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INSIDE

WHCP: ONE YEAR LATER

• Station is living up to its mission: "We Help Cambridge Prosper" — Page 8



HAVE FUN WITH YOUR NEWS

• Thought-provoking online puzzle game mixes up NPR audio — Page 14

Courtesy Gregor Hochmuth

USER REPORT

• We continue our Consoles, Mixers & Routers Buyer's Guide with the Arrakis MARC-15-15 — Page 22

Upper and lower Yosemite Falls in California's Yosemite National Park.



"Put It in Park" This Summer

The 100th anniversary of the National Park Service offers radio some great opportunities to connect with listeners.

page 20

NPS/Dannon Joyce

Cumulus Technical Team Adapts

New leader Trautmann preaches collaborative decision-making and "highest and best use"

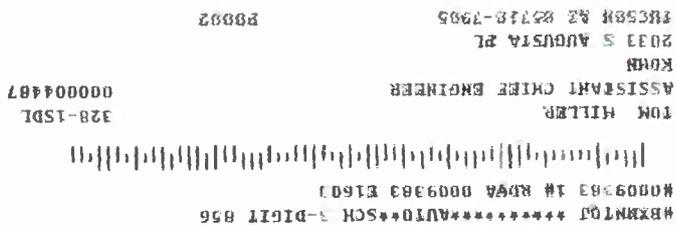
team is Conrad Trautmann. New CEO Mary Berner is tasked with turning around the financial picture at the company, which is approximately \$2.5 billion in debt. Her moves have included many executive level changes in sales and programming; and her effort to consolidate technology services at Cumulus is viewed by some as ambitious.

Cumulus, which operates 454 AM and FM radio stations in 90 markets across the United States, also owns radio network Westwood One and manufac- (continued on page 6)

NEWSMAKER

BY RANDY J. STINE

A reorganization earlier this year among the top technical positions at Cumulus, the second-largest U.S. radio group, unified broadcast engineering and information technology under the same umbrella. Leading that technical



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Radio World Founded by Stevan B. Dana

Radio World (ISSN: 0274-8541) is published bi-weekly with additional issues in February, April, June, August, October and December by NewBay Media, LLC, 28 East 28th Street, 12th Floor, New York, NY 10016. Phone: (703) 852-4600, Fax: (703) 852-4582. Periodicals postage rates are paid at New York, NY 10079 and additional mailing offices. POSTMASTER: Send address changes to Radio World, P.O. Box 282, Lowell, MA 01853.

For custom reprints & eprints please contact our reprints coordinator at Wright's Media: 877-652-5295 or NewBay@wrightsmedia.com

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NEWSROUNDUP

EAS: The next nationwide test is coming in September, and in late June, the Federal Communications Commission formally launched its new EAS Test Reporting System. EAS participants have until Aug. 26 to access ETRS and complete Form One. Start at www.fcc.gov/general/eas-test-reporting-system.

OWNERSHIP: U.S. commercial broadcasters were disappointed that FCC Chairman Tom Wheeler isn't proposing bigger changes in ownership rules. Wheeler would retain many restrictions despite calls from various quarters to relax rules to reflect the modern marketplace. His item is part of a review process that the FCC is supposed to con-



Chairman Tom Wheeler as seen on an FCC web page.

duct every four years but that is now years overdue. The National Association of Broadcasters said Wheeler "continues to ignore the will of both the courts and Congress by proposing to retain broadcast ownership rules that long ago outlived their usefulness." It questioned why the FCC would bar common ownership of two TV stations or broadcast/newspaper combinations in a local market while "mammoth mergers" like those of AT&T/DirecTV and Charter/Time Warner Cable are pushed through.

DATA: Chevrolet slashed the rates for its 4G LTE in-car cellular service in half, according to CNET's "Roadshow." It said 1 GB of in-car data each month drops to \$10, while 10 GB per month falls to \$40. Users of the annual plan now will get 20 GB for \$150.

PATENTS: Radio broadcasters are likely to keep a wary (and weary) eye on patent infringement lawsuits filed against iHeartMedia and Spotify that appear to target their audio playback networks and systems, including podcasting services. Post Media Systems is plaintiff and is demanding a jury trial and damages. Court documents show the

lawsuits assert infringement of three patents that list Alan Bartholomew of SoniClear as inventor. The back story in court paperwork indicates that Bartholomew started a software development business that led to the patents. Read more at radioworld.com/patent.

DRONES: Commercial unmanned aerial systems operators will soon be able to take to the air with the Federal Aviation Administration's blessing; the administration finalized the first operational rules for routine commercial use of small UAS. Part 107, which will go into effect in August, offers safety regulations for UAS weighing less than 55 pounds that are conducting non-hobbyist operations. Read a summary at www.faa.gov/uas/media/Part_107_Summary.pdf.



PUBLIC FILE: You can comment by July 22 to the FCC about its plan to eliminate a rule that commercial broadcast stations keep copies of the public's letters and emails in public inspection files. Reply comments are due Aug. 22 on MB Docket No. 16-161. Broadcasters support the change, saying it will reduce security risks and ease their paperwork burdens. Combined with separate initiatives by the FCC to move the entire public file process to an online database, these changes portend a day when stations will no longer need to open their doors to anyone demanding to look at a physical public file.



in Congress to help. The commissioner said pirate stations steal listeners and weaken the health of licensed stations. Some critics, he said, have argued that pirates wouldn't exist if legal stations were meeting the needs of listeners; but such arguments do not address the fundamental problem that their mere existence violates the law and commission rules, O'Rielly said. He hopes Congress will help with increased fines and penalties, easing the process to seize equipment and pursuing those who support pirates.

AHOY: Commissioner Michael O'Rielly is continuing to keep the issue of illegal operators in front of the industry. Speaking to the New Jersey Broadcasters Association, he expressed his "hopeful" sense that legislation may soon be introduced

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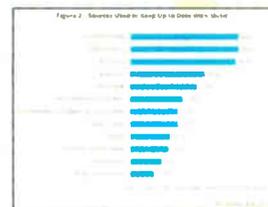
"Multilingual Emergency Broadcasting: What Went Wrong?" — A provocative commentary/Q&A with MMTC's David Honig. "History is not going to look favorably on this ruling. Twenty years from now, we will be scratching our heads in amazement." Read it at radioworld.com/multilingual



"Maxson on Tracking Interference From New Quarters" — At the spring show, an NAB engineering session looked at two modes of interference in the FM broadcast band, one from a persnickety well-known source, the other from a new quarter altogether. This story was a follow-up to one we reported in our convention previews. See radioworld.com/maxson

"BIA/Kelsey: Local Radio Stations Remain Relevant" —

One in a series delving into the recently released report "The Position of Local Radio Stations: Trends for 2016 & Beyond." Despite new competition for ad dollars, radio's ability to deliver local audiences to national and local advertisers allows it to remain an important part of the local media marketplace, BIA/Kelsey found. See radioworld.com/relevant.



KCRW Puts Virtual Reality to Work

This technology is not just about those big funny goggles anymore



KCRW VR team, from left, Rob LaFond, Alex Pieros, Joey Caroni and Sean Dellorco with the KCRW Cardboard VR viewer

BY TOM VERNON

Virtual reality got its start in 1965, when computer graphics pioneer Ivan Sutherland wrote about “a room in which the computer can control the existence of matter.” Think the Holodeck on “Star Trek.”

Work began in earnest in the early 1990s, although the results were far removed from the environment that Sutherland envisioned. VR usually involved people wearing hoods with motion sensors along with surround video and sound. Sometimes there were gloves for tactile feedback.

After the novelty wore off, VR just faded from public view. But development didn't stop, and today VR is making a comeback. Gaming and technology companies such as Sony and HTC are embracing the trend, as is Facebook, which recently purchased VR startup Oculus, in part to build virtual reality versions of its apps.

CES 2016 this winter featured more than 40 exhibitors, expanding VR's footprint by 77 percent over last year, according to an event press release. Projected sales of virtual reality headsets are expected to increase by 500 percent in 2016, with 1.2 million units sold. Revenue is estimated at \$540 million. A VR summit with industry leaders was held at the NAB Show in April.

This may be the year that virtual reality becomes mainstream.

FREE VR APP

There's nothing like sitting in on a recording session to get an intimate glimpse of musicians at work. They always make it look so easy. But that privilege is usually reserved for a select few.

KCRW, a public broadcaster affiliated with Santa Monica College in

California, wants to give this experience to everyone. The station recently released a free virtual reality mobile app that will make performances in its legendary basement studio freely available.

Radio World talked with KCRW President Jennifer Ferro and Director of Digital Media Joey Caroni about what was involved in bringing this technology to the KCRW community, and where it is going in the future.

The VR service makes available select live music performances from “Morning Becomes Eclectic,” a three-hour adult album alternative program that airs weekdays on KCRW. The launch includes VR videos from Death Cab for Cutie, Brandi Carlile, Thundercat and Purity Ring. To experience the VR broadcasts, listeners must download the free app in the iOS and Android stores. For a full

Video Producer Rob LaFond prepares the VR camera for a live session.



stereoscopic 3D experience, users can purchase an optional KCRW Cardboard Viewer that works with their smartphone for a \$5 donation to KCRW. The performances are also available as 360-degree videos within the app and on the station's Facebook and YouTube channels.

While the VR project formally launched in January, it had been on KCRW's radar and in the planning stages for over a year. Caroni explains that when launching a new venture such as VR, timing is everything.

“We wanted to be an early adopter, but

FROM THE EDITOR



Virtual reality is firing up a new era of techno-fans; and radio people are finding a way to put the tool to use. Tom Vernon reports for Radio World.

— Paul McLane

who could help them make a successful debut. GoPro donated the eight HERO4 cameras. Local VR expert Lex Halaby volunteered his time to oversee the fabrication of the mount and modification of the cameras to accommodate wide-angle lenses.



The KCRW VR page

at the same time, didn't want to launch before we could produce two or three VR recording sessions on a monthly basis. Also, the level of interest needed to be high enough to justify the effort. Now the big players in digital media are on board, and smartphones have the processing capability to display VR properly. We felt that the experience wouldn't suffer because of the technology.”

Before the launch, KCRW was busy building partnerships with VR players

PUSHING NEW EXPERIENCES

The public media broadcaster was founded in 1945 as a facility to train servicemen about the emerging technology of FM broadcasting. A charter member of NPR in 1970, its programming is a mix of music, news and other spoken-word programming. It airs programs from NPR, Public Radio International, American Public Media and the BBC, along with music programs and live in-studio performances, as well as locally produced news and culture programs. In addition to its network of stations and translators, KCRW has three streams: a rebroadcast of the FM channel, a 24-hour music channel and a 24-hour news service.

KCRW's VR project is part of a larger movement in public media to give listeners and members new experiences, going far beyond the traditional role of providing jazz or classical music channels.

President Jennifer Ferro elaborated: “We view ourselves as a community of people. Part of our mission is to provide new experiences and open up new avenues to this community. It's a relationship that we constantly work on, keeping it fresh and a little bit surpris-

THIS ISSUE

JULY 20, 2016

NEWS

- Cumulus Technical Team Adapts 1
 News Roundup 3
 KCRW Puts Virtual Reality to Work 4
 Building Community Radio:
 a Case Study 8



FEATURES

- Keep Those Nasty Fluffies
 Outta Here 12
 Cut-and-Paste Challenges the
 Authority of News 14
 Insoft Seeks Visual Radio Success 18

GM JOURNAL

- Celebrate the Centennial 20



BUYER'S GUIDE

- KIOF Wins With Arrakis
 MARC-15-15 22

SUMMER OF PRODUCTS

- 23, 24, 26, 27

OPINION

- Reader's Forum 30

ing. We're always on the lookout for the types of experiences that make us a good partner to commit to."

In addition to the uplifting, spiritual dimension of providing experiences, it has a positive impact on membership and sponsorship. "Providing a good service to our community is part of our ecosystem, so sponsorship seems to follow. Can we see the positive impact? Yes. Can we precisely quantify it? No."

KCRW's foray into VR began with live music, but the station is confident that it will find other uses.

"VR is still a technology in search of applications," said Ferro. "Using it as a medium for storytelling seems to be a natural, and that might be our next step." Caroni added, "VR can be a vehicle to bring KCRW to entirely different audiences than those who tune in to radio. Possibly a younger audience, a more global audience."

From a technology perspective, he envisions expanding VR beyond producing videos of recording sessions. "I'd like to see us streaming live VR events. The technology is evolving quickly, but right now it's very limited as far as who can do it, and who can distribute it."

KCRW recently announced plans to capture its first full concert event in VR. "While live VR still isn't ready for primetime, we are thrilled to announce we will be recording our upcoming concert with Nas for our summer SoundInFocus concert series in full VR and 360 video."

Caroni said. "This video will be distributed on several different VR platforms reaching all VR headsets and platforms."

VR can also be used for archiving. As KCRW prepared to leave its old facility and move into a new building, Caroni wanted to save something from the past.

"I'd like to do a 360-degree walk-through of our basement studios. There's so much history and so many great performers that passed through that space. A VR guided tour is a way to preserve some of that."

VR journalism is also in its infancy, but that is an area the station is holding back on for now. "There are some issues with journalistic integrity," said Caroni. "VR recording on location is a rather elaborate setup, not something you can do on the fly. VR journalism segments can come across as canned or staged. We're going to wait and see how some of the big players in media handle this."

EDITOR'S TRICKS

Video production and post production of VR material have some unique challenges, Caroni said.

"We need to merge the video feeds from our eight cameras into one seamless 360-degree canvas. But the areas

NEWS



A laser-cut custom acrylic rig was fabricated to mount KCRW's eight GoPro digital cameras.

of overlap between cameras — the stitch line — can be iffy. We needed to identify where those stitch lines were in our basement studio, and mark the walls with tape. You don't want to end up with a performer's face on a stitch line. We try and have the bands set up in such a way that there's nothing going on near these zones."

Most of this work is done with image-stitching software applications. KCRW uses Kolor's Autopano. This type of software can create panoramas,

gigapixel images and 360-degree videos. Caroni adds that the software does some but not all of the work involved in stitching multiple videos together.

The VR project not only gives a new experience to KCRW's community, it is also an added incentive for bands to perform in the basement studios. "We've had estimates of around \$65,000 from contractors to produce VR mini concerts. We offer this added value to bands. Perform in our studios, and we'll shoot a

(continued on page 10)



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CUMULUS TECH

(continued from page 1)

turer Broadcast Software International.

Trautmann's promotion was part of a larger series of personnel changes within engineering and IT. Pete Stefanske was promoted to VP of information systems, while Marsha Reid Rhodes was upped to manager, telecom. Both report to Trautmann, who succeeded longtime SVP of Broadcast Engineering Gary Kline, who now has his own consultancy. Eric Wiler became SVP of technology and broadcast operations for Westwood One.

In an email to Cumulus employees explaining the changes, Berner wrote that Trautmann "is not only a tested leader but as an experienced collaborator and expert in his field, he is the ideal person to oversee the consolidation of these two functions. Conrad has a deep background in technology and broadcast engineering ..."

Trautmann becomes SVP of technology and operations after a long tenure at Westwood One. He most recently served as chief technology officer and SVP of technology and network operations at the network.

Some months into the Cumulus technology department overhaul, Radio World asked Trautmann about the transition process to date and challenges ahead.

Radio World: Describe the scope of what you oversee at Cumulus.

Conrad Trautmann: Broadcast engineering of the owned-and-operated stations as well as Westwood One. All of IT support, so the wide-area networks and desktops. Also software development for our internal software products for traffic and music scheduling. Telecommunications and capital budgeting. The operations part of my title includes a few things outside of technology, like real estate and leases. I also oversee the centralized traffic department based in Atlanta that schedules commercial logs for some of our smaller markets.

RW: How about Broadcast Software International?

Trautmann: Yes, all of our automation products are rolled in. So we have Westwood One's STORQ automation platform, and BSI's Op-X and Simian



Members of the Cumulus/Westwood One/BSI staff at the NAB Show. From left: Dallas Engineer Sam Michaels, Regional Director of Engineering Dave Supplee, Regional VP of Engineering Yancy McNair, Westwood One SVP Engineering and Operations Eric Wiler, BSI General Manager Marie Summers (front), SVP of Technology and Operations Conrad Trautmann, Regional VP of Engineering Martin Stabbert, VP Engineering Michael Gay and Regional Director Robert Combs (front).

automation products. We have tried to look at combinations of STORQ and the BSI products. Eric Wiler is overseeing all of that for us. He took over my job as head of the network's engineering and technology. So the folks at BSI report to Eric along with the team that supports STORQ. We are making more of an effort to consolidate some development and make the best use of people resources from a support point of view and development.

RW: What's the technical hierarchy at Westwood One now?

Trautmann: All of the network engineers and techs report to Eric Wiler. Eric reports to Charles Steinhauer, COO of Westwood One, with a dotted line to me. The technology department at the network has about 70 to 80 people.

RW: How about on the Cumulus broadcast side?

Trautmann: We have promoted Martin Stabbert, Yancy McNair and Michael Gay to be vice presidents of engineering. Martin and Yancy have oversight of the radio station group, and they kind of split the country in half. That's operations in 90 cities. Michael is VP of special projects. Other "direct reports" to me include Brian Hicks, director of real estate, Jason Hutchinson, vice president of information systems, and David Beckerman, VP of business systems and application development.

RW: Mary Berner has said you are the ideal person to oversee the consolidation of the two functions of broadcast engineering and IT at Cumulus. How is it going so far?

Trautmann: We have merged corporate IT for Cumulus and network IT for Westwood One. There was so much overlap in those two departments to begin with that it has gone very well. Both staffs are happy to be on the same team. The communication is much better now that they are getting consistent and coordinated direction. It's been very positive for us overall. Then the broad-

cast engineers on the owned-and-operated side, which really didn't interface at all with the network, are now being utilized for network events. We are actually having some of the guys at the stations help with network events, so we now have a much deeper talent pool to pull from. And finally, I have been able to pull together our regional team of engineers. I'm still looking for a couple but I'll end up with a total of eight.

RW: Are you a believer in centralized or decentralized decision-making?

Trautmann: I think the word for my management style is collaborative. I like to get everyone's buy-in on what we are trying to accomplish. I seek people's opinions, which results in having a bunch of smart people guiding projects. Mary Berner has often called the old Cumulus way "command and control," with "from the top down" thinking. We are being much more collaborative in our decision-making now.

RW: What is your impression of Cumulus' technical operations at the station level since you took over in February?

Trautmann: We have some incredible people working for us. I haven't been to many of our cities yet to access the tech-

nical plants. I have been to Chicago and Los Angeles. I'm letting our regional guys handle their markets. We are in good technical shape. Like any company in radio right now, it would be nice to throw more money at transmitters and such, but we have what we need right now to be on the air, and I think that is good.

RW: How has Berner's turnaround plan impacted technology implementation at Cumulus and are there some positives you can point to so far?

Trautmann: Clearly, Mary Berner is getting a ton of traction. From a company point of view, I think people are proud and happy to be working here. I'm not sure if that was the case before her arrival. We have created a capital plan for technical. We basically solicited the markets for their requests. We didn't say no to everything, but we have organized all of those requests into buckets of priorities. We often use the concept of highest and best use. We have prioritized the project requests [for] the highest and best use of our capital funds. The regional engineers and VPs all had a role in the process. We have had to defer some capital projects until next

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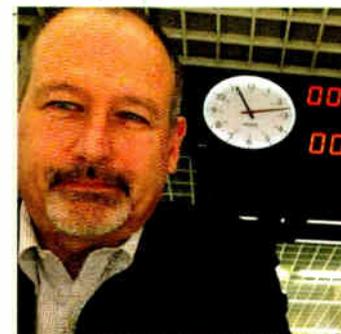
BACKGROUND

Conrad Trautmann, 52, has overseen a large number of special events and projects through his tech career.

He studied electrical, electronic and communications engineering technology at Farmingdale State University of New York, and was for six years also a machinist's mate in the U.S. Coast Guard. He began his work in broadcasting in the early 1980s as chief engineer at WEBE(FM) in Westport, Conn. He later worked as market director of engineering for Cox Radio's Long Island, N.Y., and Syracuse, N.Y., clusters.

A 15-year veteran of Westwood One, he spent much of his time at the network overseeing technical aspects of coverage for the Olympics, Grammy Awards and NCAA basketball.

Trautmann lives in Trumbull, Conn. He and his wife Dianne have two daughters.



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Building Community Radio: a Case Study

The five most important things we learned during WHCP(LP)'s first 365 days

LPFMRADIO

BY MIKE STARLING

The author is chief volunteer, WHCP(LP), Cambridge, Md..

Since WHCP's July 4 sign-on a year ago, we have been enjoying the thrills and chills of all start-ups. Each day we escalate community engagement, hone procedures, grow local programming and raise funds through underwriting and memberships.

The first 100 days witnessed inevitable shakedown tribulations and painfully long days; but since then we have been focused on quality forward momentum. Patience and persistence in achieving goals and creating a shared vision are paying dividends.

Lesson One — Start Earlier

The maxim "there are three ingredients to every big project: time, quality and money" is spot on. "Pick two" and the other one will have to give. Naturally, we didn't want to sacrifice quality or have surplus cash to throw at a healthy list of needs, so time had to give.

Even though we used 17 months of our 18-month CP we should have started in earnest sooner. I made that conscious choice. After commencing retirement I took six months to refurbish the barn out back (WHCP's studio during experimental operations), and to decompress from 45 years of 60-hour work weeks.

With a year to go on the CP, I focused seriously on a much bigger build-out than originally planned

thanks to innumerable donations from colleagues around the country. The station would not just be an iPod loop coming from the barn; those donations obligated us to build a full-service community station downtown.

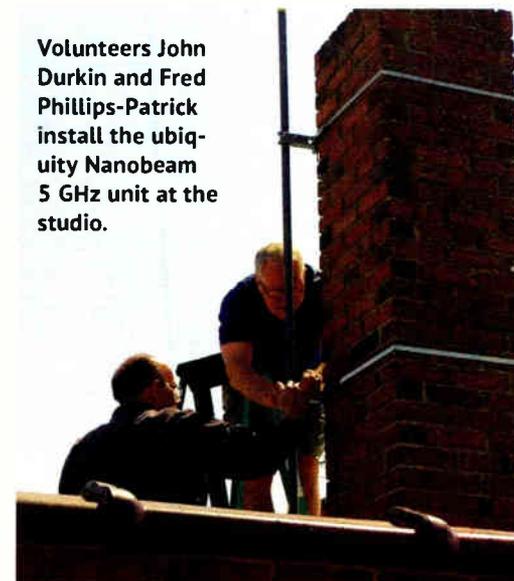
I was daily reworking wiring diagrams as more equipment arrived as donations or low-cost eBay or Amazon purchases — guided by user insights courtesy of the PubTech listserv. This was key to saving money and achieving good air quality.

Lesson Two — Beware the Software

A daily challenge is the number of software tools that have to be mastered by all-volunteer staffs quickly — and the seemingly infinite array of incompatibilities between applications and operating system versions. The vagaries of hardware differentiation and code-monkey-designed software with scant user testing can be a challenge.

Broadcast technology is the easy, and most reliable, part. Our Nautel VS300 transmitter has never had a hiccup. And the 30-year-old PR&E consoles from Wyoming Public Radio have been rock-solid. The \$200 Ubiquiti NanoBeam 5 GHz link has similarly been flawless and gets my vote as "best bang for the buck." Audacity has served admirably as the

Volunteers John Durkin and Fred Phillips-Patrick install the ubiquity NanoBeam 5 GHz unit at the studio.



free daily production tool, with amazing capabilities that we are still learning.

Too often, vexing behavior between applications and across the Windows universe has consumed precious time. Thus, all-volunteer stations need as many folks as possible conversant with different software tools — and that means youngsters, aka digital natives.

Lesson Three — Master Your Automation

Your automation system is your most important ally — and you *must* master it months in advance of going on-air. Although I read the TuneTracker manual, watched the training videos and

(continued on page 10)



Alyson Farnell is host of the "Awesome Aly Hour" and the station's first Chesapeake College intern.

CUMULUS TECH

(continued from page 6)

year, which isn't an unusual thing. We did communicate with everyone so they would at least know why a request was denied or delayed. This year's cap-ex took longer than we wanted because we were sorting out how to do it. I'm optimistic that if we can stay on track we will be in much better shape on our capital budgets and plans in the next few years.

RW: *Cumulus has announced pending agreements to sell AM tower sites in Los Angeles and Washington [KABC and WMAL] to raise cash. Do you expect to see more of that; and has Cumulus followed the trend of selling off FM towers?*

Trautmann: In both of those situations the dollars were compelling enough for us to do that. We are not actively out there trying

Conrad Trautmann relaxes with a Specialized Rockhopper mountain bike in upstate New York. As other interests, his LinkedIn profile lists "new technology, IP distribution, rally racing, automobiles and antique radios."

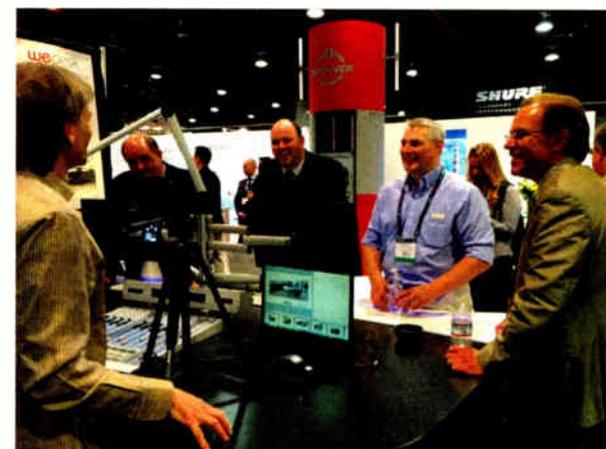
to sell properties. We had inquiries from outsiders interested in developing those properties. In those cases the radio stations are staying on the air. We are just moving them. As for FM towers, that has been discussed, but we are not actively pursuing that route. Mary Berner is more focused on using what we have more efficiently and not selling off assets.

RW: *What kind of cool technological projects are underway at Cumulus?*

Trautmann: We are building new network traffic software. A lot of other radio groups have done this. Hopefully we can integrate it with all of our radio station software. It will make the integration between the network and stations better. That's an IT and software development-type project. We are also planning to port our Westwood One STORQ systems over to the Wegener receiver platform. So instead of sending out a computer for a station that will be a STORQ station we can send them a Wegener receiver. We really are not focusing a ton on new development. We are more interested in making sure what we have works.

RW: *Are there any major studio projects to report?*

Trautmann: We are moving stations into the NBC Tower in Chicago. The studio build is expected to be done by early August. There are three FM and one AM stations making the move. And of course the Los Angeles KABC project will be another big one for us. They are moving into the Westwood One facility there. And WMAL(AM) in Washington is going to be



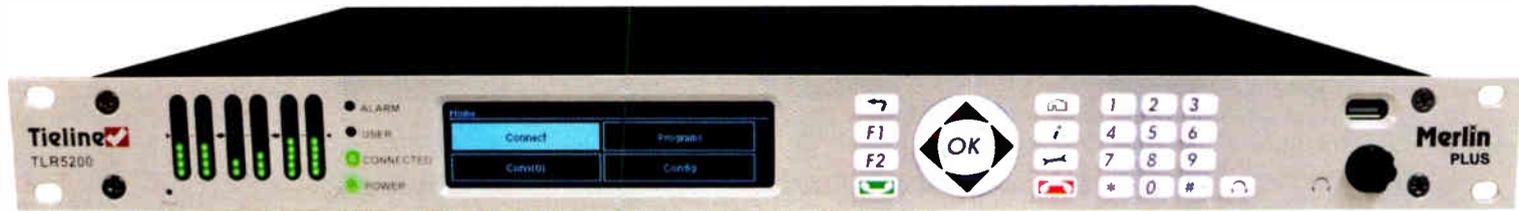
David Holland of exhibitor Omnirax chats at the spring show with, from left, Robert Combs, Yancy McNair, Michael Gay and Martin Stabbert of Cumulus.

diplexed into an existing array.

RW: *Where are you based and what's a typical day in the office like?*

Trautmann: I'm based in New York City. In fact, I haven't even changed offices. I'm still in the network building on West 42nd Street. I have a lot of back-to-back meetings to make sure projects are staying on track. I'm not traveling a whole lot. I meet with Mary Berner about twice per week. She is in Two Penn Plaza.

Six Remotes in every Box



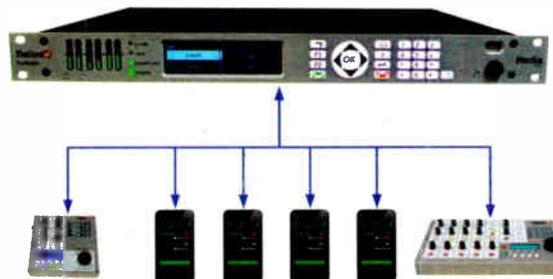
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WHCP

(continued from page 8)

cranked out logs and playfolder commands that should have worked fine, they didn't. It took four months to solve what was a subtle hardware incompatibility by moving off of our awesome quad-core server to a reasonably powerful dual-core desktop machine.

Once we moved to the new hardware, everything settled down and has been running quite smoothly. Due to the hardware incompatibility everything appeared normal, but reliability was nowhere to be found. Programs were skipped, programmers were upset and the "chief volunteer" was approaching burnout. We should have "shotgun substituted" to a different computer sooner.

We now have more than 80 unique format clocks across our 168-hour broadcast week. And each of them has dozens of commands whose syntax and pathnames have to be to be concise. Now, the only errors are when Tunetracker does exactly what we instructed it to do instead of what we meant.

You are running behind already if you have a CP and haven't been testing your air-product off-line.

WHCP bought a TuneTracker system, which some colleagues questioned as an unusual choice. Well, it may be less well-known, but I'm convinced it is unusually good on key points: elegance, price, integrated live features and a pleasing user interface (we stare at this baby scores of hours each week, so it matters). No kindergarten color schemes and mechanics.

Have laptop, will travel — Tunetracker offers a near-studio-quality remote system option called SignalCaster. We've done daylong remotes using just a laptop and the hotspot on my iPhone. Call in via Skype, log in via VNC Viewer and you are on the air in seconds with the full 40,000-song library at your fingertips and live-assist control over all broadcast elements.

Additionally, we are the only station in the market with automated, but human-voiced time and temperature constantly served up by the data from the local airport. TT also controls the Broadcast Tools switcher for live remotes (e.g., city council and "Live Mic" night). FTP provides hourly network news from Feature Story News for



Donations of equipment and services came from around the country.

only \$15 a month, and we take a number of high-quality FTP-delivered programs from PRSS's Content Depot, as well as using PRX (they both offer special incentives for LPFMs).

Lesson Four — Dollars First Means Community First

All successful organizations need a business plan. For radio that means purposefully planning integrated activities that build in underwriting support as you go. The three pillars for us are memberships, underwriters and donations.

Last year we issued a missing resource: the Cambridge Community Radio Calendar. Local award-winning photographers submitted their works and the result was a stunning "community debut." We gave the local retailers an incentive: Give us the \$12 collected for each calendar and we'll give you \$12 in underwriting during our first year on the air. This was a two-fer that helped us sign on with a nice fleet of underwriters. That

helped to get others joining the community radio movement. We have recently achieved "sold out" status at 27 underwriters, which keeps on-air acknowledgements to only 3 minutes per hour. All sponsors rotate across the schedule and we charge a mere "dollar a holler" for \$100/month. Dollars first means always saying Yes! to requests for coverage and publicity and local musician airplay. It's the time-proven formula for radio success: *community engagement*.

Lesson Five — Have Fun!

At any "all-volunteer" community radio, no one will continue to contribute if it's not fun.

It's fun to share a passion for great music. It's fun to ask interesting people about their work in the community. It's fun to help build community.

In fact WHCP's mission is "We Help Cambridge Prosper (WHCP)." Morning man Bruce Patrick came up with that while cutting lawns (his day-job that

subsidizes his role as a terrific morning DJ and PD). His enthusiasm and love for the community come through as strongly as his wacky sense of humor.

Contributing to community? That isn't really work, it is great fun — as well as a privilege.

NEXT UP

The County Board of Supervisors recently accepted our token bid for a 1,300-square-foot house on the main street not far from the high school that will provide the home for our Student Training Center and the MidShore Radio Reading Service. The building needs paint, a floor repair and lots of touch-up work (it's been vacant and on the tax delinquent rolls for many years). But we've already purchased five more BMX BIs on eBay that await uncrating. By fall, this important new addition to our community should be online.

Our first Youth Training Class with the local YMCA is scheduled for August and as I write, we have the first five high school interns signed up for summer. Already, WHCP's first Chesapeake College intern, Alyson Farnell, now produces our top ranked weekly local music show "The Awesome Aly Hour." We can't wait to hear what great radio these new youngsters will also bring to the airwaves on "101.5 FM, WHCP(LP) in Cambridge, M-D, A Great Place to Be!"

Read Mike Starling's past articles about building this low-power station at radioworld.com, keyword "WHCP."

Starling is former chief technology officer and vice president for engineering at NPR Labs and past chief engineer at KPBS(FM) in San Diego and WKYY(AM) in Amherst, Va.

VR

(continued from page 5)

VR video for free, and push it out for you."

With any new technology venture, there is an education component: explaining to the community what it is, how it works and why it's exciting. Some of that involves hosts talking it up and explaining it on air, as well as putting information out on social media. The station has also created a VR landing page on its website: kcrw.org/vr. There viewers can watch a VR case study video, sign up for email alerts to upcoming VR concerts and download the app.

Launching a new technology involves teamwork across many areas of the station. Ferro shares some thoughts on best practices. "Start small and experiment. Reach out to people in your community who are the pioneers. These folks usually are anxious to see and be part of a practical application of the technology. It's also an opportunity for brands and sponsors to learn along with you. Be as public about the process as possible.

"New ventures are inspiring to your staff and are opportunities for them to add new areas of expertise. It's important to include as many people as possible. The new skills they acquire will enhance their careers and help the station as



KCRW added fish-eye lenses to its custom Go-Pro's.

a whole."

Tom Vernon is a longtime Radio World contributor.

Tell us how your station is using VR and other new technology tools. Email radioworld@nbmedia.com.

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Keep Those Nasty Fluffies Outta Here

Here's a handy solution to keep summer fluff out of your air conditioner

WORKBENCH

by John Bisset

Read more Workbench articles online at radioworld.com

Rick Sewell is the engineering manager for Crawford Broadcasting's Chicago cluster. Each year, cottonwood trees fill the air with their cottony seeds. They fill the air conditioning coils at his sites, too.

Those sites include studio/office buildings and four transmitter locations — nearly 25 outdoor condensers to clean.

You may be familiar with self-contained Eubank air conditioning systems that are often seen hanging on the side of pre-fab buildings at cell sites. The coils of these Eubank systems are notorious for being difficult to clean.

Rick's Burnham site has five such systems in use at the transmitter and flywheel UPS buildings. The coils are hard to get at via hose cleaning. Worse, the site sits next to a swamp in a forest preserve. Not only does Rick have to worry about an onslaught of the cottonwood seeds, but water-loving weeds grow all around the site tall enough to hide Bigfoot; and the weeds just happen to bear flowers that end their own lives as air-blown seeds.

The result is an entire growing season of stuff in the coils of the AC units. Rick cleans the coils, but two weeks later they

look like they have been neglected for years. Cleaning becomes a regular summer time chore.

Playing with a fire hose every couple of weeks isn't the least pleasant task for an engineer, but Rick had had enough after two summers of dealing with this problem. He began to think there had to be a better way.

He decided to take a different approach. Rather than a new cleaning technique, he sought to keep the coils clean in the first place.

Rick knew that the Eubanks units have rather small openings on their side to allow air to flow

into the coils. As you can see in Fig. 1, there is not much of a filtering grate in place to stop anything but large items from getting into the coils.

Rick had planned to install some sort of pre-screen to catch all the fluffy stuff before it got into the coils. This would still allow air flow across the coils. He decided to purchase the materials to build his own screens and place them over the openings on the units' sides.

This project was going to involve building the screens and figuring out how to hold them in place. But it dawned on Rick that he knew of an existing product that would work perfectly. It was also inexpensive, which is always a plus.

The adjustable screens, shown in Fig. 2, would be perfect for the job. He just needed to find the right height that would translate to the width of the

(continued on page 14)



Fig. 1: Here's the Eubank air conditioner with air intake grate visible.



Fig. 2: This "pre-screen" is held in place with magnets. Seedling fluffies will be trapped.

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Cut-and-Paste Challenges the Authority of News

Online puzzle game cuts up NPR audio to a fun, thought-provoking effect

JUST FOR FUN

BY JAMES CARELESS

The following surreal content was never broadcast on National Public Radio, but can be heard online. “From NPR News in Washington, I’m Lakshmi Singh. The U.S. unemployment rate has spawned tornadoes in a volatile area of South Korea’s southern coast.”

The place where you can hear this garbled NPR content — and make up your own using snippets of real audio — is “Don’t Play With Your News” (<http://dont-play-with-your-news.com/>), an online puzzle game invented by artist and engineer Gregor Hochmuth.



Gregor Hochmuth

This project features six years of archived NPR newscasts that have been cut into 1,148,916 short clips, each containing three to five words. Each clip is represented onscreen as a piece of paper, akin to the message found inside a fortune cookie. Using the site’s clip selection unit, anyone can drag-and-drop these NPR snippets to create normal-sounding yet somewhat illogical (and occasionally ironic) news briefs.

WHY AND HOW HE DID IT

The “Don’t Play With Your News” puzzle game is one of three NPR clip-based audio projects hosted online by Hochmuth, under the general category “Breaking the News.”

The title explains Hochmuth’s artistic (and often amusing) mission: He is breaking open NPR’s radio newscasts to reveal truths about the ways listeners unconsciously accept newscasts as authoritative, with no thought to how this content shapes the listeners’ world views. Like playing with your food as a child, playing with your news is something listeners are implicitly forbidden from doing, thanks to the linear, one-way nature of radio broadcasting.

“I grew up listening to NPR news, and I still do today,” said Hochmuth, a former engineer at Google, Instagram and Facebook, who gave up the West Coast

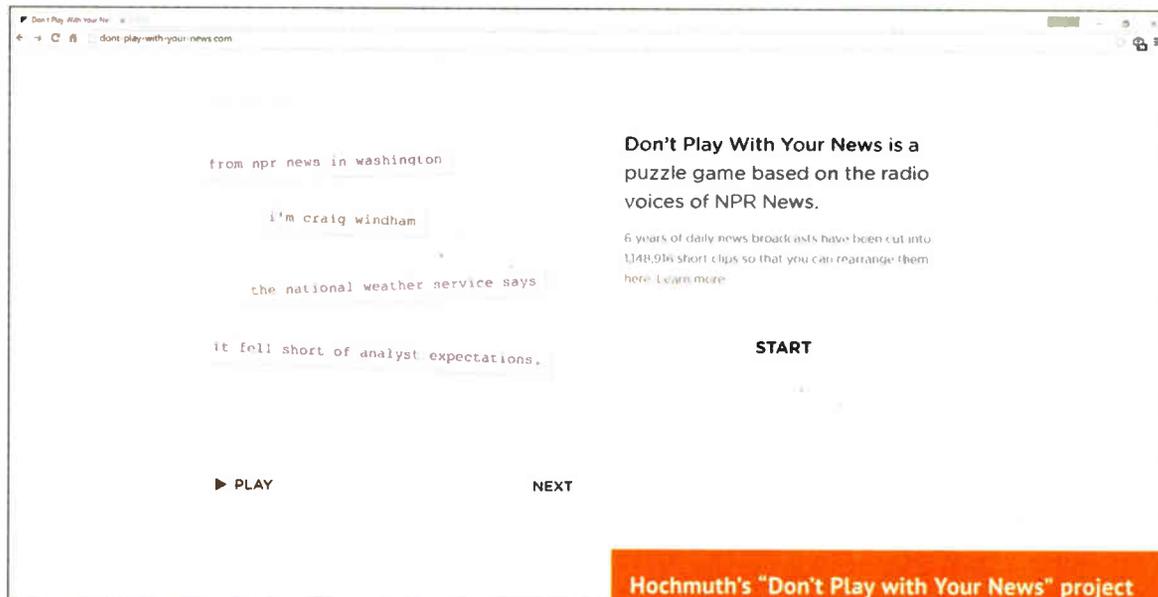
WORKBENCH

(continued from page 12)

Eubank opening, then adjust the length for the height of the opening. At the Burnham site, the 10-inch by 37-inch size was nearly perfect.

Rick then used two powerful magnets to hold the screens in place. More magnets might be necessary during high-wind events.

Now Rick has something that will keep those nasty fluffies out and will be easy to maintain and keep clean. If you adopt this tip, be sure to check and



Don't Play With Your News is a puzzle game based on the radio voices of NPR News.

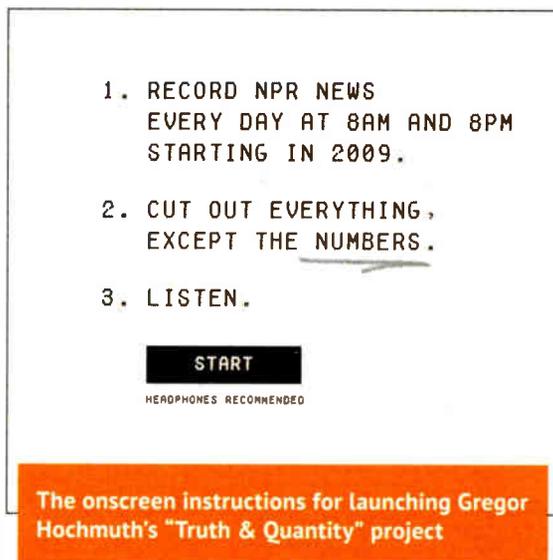
6 years of daily news broadcasts have been cut into 1,148,916 short clips so that you can rearrange them here. Learn more

START

▶ PLAY

NEXT

Hochmuth's "Don't Play with Your News" project allows users to mix and match audio/text snippets from NPR newscasts to provide novel, amusing and insightful combinations.



The onscreen instructions for launching Gregor Hochmuth's "Truth & Quantity" project

tech life in favor of becoming a New York-based multimedia artist.

“It struck me how accustomed I had become to accepting whatever was being said by NPR’s calm, measured newscasters as objective facts. That’s where I got the idea to break up the casts into clips — using tens of thousands of MP3 files downloaded from NPR’s podcast archives — and then making it possible for people to rearrange the clips and extract their hidden, unintentional but influential meanings”

clean the screens regularly or you’ll just end up with clogged screens instead of clogged coils.

In Rick’s case, the site is only a few miles from the studio; he can travel there at least once a week. It may be that Rick finds that during the worst part of the season he’ll need to check and clean the pre-screens twice a week. He is still trying to figure out how quickly the pre-filters will get clogged, but it’s well worth a trial run.

Tips to Workbench help your fellow engineers and qualify for SBE recertification credit. Send your good ideas to johnpbisset@gmail.com. Fax to (603) 472-4944.

The insight-generating quirkiness of Gregor Hochmuth’s “Breaking the News” projects is catching a lot of people’s attention online, including NPR’s.

This was no mean feat. To make sense of NPR’s audio clips without having to listen to them and take notes, Hochmuth used a voice-to-text translation computer-based system.

“I tried many versions, until I hit upon one made by IBM,” he said. “It translated the NPR audio files so accurately that I swear it must have been trained using these newscasts. I mean, the program even rendered obscure last names and place names accurately.”

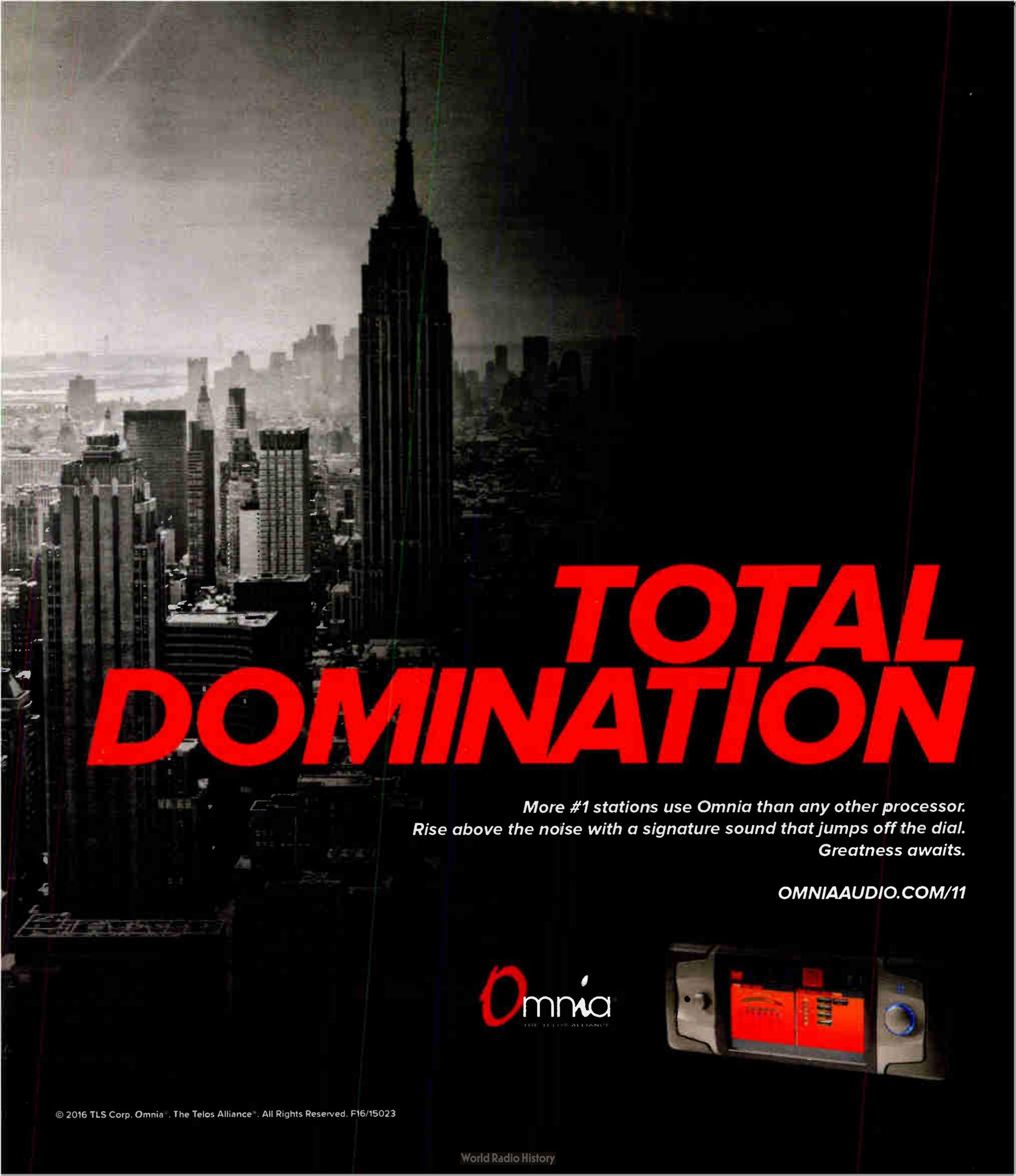
From here, the newscast files were isolated down to and then categorized by specific NPR newscasters, with Hochmuth’s own software breaking the sorted audio files into short, text-matched sound bites. Add the web-based editing interface — where the public can record and then email clip mashups to their email addresses — and “Don’t Play With Your News” was born.

The possibilities are, really, almost endless. Here are two more samples, with the breaks between snippets marked by forward slashes:

“From NPR News in Washington/I’m Korva Coleman./Congress has signed/a petition saying/Trump’s presence is not conducive/to the good of the country.”

“Bernie Sanders is in Iowa/today to replace unapproved/parts of government./He vowed to keep

(continued on page 18)



TOTAL DOMINATION

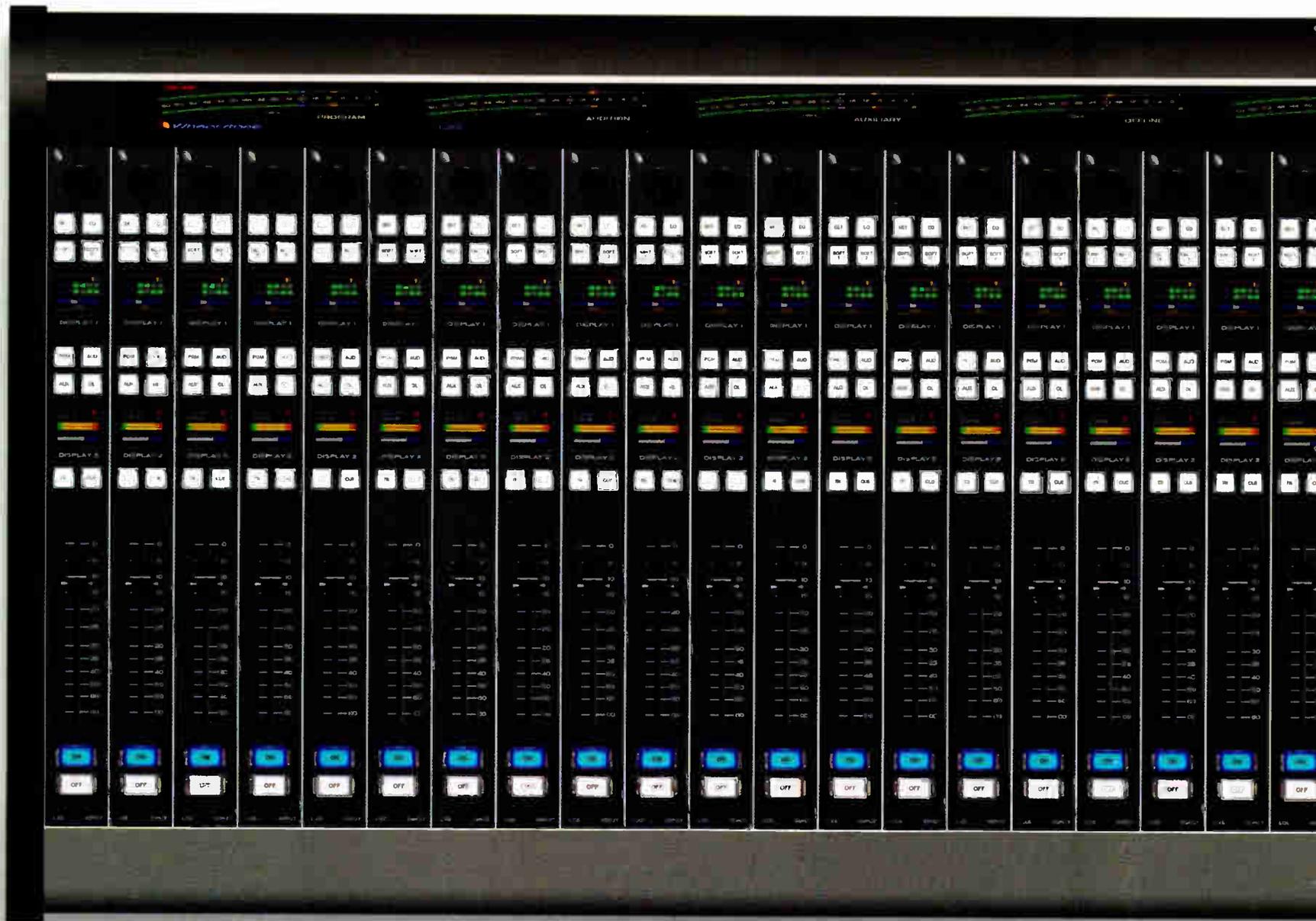
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THE TELOS ALLIANCE



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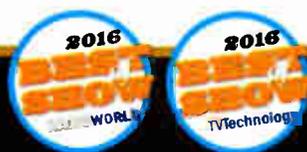


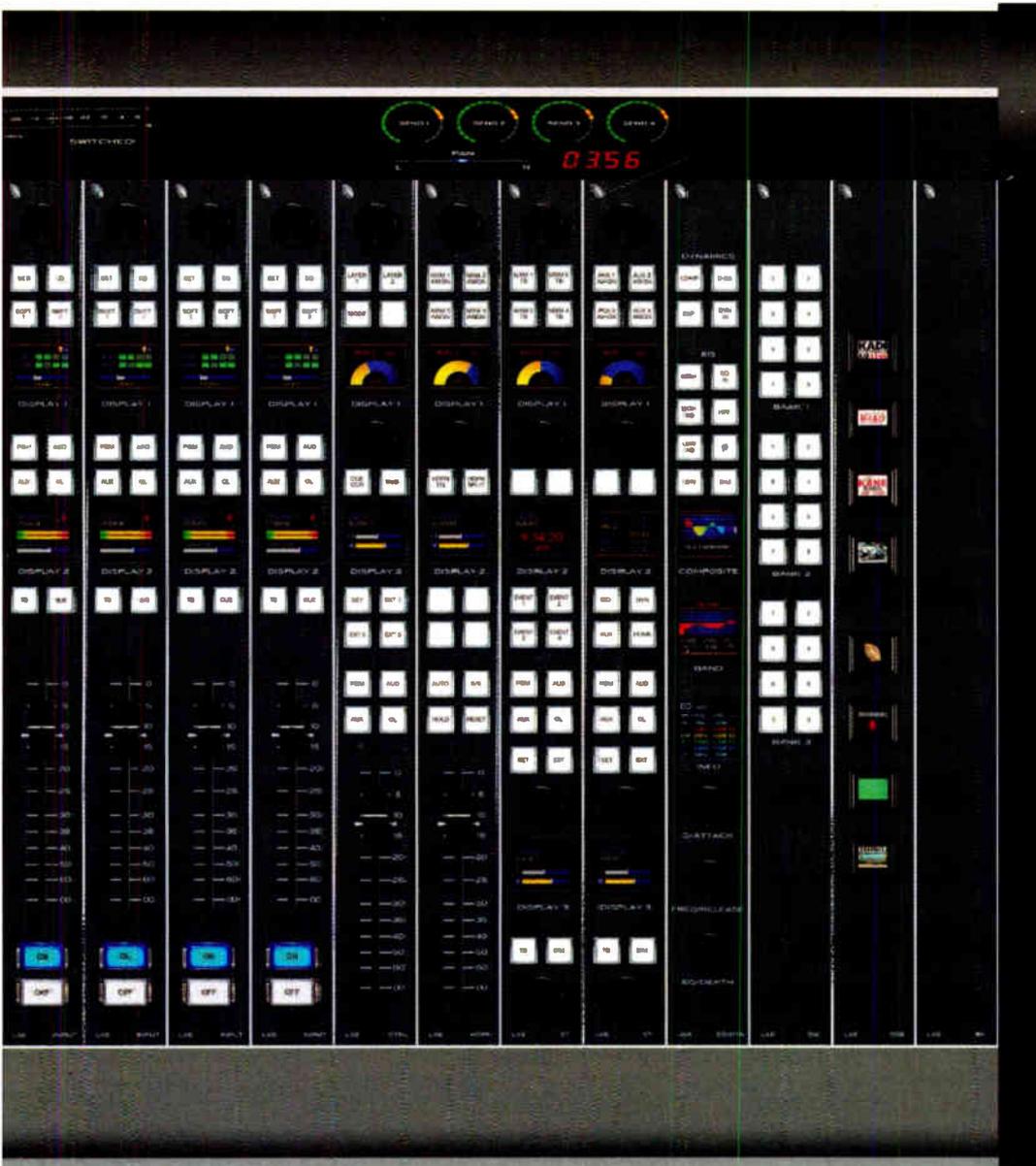
The Evolution of LX Radio Control Console

Wheatstone's new LXE console brings control surface configuration to a new level. Going far beyond the usual "any source to any fader" network concept, the LXE is a fully flexible control interface, where every switch and rotary control is programmable to perform any desired function. This means console architecture is completely customizable to client requirements, and limitations to functionality are no longer a factor. Physically compact, the LXE is available in several different form factors including countertop, countertop sunken, and split frames (split sections are not confined to one room, they can actually be in different studios).

Any Way You Want It

ConsoleBuilder software allows every switch on the surface to be programmed for function, mode, and even color (switches are RGB led illuminated). In fact, built-in software allows every button to be scriptable, letting you create powerful macros for as many controls as you want. Multiple full color OLED displays on each panel keep pace with ongoing operations, and event recall allows painless one touch console reconfiguration at the press of a button. With its inherent control flexibility and ability to access thousands of signals (sources and destinations are limited only by the size of the network) the LXE takes facility work flows and audio control to a new level.





The World At Your (Motorized) Fingertips

The LXE can have up to 32 physical motorized faders, with full DSP processing available on all 32 channels. Surface(s) interface seamlessly into the WheatNet-IP Intelligent Network, and utilize BLADE-3s for audio, control and associated logic data flowing on single CAT6 interconnecting cables. The system can ingest and convert virtually all audio formats: analog, microphone, AES/EBU, SPDIF, AoIP, MADI, SDI and even AES67. Loudness metering, phase control, and full EQ/Dynamics are included.



All New Graphical User Interface

LXE's new GUI has pre-built screens for everything you normally use – metering, clocks, timers, dynamics, EQ, assigns, and more. All are touch-screen accessible with gestures you're used to using on your smart devices. And, the GUI is just as customizable as the LXE surface. Using our ScreenBuilder-LXE software, you simply drag and drop objects and define their functions via a simple wizard interface. You can store multiple custom screens, if you like, to go with your custom LXE setups.

THE ALL NEW LXE BROADCAST AUDIO CONSOLE



CUT AND PASTE

(continued from page 14)

fighting/against a hostile takeover bid/ from Kraft Foods.”

SILENCE AND NUMBERS

In addition to “Don’t Play With Your News,” Hochmuth has posted two other “Breaking the News” projects online. They are “Silent Sky” (<http://silent-sky.com/>) and “Truth & Quantity” (<http://truth-and-quantity.com/>).

“‘Silent Sky’ is an iPhone/Android app that edits together the various silences, pauses breathes, and other unspoken parts of NPR newscasts,” said Hochmuth. “About 5 percent of the newscast contain these silence, which have been broken

--- MARCH 2016 ---

181 PASSENGERS

2 YEARS

100 FEET

670 PEOPLE

4 STATES

9 PEOPLE

200 ROLLS

109 POINTS

2 TOWNS

8 YEARS

5 DECADES

131 POINTS

Gregor Hochmuth’s “Truth & Quantity” project displays and plays the specific quantities of items reported on NPR daily.

up here into nearly 1 million very short clips. Every time a listener requests to hear ‘Silent Sky’ on their mobile, they receive a unique 30 second, multi-layered audio compilation from this clip database. No two are the same.”

“Truth & Quantity” takes a look at the numbers that underpin broadcast news stories, and define the level of importance listeners assign to the content they report. To do these, only the numbers and the nouns these numbers quantify are supplied in the lists generated by “Truth & Quantity.”

For instance, in March 2016, NPR’s



newscasts mentioned 463 stores/two parties/nine points/490 delegates/131 points/30 cents/three rivals/four years/nine people/two decades/two towns... and the list rolls on from there. You can also choose a specific number and see/hear all the nouns associated with it. (In addition to the onscreen scrolling, “Truth & Quantity” offers downloadable MP3 files, plus weekly compilations posted on iTunes.)

“The numbers we hear associated to nouns on air helps define the importance we assign to the news stories we

hear, and how we shape our view of the world,” said Hochmuth. “Focussing on these quantities specifically, and how they are framed, provides insights into what we’re hearing and how it may be affecting us.”

TRULY NEWSWORTHY

The insight-generating quirkiness of Hochmuth’s “Breaking the News” projects is catching a lot of people’s attention online, including NPR’s.

“Yes, they’ve contacted me about doing an interview,” said Hochmuth.

SUPPLYSIDE

Insoft Seeks Visual Radio Success

Supply Side is an occasional feature about companies that make and sell equipment and services.

Insoft LLC makes HDVMixer Visual Radio. It is a privately owned company founded in 2014. Based in North Miami, Fla., it employs eight people. Alejandro “Alex” Bonello is president and majority owner.

Radio World: *Insoft is a new name to many of our readers.*

Bonello: Even though Insoft is a young company, its inspirations are not. During my childhood I was lucky enough to come across a TV Show called “Radio Image” (1987–1990). This was a very popular show at the time; and the host, Mr. Juan A. Badía, was one of the most influential media talents in my country of birth. This show gave me the idea that it was certainly possible and desirable to mix radio and TV into a successful new form of media. But the technology available at that time made it impossible.

In 2007 I got to work for Mr. Badía as chief engineering adviser for his radio network. He soon asked me if I could come up with a way in which he could do a show like “Radio Image” from a conventional radio studio. I had had that same idea for 22 years, and now technology was finally on our side! After three years of R&D, we came up with what we called Visual Radio. The first station using our technology started regular transmissions on July 9, 2012, airing music videos and live studio multi-camera content 24/7 to their audience.

RW: *What did you exhibit at the NAB Show?*

Bonello: The era we are living in is all about image. Social media posts can have text, picture or video. But it’s impossible to post audio. So broadcasters need to add visual content to their radio stations in order to keep the engagement going.

At the NAB Show we highlighted our HDVMixer Visual Radio solution, a one box does-it-all video server that can be easily integrated into radio workflows. HDVMixer allows broadcasters to produce appealing professional video content effortlessly. Robotic PTZ cameras are automated by console’s mic faders, or mic’s audio levels. Imagine how powerful streaming a morning show interview on Facebook Live or YouTube Live can be. HDVMixer does that with one click, making visual radio a new mind-blowing social engagement experience.



RW: *Any best practices or common mistakes to know about when planning a visual presence?*

Bonello: There are many things to pay attention to when going visual.

A common mistake is to confuse Visual Radio, which is a social-based media, with TV, which is a broadcast media. Deploying a TV studio inside a radio station is not the way to go; it’s cumbersome, inefficient and unaffordable in most markets; whereas HDVMixer provides click-and-forget visual preset triggering and auto-update social media integration.

Secondly, social media is your greatest ally, and presence there is key. Either stream live or upload HDVMixer recordings; but publish content to social media regularly. Streaming only live interviews and posting short video highlights is sometimes more engaging than streaming a complete radio show.

Third, the camera lens is the 21st century mic. Everyone in the studio should make eye contact with the audience. Viewers are supporting the show, so let’s look them in the eye. Radio is all about connecting to people, whether they are listeners or viewers.

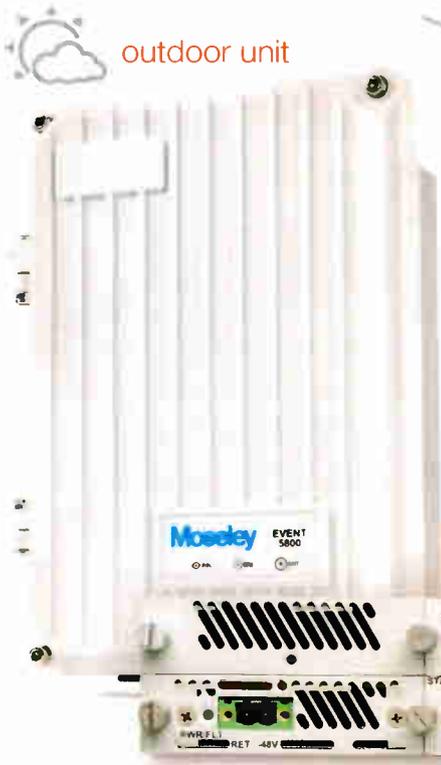
Fourth, content is still the key to success. Social media engagement comes as a result of appealing interviews, support videos and visual remotes. Visual radio is a silver bullet only if aimed in the right direction!

RW: *What else should we know?*

Bonello: I come from a family that has been passionate for audio and broadcast technology for three generations. My grandfather devoted his life to improving sound recording in films. My father, Oscar Bonello, came up with the concept of lossy audio compression in 1985. At the NAB 1990 Radio Show his company, Solidyne, presented the first PC-based compressed audio radio automation system. Therefore, Insoft is a company with a long lineage of excellence behind it. Pushing the envelope of broadcasting is in our DNA.

For more information, visit www.HDVMixer.com.

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outdoor unit



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indoor unit



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Celebrate the Centennial

Mark the 100th anniversary of the National Park Service this summer

Here's a riddle for you: What has trees, rivers, mountains, wildlife and historical significance; belongs to every American; and is turning 100 on Aug. 25?

Our national parks! Or more specifically, the U.S. National Park Service. Yes, fans of the great outdoors, it's time to celebrate a century of tender loving care for the beauty, majesty and history of federal land.

There are over 400 parks in the National Park System, with 84 million acres and found in every single state and territory. We're talkin' national parks, battlefields, historic sites, seashores, lakeshores, monuments, recreation areas, military parks and even the White House.

The number of recreational visitors to the national parks last year totaled over 300 million people.

Why should this be important to you, radio broadcaster?

Because the number of recreational visitors to the national parks last year totaled over 300 million people. That's a lot of listeners with emotional ties to this brand of national pride and recreation. There are lots of ways for your station to get involved in the celebration of the centennial. Let's explore a few.

STATION CENTENNIAL CELEBRATIONS

A few news/talk stations have already run initial stories about the anniversary celebration. This is a good way to start, but I encourage spoken-word formats to go much deeper than a one-and-done introductory story.

Between now and the anniversary in August, consider scheduling a series focusing on the national parks located near your listening audience. Interview locals and find out what they love about those particular parks, probing for memories. Conclude each story by asking listeners to submit their own photos and stories. Next, archive this audio series on your website with these photos and a link to the National Park

Foundation site that offers specifics on how people can become volunteers or donate funds.

Music stations could also consider a photo contest in honor of the anniversary. All of the photos could be placed

ered cars making official stops at nine national parks in seven states. Lots of historic sites will also serve as checkpoints. Maybe there's a way you can get in on the race. People will be quite curious about these solar-powered cars,

PROMO
POWER



Mark Lapidus

tion. Can you help out local scouts with fundraising efforts or publicity? Ask them what they're up to and how you can provide media assistance.

online and a vote could occur with winners selected for various levels of prizes including hiking gear, cameras, tents, etc. Perhaps the grand prize could be sending the winner and a guest to see other amazing national parks across the country.

Could you get your act together quickly for a national park fundraiser? There's a lot to fix in our parks, but funds are lacking in the budget. If you could manage a radiothon, or even a pay-for-play weekend or two, you'd score points with listeners (as well as the feds).

PIGGY BACK ON OTHERS' EVENTS

Many parks are hosting events this summer that you can help promote on-air. Pre-promote and then send someone to attend and check in to report what's going on. Mobilizing your community to do something worthwhile is rewarding for participants and creates "feel-good" time for the station.

On July 30, the American Solar Challenge hits the road with solar-pow-

and it would be cool to be involved with this activity.

Many Boy Scout and Girl Scout troops will participate in the celebra-

Whatever you decide to do, be sure also to plan some promotional event for the actual anniversary celebration on Aug. 25.

Search for park activities — or at least air announcements featuring your listeners, local politicians and local celebrities all wishing our National Park system a special "Happy Birthday."

Looking for volunteers who know a lot about the parks? Contact the National Park Foundation or get in touch with the Student Conservation Association. SCA has been around since 1957 and has had more than 75,000 people provide 28 million hours of hands-on service for the environment. This can be a great resource to get your community involved in volunteer work, especially if you aren't actually located especially near to a U.S. national park.

Are you interested, but still not sure if this is a good fit for your station? Start your exploration by visiting the website created specifically for the NPS centennial campaign: findyourpark.com. Clicking around will trigger all kinds of great ideas of how you can get in on the fun.

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KIOF Wins With Arrakis MARC-15-15

Las Vegas LPFM "goes big" and gets automation too

USERREPORT

BY GREG LAPORTA
President
KIOF(LP)

This article is part of our Buyer's Guide coverage of consoles and mixers.

LAS VEGAS, Nev. — KIOF(LP) started as an idea in January 2010. We saw the need for local community radio to discuss real issues that affected Las Vegas families during the 2008 financial crisis. As we began to discuss the idea for a local community radio station with family and friends, we outlined a plan to bring together an independent broadcast media service to Las Vegas, Nev.



Initial programming strategies were later discussed throughout the year to determine topics that would be of the

public's interest. With months of effort, our dream became viable, and we saw its potential. Later that year, Las Vegas Public Radio officially was founded.

We began our journey with Arrakis Systems in 2013, while we were in the process of designing our main studio in anticipation of obtaining an LPFM broadcast license. Our main studio had to have enough capability to meet our everyday broadcast needs, but also needed to be cost-effective. LPFMs operate on very limited budgets so our final design gave us the most for our money.

FLEXIBLE CONFIGURATION

It was always an option to go with used equipment, but buying a new console for a new project made sense. We didn't want to bother with the risks of used equipment, not knowing exactly what we were going to get. We decided that we didn't want to buy a second-hand console for our main studio.

Several of us involved with KIOF are former broadcasters, so we already knew about Arrakis consoles, and we knew we could get all that we needed for a great value. So we started our search there. We wanted a big console for our main studio that would give us expansion capabilities. The MARC-15-15 was an obvious choice, since it met our specifications and we could have it customized to meet our needs.

The MARC series board is cost-effective especially for the amount of features you get with it. It has three output busses, 15 channels, and the modular design allowed for configuring it the way we wanted it. We needed mic channels of course, but we also liked that you could have two phone input modules for our hybrids. We also

liked the USB modules. With these we could connect our Mac computers for production work, as well as connect to Arrakis' automation, Digilink-Xtreme. We received their free version of Digilink-Xtreme (now called DHD-Live), but have since upgraded to their full version of the Digilink-Xtreme.

One of the things that made the decision to go with the MARC easier was the demo video. It was informative and gave us a great idea of what we were getting. I felt informed going into the purchase, and felt comfortable with making the large expenditure.

So after vetting the features and the specs, and doing extensive research, we decided to pull the trigger, and get ourselves the MARC-15-15. We sent Arrakis a list of the modules we wanted, and they configured it in-house. We also decided to purchase pre-made cables, which we later came to appreciate.

The board came about a week later. The installation was quick and easy. Everything was plug-and-play with the pre-made cables from Arrakis. This drastically simplified the installation to our equipment. The MARC has RJ-45 connectors, which are easy to use, and I am sure we could have easily made the cables ourselves. But for the price, why not save the time and effort.

As we have used this board over time, our love for it has only grown. One of the other features we love is the VU meters. They are easy to read and the LEDs make it easy for non-broadcast staff to follow what is happening during "Live" shows.

As mentioned, we also use Digilink-Xtreme automation, which we appreciate. Besides being a great automation, one of the nice parts to having their console and automation, is that it is all supported under one roof. I don't have to call 10 different places to get help with both.

One last thing that got us extra-excited about choosing to go with the MARC is the addition of Arrakis' new Simple IP. While visiting their booth at the NAB Show this year, we saw the introduction of Simple IP, an AoIP solution. This is exciting for us, because it is an affordable solution to initiating AoIP, and, of course, it is compatible with our MARC board (or, frankly, most any IP-based audio equipment). So when we add studios, we'll be able to interconnect them painlessly through our LAN.

Overall, we are very happy with the MARC, and feel the decision to go big or go home was the right one.

For information, contact Ben Palmer at Arrakis Systems in Colorado at (970) 461-0730 or visit www.arrakis-systems.com.

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TIELINE AIMS BIG

Codec maker Tieline is looking at codecs in a slightly different way with its ViA. The new product offers IP, ISDN and POTS I/O. The IP can be accessed via Ethernet, built-in Wi-Fi or USB cellular.

Tieline explains in a release: "ViA includes Tieline's new proprietary Fuse-IP data aggregation technology, which lets you bond any available IP interface. Choose from two USB modems, two Ethernet connections or onboard Wi-Fi. For example, you can bond two USB modem data links from different telcos and let Fuse-IP technology automatically manage the data capability of each link."

Tieline CEO Will McLean believes ViA will "fundamentally change the way engineers perform live remote." He said ViA also is notable for its simplicity and usability when creating and monitoring live connections.

The battery-operable ViA is native IP but ISDN and POTS paths can be enabled with available modules that fit into open slots. These modules can also be used to create an IFB circuit.

ViA offers three XLR inputs, three headphone, an AES3 digital input and a stereo aux input. A three-channel mixer is onboard. An LED touchscreen facilitates local operation.

Aiding transmission is Tieline's SmartStream Plus technology for redundant streaming. Signal quality features include Automated Jitter Buffer management, Forward Error Correction and advanced error concealment strategies.

Streaming formats include 24-bit, 96 kHz linear audio, Opus, Tieline Music or MusicPlus, LC-AAC and HE-AAC v.1 and v.2, AAC-LD, AAC-ELD, aptX Enhanced, MPEG Layer 2, G.711 (u-law and a-law) and G.722.

ViA can also be remotely operated via IP.

Info: www.tieline.com



Stay Cool With Hot New Gear

It's new equipment season again! Radio World's "Summer of Products" feature is all about new gear that has come onto the market in recent months, especially during spring convention season. Over several issues we feature equipment that caught our eye. Send ideas to radioworld@nbmedia.com with "Summer of Products" in the subject line.

WHAT'S THE FREQUENCY, ESE?

ESE has launched the ES-410, a GPS-based frequency generator that generates a stable source of 10 MHz and 1 PPS using GPS satellites as a reference. The unit provides 10 MHz in both sine wave and square wave (5 V logic) form. Four sine wave and four square wave outputs are provided. The 1 PPS output is a 50 percent duty 5 V logic signal, with the positive-edge coinciding with the UTC seconds change.

An ESE TC90 timecode output is provided for driving remote time displays. A USB interface allows configuration of the time zone and other parameters, and outputs the time. Ships with an indoor/outdoor antenna and 16-foot cable.

If frequency distribution is needed, ESE offers the ES-210, a quad 1 x 6 1 MHz/5 MHz/10 MHz distribution amplifier. The unit provides four independent 1 x 6 frequency DAs in a single rackmount enclosure.

Info: www.e-se-web.com



WORLDCAST'S ECRESO DEBUTS 10 KW TRANSMITTER

WorldCast Systems says that its Egreso FM 10 kW transmitter is based around a digital FM modulator that enables excellent audio purity and hosts a range of built-in features such as audio backup, RDS and stereo encoding and an FM limiter with MPX power control. It emphasizes the unit's reliability, redundancy and overall efficiency.

The power amplifiers, power supplies and even the fan modules are hot-swappable and redundant. A passive six-way coupler, as well as built-in dummy loads, ensures that, should one of the six amplifiers suffer a fault, the transmitter can stay on-air indefinitely at 9 kW until the fault is rectified.

Efficient, self-monitoring power supplies and a new planar design contribute to an overall transmitter system efficiency of up to 76 percent, which the company says is the highest available in the FM broadcast market.

WorldCast Systems says a new architecture for the 10 kW system ensures ease of access, use and maintenance. The Egreso FM 10 kW can be supplied with a warranty of up to 10 years.

Info: www.worldcastsystems.com



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NEW SBE BROADCAST ENGINEERING HANDBOOK AVAILABLE

The Society of Broadcast Engineers has published the "SBE Broadcast Engineering Handbook."

Co-produced with McGraw Hill Education, it is subtitled, "Hands-on Guide to Station Design and Maintenance." For the radio and TV engineer, the book offers practical information on video, audio and broadcast transmission systems from expert writers.

Featuring "everything from basic principles and formulae to the latest technologies and engineering trends," the book includes practical coverage of major broadcast technologies for radio, TV and related fields.

It contains sections on regulatory issues, RF transmission, DTV transport, information technology systems, production systems, facility issues, broadcast management, along with three reference annexes. Editor in Chief Jerry Whitaker, vice president of Standards Development for the Advanced Television Systems Committee, oversaw approximately 50 contributing authors. Price: \$199.

Info: www.mhprofessional.com

WINMEDIA OFFERS VOICE-TRACKING

WinMedia is offering a voice-tracking module for its Mixing Module.

The WinMedia Voice-Track system is a multiple-voice tracking feature that can localize voice tracks for regional broadcasts. The company explains that with this module, broadcasters can prepare a single playlist and have on-air talent add their voice tracks to one of 32 available recording tracks.

Voice-Track is embedded in the WinMedia Mixing module and allows users to edit mixing points, control all voice-tracks simultaneously, and have talent record voice-tracks of the same length. With multi-zone capabilities, the on-air module triggers the right voice-track for each broadcasting zone from the playlist.

Info: www.winmedia.org



BURK PUTS THE PLUS INTO ITS SNMP

Burk Technology has upgraded its SNMP remote site management software for its ARC Plus Touch and ARC Plus SL.

The company says, "Now with SNMP Plus, traditional and SNMP equipment can be seamlessly integrated over the same network."

It explains that "SNMP channels behave like any other ARC Plus channel. SNMP data can be mapped to ARC Plus meter and status channels for monitoring and alarm generation." ARC Plus command channels can initiate SNMP Set commands for control of connected SNMP equipment.

SNMP Plus enables creation of comprehensive automated functions on the ARC Plus that encompass all controlled equipment whether connected via parallel interface or SNMP.

It is available as an option on new ARC Plus Touches and ARC Plus SLs; it can be loaded into version 5 ARC Plus Touches and ARC Plus SLs in the field.

Info: www.burk.com

GATESAIR ADDS TO INTRAPLEX IP LINE

Manufacturer GatesAir has added two members to its Intraplex IP Link line.

The Intraplex Link MPX, pictured, is designed for high-quality digital AES192 FM composite signal STL use. The company says, "It is especially ideal for broadcasters that lack the network bandwidth to distribute a full AES192 digital FM composite signal, which typically requires 5 MBps of bandwidth, from studio to transmitter; and/or lack AES192 signal receiving capability in their legacy excitors. It is also highly configurable, allowing broadcasters to adjust bit rates for optimal bandwidth usage across a wide-area network, using less than half of the bandwidth required for AES192."



The Intraplex Link MPX eliminates the need to install stereo generators, audio processors and other auxiliary equipment at multiple receive locations. Stations can send audio and data, including RDS information, in one bandwidth-efficient stream to multiple transmitter and booster locations.

Onboard is GatesAir's Intraplex SynchroCast simulcast technology and GPS for aiding timing recovery in multipoint distribution applications. It can team with the Intraplex HD Link microwave STL to handle composite signals in a 950 MHz link.

GatesAir Chief Product Officer Rich Redmond called it an IP transport solution that simplifies program distribution by keeping the audio processing at the studio, with optimal bitrate usage to suit varying network limitations.

GatesAir also introduced the Intraplex IP Link 100P, a single-channel, full-duplex codec. It adds advanced signal monitoring capabilities and integration with SynchroCast systems that are absent from base IP Link codecs, providing another audio contribution and distribution option for simulcasting across transmitter networks.

Info: www.gatesair.com

AETA RINGS UP SCOOPFONE US

AETA Audio Systems is expanding its ScoopFone family with a U.S. version of the range of professional mobile phones for broadcasters. In addition to HD Voice calls at 7 kHz audio bandwidth, the ScoopFone US allows VoIP calls; the user can



transmit through HD Voice, 3G/3G+, as well as wired IP connections in one box. Coding algorithms available for IP are Opus, G.722 and G.711.

With HD Voice, the ScoopFone U.S. uses a dial-up connection over the 3G mobile network providing Quality of Service. HD Voice delivers higher voice transmission quality by extending the frequency of range of traditional or narrowband voice calls (300 Hz to 3.4 kHz) out to wideband audio ranges (50 Hz to 7 kHz). The 7 kHz wideband quality allows fuller signature character of the speaker's voice. Unlike mobile data links, HD Voice delivers a priority connection with secure quality once the call is established — all, the company says, with lower cost and latency.

In IP the encoding mode is automatically selected depending upon the device being called, with a priority for Opus. A network-quality meter guides the user for adjusting the bitrate if needed. To simplify IP connections, an SIP account is available and active.

Like the ScoopFone HD, the ScoopFone US works with any microphone and offers mixing between one microphone/line and a second line input, together with an interface that journalists can operate easily under pressure. The unit is powered by rechargeable NiMH battery with an integrated charger or standard AA batteries.

Info: www.aeta-audio.com

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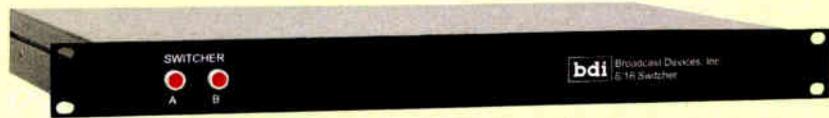
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World Radio History

BROADCAST DEVICES RELEASES 8/16 SWITCHER

RF support equipment manufacturer Broadcast Devices Inc. announced the availability of an 8- or 16-channel passive A/B switcher.

This multipurpose device can cover many duties in a facility such as basic audio routing, emergency multi-pair backup switcher, 7/5.1 audio monitor selector, emergency studio switcher, emergency router bypass switcher, emergency digital console switchover and much else that can be dreamed up.



BDI notes, "Because the 8/16 switcher is passive in its switching function signals can be mixed in one switcher to include analog or digital audio and control signals."

If more than 16 pairs are involved multiple units can be linked. It is shielded against RFI and its onboard power supply is designed for "harsh electrical environments," while being flexible enough to handle foreign power systems.

The interfaces are Tascam 25-pin. XLR and BNC adapters are available.

Info: www.broadcast-devices.com

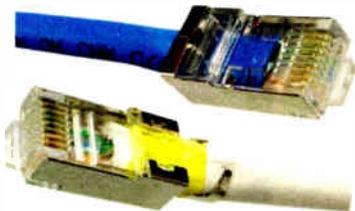
PLATINUM TOOLS PRESENTS CAT-6A CONNECTORS

Platinum Tools has some parts for engineers and IT managers who like to make their own cables, Cat-6A connectors.

Connector specifications are listed as: max cable OD: 8.5mm/0.335 inches; max conductor OD: 1.35mm/0.053 inches; and UL and ROHS compliance. The connectors are also compatible with Platinum Tools' Tele-TitanXg and Tele-TitanXg 2.0 crimp tools.

Platinum Tools Product Manager John Phillips said, "Streaming media whether data, audio or video, is on a sharp rise and users are demanding more bandwidth. ... That means bigger cable, such as Cat-6e, Cat-6A and Cat-7, and usually shielded. For maximum performance, connector and crimp tool choice is critical." He said the Cat-6A/10Gig termination system exceeds those requirements.

Info: www.platinumtools.com



BIQUAD BROADCAST DEVELOPS PROCESSOR



Brazilian broadcast equipment maker Biquad Broadcast will be a new name to many

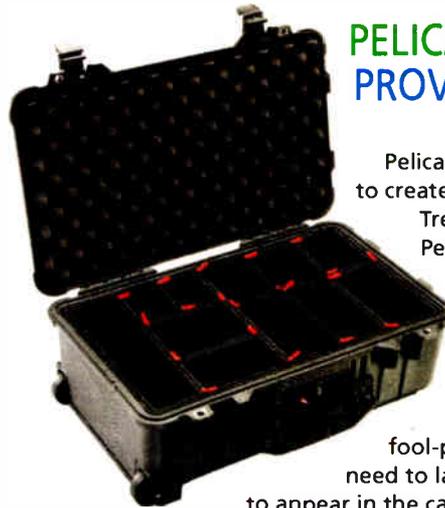
but it makes a wide range of audio broadcast gear. One example is its new DAP Uno processor.

The DAP Uno offers the processing characteristics and software features of the company's DAP4 in a simplified, lower-cost model. It is designed for AM and FM stations, with 20 factory presets, "smart" AGC, five-band processing, a "smart" clipper, a digital stereo generator with greater than 80 dB of channel separation and a digital clipper.

In addition it has a USB port for interfacing with a computer. The digital MPX output is 24-bit/192 kHz. It is compatible with AES67, Ravenna, Dante and Livewire.

Info: biquadbroadcast.com/en/

PELICAN & TREKPAK PROVIDE CASE SOLUTION



Pelican Products says it is working with TrekPak to create a better portable equipment case.

TrekPak is a specialist in sectional dividers.

Pelican is making six of its medium and large equipment cases (1510, 1550, 1560, 1600, 1610P and 1650) available for optional TrekPak treatment.

A release explains: "The TrekPak system comes with pre-installed wall sections, divider panels, locking pins and a fool-proof cutting tool. ... Case owners simply need to lay out their gear the way they wish for it to appear in the case, measure and cut the divider sections, and lock them in place with the provided U-pins. Each divider

section is manufactured from a waterproof, closed-cell foam that is laminated to a rigid corrugated plastic panel. They are light, strong and almost impossible to tear or shred."

The configurable system includes extra divider materials, and divider panels are available separately to switch up the layout any time.

Info: Pelican.com

GENELEC MONITORS THE NETWORK

Audio monitor maker Genelec has been showing an interesting new monitor — one that has an IP network interface built in.

The 8430A has an RJ45 Ethernet connector to go along with an XLR analog input. According to Genelec the monitor can handle AES67 and Ravenna audio.

The 8430A looks like a standard Genelec monitor. Its particulars are a 5-inch woofer and 3/4-inch tweeter with dual 50 W Class D amplifiers, one for each driver. Frequency range is said by Genelec to be 45 Hz–23 kHz.

It is also compatible with Genelec's GLM speaker management system.

Info: www.genelecusa.com



ARRAKIS KEEPS IT SIMPLE

Arrakis Systems has a new trick — Simple IP, an IP networking protocol along with hardware to make use of the new digital audio network power.

Simple IP is AES67-compliant. Using the Dante standard, this device can send and receive audio to any other AES67 device — whether that is a console, switcher or other compliant piece of hardware.

Arrakis says that with Simple IP, users connect audio equipment to one of the Simple IP boxes (shown). These boxes have 8-in x 8-out mono connections; allowing users to connect up to eight audio channels in and out or 4-in and 4-out for stereo. Simple IP works with any of Arrakis' ARC or MARC series consoles. Using RJ45 inputs and outputs connections can be made quickly. The same is true of other audio equipment.

Dante will work with any Ethernet switch, automatically auto-detecting the device on the network.

A free software Dante network controller app is available.

Info: www.arrakis-systems.com



ENCO AND BENZTOWN PROVIDE INTEGRATION

In what could be a look at things to come, imaging and production library services provider Benztown and radio automation developer ENCO Systems are working together to make Benztown's content immediately accessible through the GUI of ENCO's DAD automation platform.



According to their announcement, "The new system enables seamless, intuitive and quick radio production and imaging that provides radio producers and air talent with immediate access to Benztown's production library content, including automated customized content updates pushed out to stations per their specifications in real time." The new automation system goes a step further by offering direct integration of content to production-oriented systems, with no extra steps involved in downloading content toolsets from other websites and apps.

Benztown President Dave Denes said, "This is the first time that production libraries have ever been integrated into an automation system for radio production." ENCO General Manager Ken Frommert said, "The integration of Benztown's production and imaging libraries with DAD radio automation represents an evolution of the flexibility and power built into our products."

Info: www.enco.com

COMREX DEBUTS VH2 "HYBRID"

Comrex has added a new product to its telephone system line. The VH2 is a two-line VoIP-based "hybrid" that the company says has been long requested by customers.



"With simple front-panel controls, VH2 enables users to manage telephone calls easily in excellent, studio-grade quality. Many broadcasters find VoIP trunks to be more cost-effective and readily available than traditional phone lines. VH2 also connects directly to several VoIP PBXs."

The company's Tom Hartnett explained on his blog that he puts hybrid in quotes "because it's not doing the traditional phone line cancellation (not required in the VoIP world); but functionally it acts like a traditional studio telephone interface ... Like a traditional hybrid you can bounce calls" between the VH2 and a companion VoIP phone, making outgoing or taking incoming calls on the handset and moving them to the hybrid with a button push.

Info: www.comrex.com

FM COMBINERS SHIPPING FROM KINTRONIC

Kintronic Laboratories offers 600 W and 1200 W FM combiners with two-, three- or four-input ports.

The company's FM, STL, TV and telecom solutions also include isocouplers (translators), coaxial and waveguide isolation inductors, FM filters, patch panels, coaxial switches, controllers and indoor and outdoor temperature-controlled equipment racks.

For AM/medium-wave and short-wave products Kintronic Labs has RF components, directional antenna systems, dummy loads, antenna tuning units and control and monitoring systems.

Kintronic also has a new multiband, analog and digital broadcast software-defined receiver. Kintronic Labs provides a number of services including AM/MW antenna, transmitter, tuning and ground system layout; nondirectional, directional and multiplexed antenna system design; and the collection of station data for FCC filings.

Info: www.kintronic.com



ON AIR LIGHTS: Wall and Desk Top Models



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OAL-101W



OAL-101R

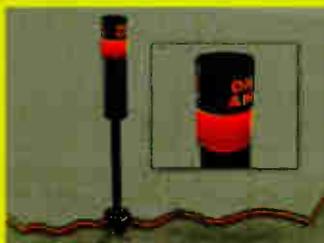
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Model 6710/6715 coaxial load resistor, \$2500. 706-499-2922.

SC48 Marti STL Antenna, \$600.00, and an XLink STL Frequency Agile Receiver, \$750.00, new, both in original boxes, left over from relocation project, buyer pays ship cost from Show Low, AZ. Bob Zellmer, 970-302-0161.

RADIOWORLD

AUDIO PROCESSING (INCLUDES ON-AIR)

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Teletronix LA-2A's, URE! LA-3A's & LA-4's, Fairchild 660's & 670's, any Pultec EQ's & any other old tube compressor/limiters, call after 3PM CST - 214 738-7873 or sixtiesradio@yahoo.com.

AUTOMATION EQUIPMENT

WANT TO SELL

DIY-DJ Version 2.0 is now available. Over 500 copies of DIY-DJ, a Linux based radio automation system, have been distributed and now version 2.0 is available. Voice tracking, join satellite feeds, do unattended sports and remote events, temperature announce, scheduler, automatic cut editing on import, and much more. It's FREE. If you are using version 1.0 or would like to try DIY-DJ, go to krwvfm.com, register and download your free full version. The only thing we ask is that you let us know if and how you are using the software. Call (406) 679-0527 or email krwv@digitaldevelopment.net for a copy today.

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I'm selling between 150 and 200 cassette tapes that consist of old-time radio shows, sports shows, some local New York radio talk shows, etc... Must take entire collection and the price is negotiable. Please call me for details and, my phone number is 925-284-5428.

Radio broadcasts of Major League Baseball, NFL, and some college football games that are on cassette tapes, approx 100 to 125 games, time period of entire collection os from the 1950's - 1970's, BO. Must purchase entire collection. Contact Ron, 925-284-5428 or ronwtamm@yahoo.com

Delta OIB Operating Impedance 3ridge, \$1100; Inovonics DAVID FM audio processor, \$800; Shure M267 mixer w/rack mount, \$75; Bird 8920 Terma-line dummy load, never used, \$1500; RCA (Nems-Clark) field strength meter, \$900; IFR 1200 service monitor w/all cables, \$1600; Protek portable spectrum analyzer, \$900; AEA VIA Bravo antenna analyzer/tuner, \$500; Marti RPT 15 450 Mhz xmtr, \$300. 412-952-1930 or pgholdies@gmail.com.

WANT TO BUY

Collector wants to buy: old vintage pio gears, compressor/limiter, microphone, mixing consoles, amplifiers, mic preamps, speakers, turntables, EQ working or not, working transformers (UTC Western Electric), Fairchild, Western Electric, Langevin, RCA, Gates, Urei, Altec, Pultec, Collins. Cash - pick up 773-339-9035 or ilg821@aol.com.

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2" plastic "spot" reels 6.5 or 8" diameter, as used for quad video. Wayne, Audio Village, 760-320-0728 or audiovlg@gte.net.

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I'm looking for San Francisco radio recordings from the 1920's through the 1980's. For example newscast, talk shows, music shows, live band remotes, etc. Stations like KGO, KFRC, KSFO, KTAB, KDIA, KWBR, KSFX, KOBY, KCBS, KQW, KRE, KTIM, KYA, etc, I will pay for copies... Feel free to call me at 925-284-5428 or you can email me at ronwtamm@yahoo.com.

Looking for a broadcast excerpt of a San Francisco Giant's taped off of KSFO radio from 1959, interviews with Willie Mays, Dusty Rhodes & some play by play excerpts, also features a homerun by Willie Mays and Felipe Alou stealing second base, running time is 18:02, also looking for SF Giants games and/or highlights from 1958-1978 also taped off KSFO Radio. Ron, 925-284-5428 or ronwtamm@yahoo.com.

Looking for KFRC signoff radio broadcast from 1930 Andy Potter, running time is 0:22 & also the KLX kitchen the program guest is Susanne Caygill, a discussion of women's affairs with a long promotion for Caygill's appearance at a local store. Anne Truax,

Susanne Caygill, running time is 13:44. Ron, 925-284-5428 or email ronwtamm@yahoo.com.

Looking for KTIM FM radio shows from 1981-1984 if possible unscoped. R Tamm, 925-284-5428 or ronwtamm@yahoo.com.

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WANT TO SELL

Johnson Electronic SCA880 module, 67/92 Khz, 417-881-1846.

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vertical FM antenna system w/ power divider, 90.1 MHz, BO, must pick up locally, will not ship; PTEK FM-300ES xmtr, less than 5 yrs old, \$2500/BO; Armstrong X-Link 950MHz STL system xmtr & rcvr, sold as set, \$4000/BO; Scala PR950 STL antennas (2), \$400/ea; Wheatstone VP-8 Plus digital audio proc/stereo gen, \$2500/BO; Complete Comrex ACCESS system, \$6000/BO; Comrex MATRIX system, \$1000/BO; Sage Digital ENDEC EAS system, \$1500/BP; submit offers before July 15 to Bart Jones, bjones@hastings.edu; after July 15 to Gary Johnson, gjohnson@hastings.edu.

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READER'S FORUM

INTERMODULATION

Regarding "New Kinds of Interference in the FM Band," March 30 issue:

FM broadcasters should remember that intermodulation can cause interference to things other than broadcasters: The Instrument Landing System is just above the FM broadcast band. The wrong combination of FM signals near an airport can thus create IM in aircraft ILS receivers — a process that is considered in the licensing process, so it is not possible with a properly licensed station.

Of course this is exacerbated by FAA's 20-year refusal to require all U.S. aircraft ILS receivers to comply with International Civil Aviation Organization standards — a lobbying position of the Aircraft Owners and Pilots Association, general aviation's counterpart to the NRA.

But FM pirates do not go through proper licensing and may end up using frequencies that can lead to IM products on specific ILS airport frequencies. While pirate powers are usually low, two obscure technical issues are relevant:

1) If a strong upper-end FM signal is near an airport, and it is strong enough to start overloading the ILS receiver, a minimal second FM signal on the right frequency can generate an IM product on the ILS frequency — even a signal that is too weak to properly receive! (I have seen this in an FAA lab test.)

2) If the ILS assignment frequency is related to the two FM transmissions by the formula $2F1-F2$, the amount of IM generated in the ILS receiver is proportional to the square of the F1 power but only linear with the power of F2 at the ILS receiver. Thus modest-power F1 broadcast signals can generate ILS IM in mediocre ILS receivers allowed by FAA in the presence of strong FM signals at a certain frequency!

Because of these two factors, as well as the AOPA lobbying against the 20-year-old ICAO immunity standard, modest pirate signals near an airport might generate ILS interference. Broadcasters and their trade association might want to point this out to the FCC in view of its downsizing of field enforcement.

It is interesting to note the FCC's "Enforcement Advisory" on pirate FMs totally ignores this issue. Perhaps broadcasters should raise this to the FAA? Why not press the National Association of Broadcasters? NAB acceptance of this document (<http://tinyurl.com/nab-pirate>) may show that their FM members truly are second-class citizens, as NAB accepts this nonsensical approach to rationalize the fading away of FCC enforcement. In view of NAB's demonstrated disinterest or naiveté, it might be better to contact FAA directly.

Michael J. Marcus, F-IEEE
Marcus Spectrum Solutions LLC
Cabin John, Md.



istockphoto/mitija2

PRESERVATION

Regarding "Christopher Sterling: Better Late Than Never to 'Save America's Radio Heritage'" (RW online):

This equally well includes vintage studio and transmitting equipment. There is currently a lot of interest in preserving and restoring old broadcast equipment by hobbyists, amateur radio operators and engineers/technicians actively seeking discontinued replacement parts to maintain older equipment still in service at broadcast facilities.

Recently, a station sent the inner workings of a mint condition Gates BC1-F transmitter to a metal recycler after giving the cabinet to a local resident who wanted to re-purpose it as a tool closet for his workshop. The station owner had sought a new home for the unit, and the local resident was the only taker. Problem was, its availability was announced only on Facebook! Had they listed the transmitter on a broadcasting or ham radio forum with nationwide reach, I'm sure they would have received plenty of responses and the transmitter, or at least its inner components, would have been saved. Someone might have even paid some money for the old transmitter. Facebook and Craig's List are not the most likely media for finding someone interested in old broadcast equipment or archives of recordings and historic written records.

Donald Chester
Owner, AFIRF Consulting
Woodlawn, Tenn.

WRITE TO RW

Email radioworld@nbmedia.com with "Letter to the Editor" in the subject field. Please include issue date.



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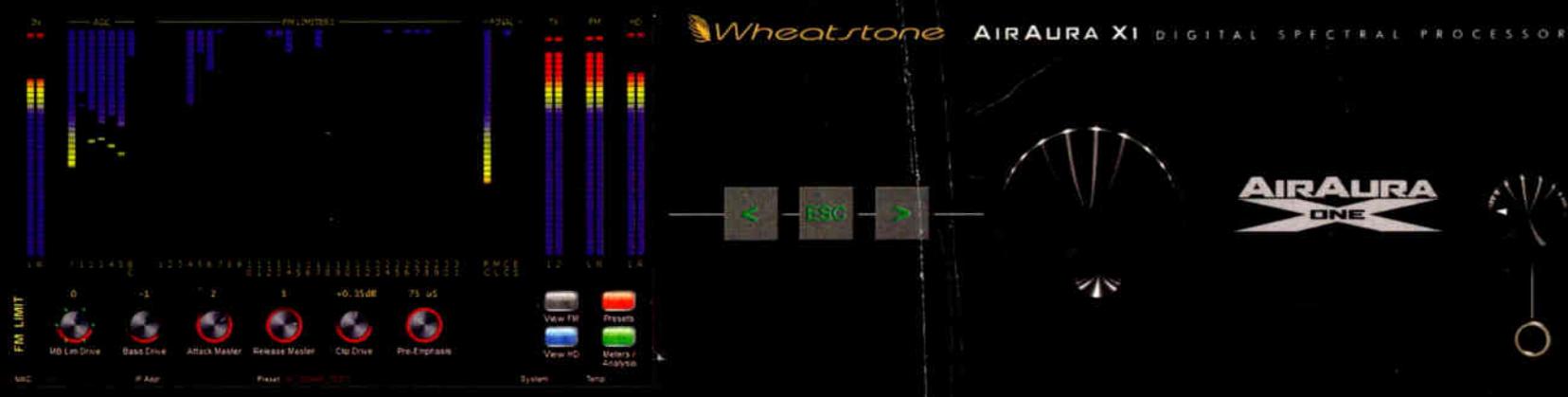


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