistake

With The System in Wide Use, Its Shortcomings Are Becoming Apparent to More And More Broadcasters

by Jack Hannold

If you doubt that IBOC is in trouble, consider the defensive responses my commentary ("Has Anyone Thought This Through?" in the April 20 issue) elicited from some RW readers.

"Jack Hannold's thesis," wrote John Byrns (*Reader's Forum*, July 19), "is that the FCC made a mistake in its choice of an FM stereo system in the early 1960s, that 'the AM stereo mess of the 1980s' was a similar mistake, and that this process is repeating yet again in the case of IBOC."

No, those were my supporting premises. My "thesis," stated in the very last sentence, was that "when technologies compete, economic and political considerations can trump technical ones at the FCC."

Just the facts

Byrns continued, "If the author's muddled facts with respect to the FM stereo system choice are any indication, then it is hard to accept his conclusions with respect to AM stereo in the 1980s and IBOC today. A few of these muddled facts, and the truth, follow."

I'm grateful to Mr. Byrns for boldly stating his motive for attacking the Crosby FM stereo system, which hasn't been used in this country, even experimentally, for decades. But unfortunately, it was Mr. Byrns who muddled the facts.

Like the Zenith pilot tone system, Crosby provided L+R mono-compatible audio and an L-R subcarrier. But instead of a noisy AM (actually DSB) subcarrier, Crosby used a *wideband FM* subcarrier, providing a better signal-to-noise (S/N) ratio in stereo from all but the weakest RF signals.

FM is not entirely free of noise. While AM has a *rectangular* noise spectrum, with the amplitude of random noise in the demodulated signal constant across the audio spectrum, FM has a *triangular* noise spectrum, with the amplitude of noise increasing with frequency, i.e., it rises at a rate of 6 dB per octave, or 20 dB per decade.

Thus at 4 kHz, the noise level is 20 dB higher than at 400 Hz, and at 40 kHz it is 40 dB higher. So the L-R subcarrier, whether DSB or FM, is accompanied by a high level of noise.

FM uses *pre-emphasis* to overcome high frequency noise. Sounds above 2 kHz are boosted 6 dB per octave at the transmitter by a pre-emphasis circuit. A complementary *de-emphasis* in receivers rolls off treble response at the same rate, restoring highs to their proper level and simultaneously reducing high-frequency noise. But it only works in mono, because the DSB subcarrier is not boosted by pre-emphasis, and is thus subject to AM noise when the main carrier signal is weak.

But an FM subcarrier, like the main carrier, benefits from *limiting* (the elimination of AM noise imposed by interference), as long as its amplitude — which remains constant in FM — is slightly above the peak amplitude of the noise within the subcarrier channel, yielding a much better stereo S/N than Zenith on all

but the weakest of weak signals.

Mr. Byrns' argument that the Crosby system suffered distortion "caused by ... filtering off some of the FM subcarrier's sidebands ... in order to fit [it] into the space available ... on the main carrier" is nonsense. In theory, FM sidebands extend to infinity; but beyond a certain point — a point determined by the modulation index — sideband components are so small (and so insignificant) that eliminating them causes no audible distortion.

This isn't the first time industry people have uncritically embraced a questionable new technology. Many broadcasters — and many in consumer electronics, too — were eager to adopt CBS Labs' FMX system back in the 1980s.

As long as the modulation level is compatible with the intended receiver, there's no audible distortion. If filtering out components of such minuscule amplitude created audible distortion, all FM receivers would suffer degraded fidelity just from having enough selectivity to reject adjacent-channel interference.

And would the leading component makers of 1961 — Fisher, H.H. Scott, Harman-Kardon, Marantz, McIntosh, Dynaco, Heath, et al. — have supported an FM system with *more* distortion than Zenith, even with a better stereo S/N? Of course not.

As for mono S/N, both Mr. Byrns and Hal Kneller (*Reader's Forum*, July 19) took some pains to point out that because the only real limit on main carrier modulation is that for the L+R audio and the L-R DSB *combined*, L+R can reach 90 percent modulation. Yes, but that's mono!

L+R modulation over 60 percent can only be achieved on material with relatively little separation; and making every recording fit that mold (by arbitrarily blending those that don't into near mono) entails a big sacrifice in stereo imaging for little gain in mono S/N.

Adjacent-channel interference

Ted Schober (*Reader's Forum*, Aug. 2), who calls me his "neighbor" though I live 15 miles away, took me to task for not knowing what's available here.

"Jack did not realize," he wrote, "that the very IBOC technology he decries provided him with not one, but two excellent [Philadelphia] classical music stations, WHYY-HD2 and WRTI-HD2."

But in fact, I listen almost exclusively to public radio. So though I don't own an "HD" radio (and don't plan to buy one), I've been hearing WHYY tout HD2 (via analog) for months. But I haven't heard any such announcements on WRTI, and its Web site says nothing about HD2.

And for that matter, Ibiqity's Web site lists WRTI's HD2 format as T.B.D. Is that "To be decided"? Could Mr. Schober be wrong about WRTI?

He certainly was wrong about adjacent-channel interference:

"Some of [Hannold's] other points about interference are well taken," he says. "Wilmington's WSTW(FM) 93.7 is a grandfathered short-spaced station which caused a lot of interference to [Philadelphia's] WMMR(FM) 93.3 and WYSP(FM) 94.1 in the days of tube FM radios that had poor adjacent-channel selectivity. The interference from WSTW's IBOC is certainly no worse than the main channel signal caused in 1958." [Emphasis added.]

I beg to differ. In 1961, my first FM tuner was a three-tube Granco with a sin-

gle IF stage. While the Granco sounded good on strong local stations, its selectivity was terrible, even by 1961 standards. Nevertheless, I could always get either WIP(FM) 93.3 or WDEL(FM) 93.7 without any problem, because their field strength was nearly equal at my house, and the Granco's capture ratio was fair.

WIBG(FM) 94.1, operating well below full Class B power in those days in order to protect a co-channel station in Sunbury, Pa., was another matter; but I *could* get WIBG on the Granco after WDEL signed off at midnight — or any time on a radio with at least two IFs.

So it's disingenuous of my "neighbor" Ted to suggest that the nominal 250 kHz gap between two second-adjacent analog stations presented the same kind of difficulty for a tube receiver — even a cheap one — that the 2 kHz gap between the IBOC signals of the same two stations poses to a digital receiver.

Interested parties

I don't know John Byrns' profession, but Ted Schober is a consulting engineer who installs IBOC, and Hal Kneller is manager of public radio initiatives for Harris. They're hardly disinterested parties. They really believe IBOC is the next big thing, and they want to be in on it.

And of course, there'll be big money in patent royalties, not only from broadcasters but also from consumer receivers, if IBOC becomes dominant. So the gloves are off.

But this isn't the first time so many industry people have uncritically embraced a questionable new technology. Many broadcasters — and many in consumer electronics, too — were eager to adopt CBS Labs' FMX system back in the 1980s.

FMX used a second DSB subcarrier with a highly compressed difference signal. The DSBs were in quadrature, like the I and Q chroma signals in color television. And like those color TV subcarriers, the FMX signals suffered unacceptable levels of crosstalk whenever the

main carrier was subject to severe multipath conditions.

While the L+R audio on FM is still effectively wideband FM at half the mono modulation level (deviation ratio: 2.25), the L-R subcarrier is effectively narrowband FM (effective deviation ratio of 0.637). But unlike TV, radio finds much of its audience in cars, where multipath is a major problem.

I thought I was alone in seeing potential problems until Amar Bose published a study documenting the problems with FMX, and both the broadcast and electronics industries rapidly lost interest. Dr. Bose is now 77 and retired from MIT, and perhaps that's why he hasn't looked into IBOC. (Or perhaps he has, as there are still no IBOC receivers on the Bose Web site.)

But maybe a Bose study isn't necessary. With the system in wide use, its shortcomings are becoming apparent to more and more broadcasters, and not just small-market people who have been criticizing it all along.

Consider the letter to Radio World from Robert Conrad (*Reader's Forum*, July 19), the president of Cleveland's classical WCLV(FM) and Seaway Productions, who complained that IBOC audio quality is not what was promised, and that signal coverage is terrible. I admire his courage. Most people in his position would be embarrassed to say that after having put so much of their money — and, in some cases, their prestige — behind this junk technology.

As Mr. Conrad said, broadcasters' efforts to promote IBOC "will only disappoint, and perhaps antagonize, a significant segment of the audience who find that the system doesn't deliver."

Let's hope the industry as a whole will recognize that IBOC has been a mistake, and that it does so soon enough that it will be only the larger broadcasters — and, I'm afraid, all too many financially strapped public broadcasters — who will have invested prematurely, and unwisely, in this ill-conceived technology.

Jack Hannold is a freelance writer and former broadcaster. Reach him at jackhannold@yahoo.com.

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GUEST COMMENTARY

Say Goodbye to Ancient Modulation

by Ira A. Wilner

As a broadcast engineer who has been involved with both FM and AM IBOC in the field, I feel compelled to add my voice to the ruckus about HD Radio.

HD-R for AM is both different and the same as HD-R for FM. Let me explain.

Shared characteristics

As a concept for public consumption, high-definition radio (buzzword: "digital") is an important tool that says radio has renewed itself, that it is current and it is keeping up with the profound changes brought about by the digital revolution. If we, the broadcast industry, do not get behind it unanimously, it will indeed go the way of AM stereo.

And if this happens, we will certainly be left behind in the background noise of all the digital media on and off the Internet.

The television industry recognized that it must push ahead with HDTV with a little shove from Congress. We aren't that lucky (or unlucky) and thus have to be self-motivated.

Newness is an inescapable product promotional marketing tool and a needed boost for the radio industry today. AM — ancient modulation — probably requires it more than FM.

Different characteristics

HD Radio brings three striking performance enhancements to AM radio:

1) Audio bandwidth can approach CD quality, providing strikingly more realistic sound with greater definition than is normally encountered with today's analog AM receivers;

2) All noise associated with AM reception is eliminated. There is no ignition noise or AC power line buzz;

3) HD-R gives AM the same visual content of FM RDS plus the HD-R extensions, such as the ability to display messages on the radio dial.

In addition, especially noticeable in an acoustically dry automotive environment, AM HD-R can deliver stereo sound with lush ambience. And unlike the Motorola and Kahn analog AM stereo systems, it does so without noise.

It is time to rethink what the AM broadcast band should be rather than what it has been. Forget about skywave propagation. It is time to consider AM as a local service like FM. It is time to experiment with anti-skywave antenna systems. With the proliferation of always-on gadgets that generate hash in the AM band, analog reception — even in the city-grade service contour — is noisy.

The digital genie comprising thousands of microprocessor gadgets is out of the bottle, as is its noise fog. Nothing will put it back in. The only way the AM band can fight back is with fulltime digital modulation.

We should not be overly concerned about digital hash from IBOC. Hash already is a fact of life on the AM band. If we redefine AM as a local radio service that can continue to be received at night in the immediate vicinity of its city-grade ground wave, the digital carrier noise issue becomes less problematic.

HD Radio brings two striking performance enhancements to FM radio: it eliminates multi-path distortion while permitting full stereo separation; and it permits the broadcasting of additional new program offerings on the existing RF channel.

FM HD-R permits better stereo separation, and thus image lushness, in an automotive environment in outlying parts of the city-grade contour where most mobile receivers have already partially blended to monaural. Furthermore, it doesn't share the 20 dB audio noise floor penalty caused by the 38 kHz amplitude modulated stereo separation (L-R) audio subcarrier of the Zenith FM multiplex system.

Multicasting is self-explanatory. It is, in my opinion, the killer application for FM broadcasters. It gives new, free choices to the listening public, assuming we are willing to produce new and innovative programming content.

Because the Ibiquity standard supports AM and FM equally regarding all-mode AM/FM reception, we need to go forward and equip both bands with HD Radio transmitters. And we need to pressure the FCC into allowing full-time IBOC on AM. But to do so we need to view AM as a local service and concentrate on groundwave reception, including the development of anti-skywave antennas.

Should Satellite Radio Merge?

XM and Sirius have spent a lot on operations and programming even while moving back the target dates by which they expect to break even. Now, both are experiencing a painful trifecta of new circumstances as they enter their fifth and fourth years in service, respectively:

- ✓ The FM modulator probe by the FCC has cost both companies time to market for some products and added expense for redesigns;
- ✓ New subscribers aren't coming on as fast as they had been, while more automakers now plan to add iPod adapters to their vehicles;
- ✓ Automakers that install satellite radios are having a tough time selling new vehicles.

Wall Street analysts are asking whether the companies will ever be in the black. Some investors want a quick fix — like a merger.

A merger might make good business sense for shareholders; but it wouldn't serve the public interest. With a monopoly in pay radio, there would be no competition for hardware or subscription prices.

Consider what competition has wrought. Both spent billions of dollars to get themselves up and running, building studios, launching satellites and subsidizing receiver development. Sirius in particular spent a nail-biter of a first operational year, with satellites in space but no radios in the stores.

They've paid millions for high-priced talent to produce original programming. They offer programming that is interesting and well presented. Much of what's on satellite is good radio.

Sirius and XM are also using their spectrum for other businesses, such as real-time traffic and weather services, and both are developing the ability to deliver video.

So competition with each other has pushed innovation, to the benefit of consumers. Traditional radio, in turn, has been forced to adapt to the presence of satellite. That's good. But a single pay radio service would enjoy unfair competitive advantage against traditional broadcasters.

Also, XM and Sirius paid for spectrum, but the FCC still regulates how it's used; in exchange for approving a merger, the commission might decide one of those two chunks of S-band spectrum needs to be returned for re-auction.

In the consumer electronics world, satellite radio is now an established product category. This means radio prices will continue to drop at retail and the cost to make products are dropping as well. Lower prices usually means more sales, but the satcasters would receive less per radio as they get a percentage of each product sold.

Satellite has a finite window to reach more subscribers and cut costs before investors demand changes. The fourth-quarter selling season is crunch time and this may give merger discussions a boost.

But this trial balloon deserves to be shot down. The public, and the broadcasters who compete with these new satellite services, deserve that.

— RW

The era of DX'ing has come to an end now that the entire world is wired for the Internet. We no longer require the ionosphere to provide an over the horizon path.

For FM, we have to think new content, free content; and invest in our audience by providing them with more choices such as HD-R multicasting.

Ira Wilner has been a freelance broadcast engineer in New England for 30 years. He is employed by Saga Communications.

Correction

The phone number for Omnirax in the Sept. 1 user report "Omnirax on Tour With Westwood One" was incorrect. The company can be reached at (800) 332-3393.

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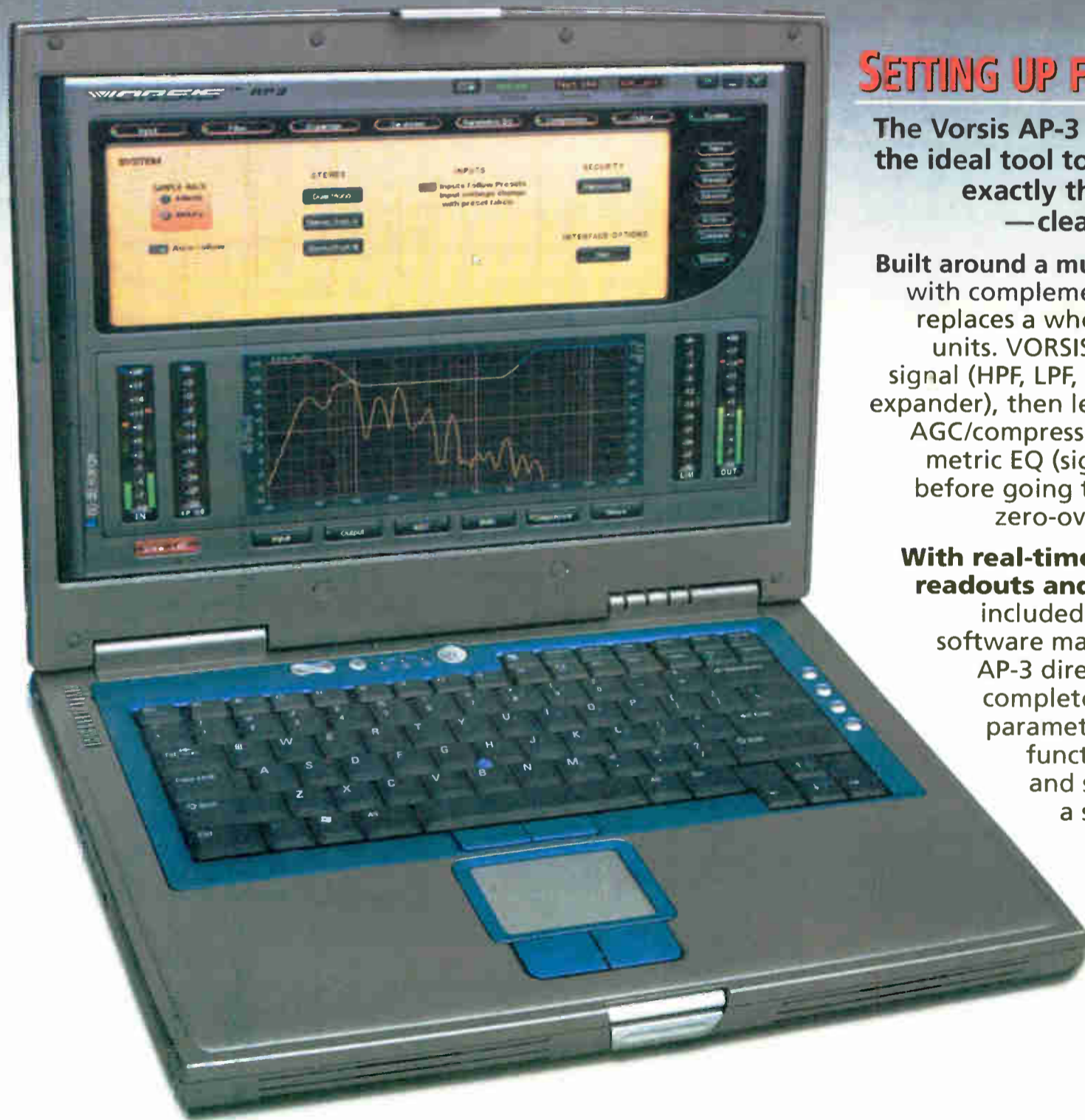
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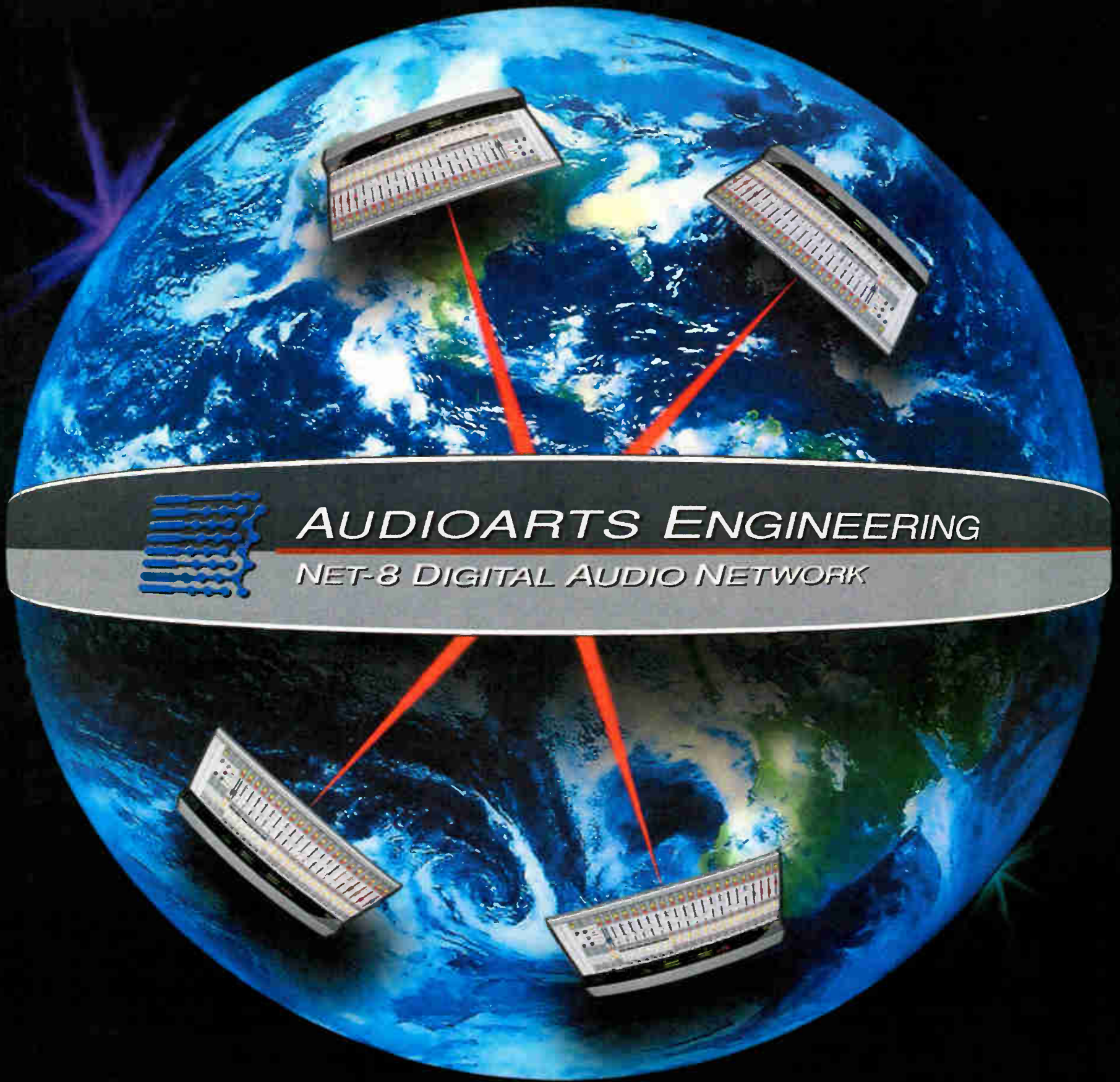
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