YOUNG ENGINEERS — Page 16

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LPFM Stations Seek Technical Upgrades

Advocates argue that the low-power FM service is now a mature one

REGULATION

BY RANDY J. STINE

The low-power FM service in the United States has grown to more than 2,100 stations. Advocates say it has matured to the point that those stations should have an opportunity to improve their signals through technical upgrades.

The FCC is considering a Notice of Proposed Rulemaking that would, among other things, allow for more widespread use of directional antennas by LPFM stations. Currently the rules allow LPFMs to use directional antennas under special circumstances, including as part of a second adjacent waiver request or for LPFMs licensed for public safety purposes. The commission is also proposing to allow LPFMs to use boosters.

The approximate service range of a 100 watt LPFM station is about 3.5 miles, according to the FCC.

DIVERSITY & LOCALISM

Advocates say the commission was understandably conservative at the outset of the service almost two decades ago, authorizing small coverage areas with very low powers and height, and imposing strict transmitter requirements. Now, they say, LPFM deserves additional engineering options to improve reception.

Commission Chairman Ajit Pai wrote in a blog post this year: "When the commission launched the service in 2000, it designed LPFM requirements to be simple. The purpose was to make it easier

(continued on page 4)

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Facility Profile: WRSU(FM)

page 6

Music Director Bennett Rosner sits at the SAS iSL 28.3 console in the WRSU air studio, with General Manager Justin Sontupe, left, and news anchor Ryan Margolis during the "R U Awake" morning show.

Studio photo courtesy WRSU; sign photo by Paul Kaminski

Symposium Examines Changing Radio Landscape

BTS sessions explored connectivity, HD Radio ops, AM protection and more

BY JAMES E. O'NEAL

Convening for the 69th time in as many years, this year's IEEE Broadcast Technology Society's annual fall Symposium brought together some 120 engineering personnel from as far away as Japan and South Korea to exchange information about developments in disseminating information and entertainment to mass audiences.

Although the ATSC 3.0 and 5G rollouts got the lion's share of attention this year, contemporary radio technology and issues were visible, with presentations

(continued on page 12)

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FCC to Explore All-Digital Option on the AM Band

Once unthinkable, the idea of turning off analog signals now appeals to some

BY PAUL McLANE

AM radio station operators in the United States may soon have the option of switching their transmissions to all-digital.

It's not a done deal; but the concept is about to take a step closer to reality, because the Federal Communications Commission said that, at its meeting in late November, it would consider a proposal to start a process, taking comments on whether to allow AM band licensees to make the switch if they wish.

Ben Downs, VP/GM of Bryan Broadcasting in Texas, had petitioned the FCC in March to initiate a proceeding to authorize the all-digital mode of HD Radio.

Allowing stations to use all-digital transmission is an idea that some broadcasters feel could give business-challenged AM stations in the United States new life, or at least another option.

Legacy AM receivers would not hear these stations; but the widespread use of FM translators by AM operators may make the previously unthinkable more appealing.

A crucial consequence here is that turning off an analog transmitter would mean that most existing receivers could no longer pick up that signal. But the widespread use of FM translators by AM operators may make the previously unthinkable more appealing, because the existing content would still be heard on FM analog receivers. And adding an all-digital AM option could open up new possibilities for them as the number of digital receivers in the marketplace continues to grow.

One station, WWFD in Frederick, Md., owned by Hubbard, is operating in all-digital AM under special temporary authority, as RW has reported.

Chairman Ajit Pai described the proposal in a blog post: "Just as the FCC is trying to keep pace with changes in the market, so are AM radio operators, and the commission wants to give them as much flexibility as possible to compete in the digital age," he wrote.

Pai said the proposal "would seek comment on topics ranging from the predicted benefits of all-digital AM broadcasting to the interference potential of all-digital stations, as well as addressing the technical standards for all-digital AM stations. And because all-digital broadcasting would be on a voluntary basis, AM operators would be the ones deciding if transitioning is right for them."

The docket opened by the Media Bureau is No. 19-311, "All-Digital AM Broadcasting."

"POSITIVE STEP"

Downs was pleased. "I think this is a uniquely positive step in AM revitalization," he said. "We've talked for years about the rise in the noise on the AM band and how the quality of receivers has declined. But this is the first time we've had a chance to directly resolve both of these issues."

Getty Images/alengo

The approval of AM all-digital, he said, would provide "a technology that cleans up all the noise and hash we've been complaining about and sends an FM-quality signal out of the speakers."

Downs said he recognizes that all-digital would not be the right choice for every station. "We asked for a voluntary standard because of that." But he feels there are at least two circumstances where it makes a lot of sense.

One, he said, is for an AM station competing with music and that has an FM translator for "backup."

"In that case, the station would be able to compete with high-quality audio while the translator covered listeners who only have analog radios."

The other, he said, is a major-market station that wants to compete with music but hasn't been able to break through the low-fidelity reality of AM radio receivers.

"Plus it would be nice to see title, artist and album on the AM dial just like our FM friends," Downs said.

"There are enough HD radios being driven around now that it makes sense for operators to think about this step. Every HD radio that's been sold has the ability to receive AM all-digital. So do you take your chance with the 25% of cars with HD Radio or the shrinking percentage of people who listen to music on AM? It's a market-based decision."

Downs said he does not consider an all-digital option as the only answer to AM problems, rather a piece of the solution. "And it directly impacts the problem we face on the AM band. I'm glad the FCC realized that AM radio just wants a level playing field. This coming vote allowing all-digital AM is a chance to give AM operators a tool to compete."

Comment on this or any story. Email radioworld@futurenet.com *with "Letter to the Editor" in the subject field.*

Further reading: A Radio World ebook last spring explored possible implications of this possible development; find it under the Resources tab of radioworld.com, *click on Radio World ebooks.*

World Radio History

LPFM

(continued from page 1)

for non-profit organizations with limited engineering expertise and small budgets to readily apply for, construct and operate stations service highly localized areas."

Pai said the NPRM includes changes to increase flexibility while maintaining interference protection and the core LPFM values of diversity and localism.

The proposed rules would not be "a carte blanche for all LPFMs" to use directional antennas, said Michi Bradley, founder of REC Networks and an LPFM advocate who has pushed for rule changes.

Bradley said the main beneficiaries of the change would be a handful of LPFM stations near the Mexican border. Currently, stations within the Mexican border strip zone, within 125 kilometers, are limited to 50 watts ERP non-directional, Bradley said.

"The proposal would add a third category to allow LPFM stations to use DAs to limit power to 50 watts or less along radials that are within 125 km of the border and to allow the full 100 watts in directions away from Mexico," Bradley said.

The studio of WXOX, a low-power FM in Louisville, Ky., features a mural by Wilfred Sieg of the Art Cartel. WXOX is among the stations that filed comments to the FCC.

Another aspect of the proposed directional antenna changes is to permit, in certain cases, the use of composite directional antennas, as opposed to off-the-shelf models.

"This would give LPFM stations more flexibility to use antennas, such as the Nicom BKG-77, which are not listed in the FCC's standard pattern list, as well as use multiple skewed antennas in order to maximize coverage while still protecting second adjacents or meeting international agreements."

The FCC in its NPRM stated that

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THIS ISSUE

NOVEMBER 20, 2019

NEWS

LPFM Stations Seek Technical Upgrades 1
Symposium Examines Changing Radio Landscape 1
FCC to Explore All-Digital Option on the AM Band 3
Scarlet Knights' Station Gets a Fresh Start 6
Shulz and Nordstrom Made a Difference 10

FEATURES

They Don't Call Capacitors "Old Sparky" for Nuthin' 14
They Have Their Eyes on Engineering 16

BUYER'S GUIDE

Sweet Dreams, Sweet Streams 18
Tech Updates 18, 20, 22, 24, 26
StreamGuys Helps Atunwa Digital Help Broadcasters 20
StreamS Shines for Family Life Radio 22
WideOrbit Provides Podcasting for Federated Media 25

OPINION

How D-C Cranked Out All Those Tapes 28
Alexa Is in My Ears and in My Eyes 30

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it doesn't think the use of DAs will be widespread: "We believe that directional antennas, whether off-the-shelf or custom models, will not be used widely in the LPFM service due to their higher cost and limited necessity. Nevertheless, the use of such antennas could, if properly engineered, provide significant flexibility to LPFM licensees subject to international agreements and to those that must relocate in areas with few available transmitter sites."

The FCC is also contemplating a new definition for LPFM minor changes to include those that involve overlapping 60 dBu contours of the station's existing and proposed facilities or a move of 5.6 km or less.

In addition, the proposal would allow LPFM stations to retransmit their signals over FM booster stations without a waiver in order to fill in terrain-associated gaps in service. REC believes very few LPFM stations would benefit from having FM boosters but that in some cases it may help fill in certain gaps in challenged coverage areas.

EXPERT ASSISTANCE

A Radio World review of comments filed through early November showed many commenters urging the FCC to adopt the technical upgrades.

Steven White, director of Triangle Access Broadcasting, Inc., said the FCC's original goal of installing simple technical rules made sense under the circumstances.

"What became apparent was that, while the LPFM rules are comparatively simple, expert assistance was still required for many organizations that just don't happen to have the right balance of people within themselves," he wrote.

"If technical services are required anyway, then it is only proper to make the fullest use of those services and maximize the use of spectrum achieved with directional antennas."

Veteran broadcast engineer Dana Puopolo wrote, "I support this proposal because it is well past time the commission stop treating low-power FM stations as second-class citizens. No other class of full-power FM station, translator or booster has the amount of technical restrictions as low-power FM stations do.

"For example, no other FM facility is restricted to such a small operating power, use of directional antennas, certification requirements for transmitters, use of an arbitrary 12 kilometer buffer and other restrictions as low-power FM stations are. The low-power FM service has become a mature service. It should be allowed the same rights (and responsibilities) as any other FM service."

The Inge Davidson Foundation, licensee of WZML(LP) Bryn Mawr, Pa., wrote in support.

"For far too long, low-power FM stations have been at the bottom of the pecking order. No other class of full-power FM station, translator or booster has as many restrictions as low-power FM stations do," said Linda Davidson, chairwoman of the foundation.

Mike Starling, president and GM of Cambridge Community Radio and WHCP(LP) in Cambridge, Md., expressed support for the "common-sense LPFM technical improvements outlined in MB docket No. 19-193." Starling is a former director of technical operations at NPR.

VOICING CONCERNS

Other commenters, including full-power broadcasters, expressed concern about increased crowding in the FM band.

Representatives of Entercom Communications met with Chairman Pai recently and said that "certain modifications to the LPFM technical rules proposed in the Notice of Proposed Rulemaking ... could bring increased congestion to the FM dial leading to interference to full-power stations," according to a public filing.

The New Jersey Broadcasters Association reminded the commission of the need to "adhere to the obligations of secondary broadcast services" as it proceeds.

"Specifically, the obligation that secondary services not interfere with full-power radio broadcast stations," the NJBA wrote. "In addition, the need for further expansion and competition from LPFM services is dubious at best — given that the radio broadcasting industry has already been subjected to increased competition from the recently-enacted FM translator rule changes, digital media, satellite radio, podcasts, internet and other media sources."

The National Association of Broadcasters told the FCC, "NAB is concerned that the proposal to allow LPFM licensees expanded use of directional antennas could cause interference to full-service FM stations. We further object to the commission's proposal to grant a blanket authorization to LPFM operators to use boosters," the association wrote.

In addition, NAB supported the com-

(continued on page 6)

World Radio History

Scarlet Knights' Station Gets a Fresh Start

Rutgers University station WRSU has completed a digital overhaul of its systems

FACILITY PROFILE

BY PAUL KAMINSKI

WRSU(FM), 88.7 FM is the student voice of Rutgers University, with studios on the main campus in New Brunswick, N.J. The station broadcasts from the Student Center as it has done since 1969.

Over those 50 years, WRSU navigated the challenges inherent in using analog equipment that often was near the end of its life cycle. But originating a broadcast schedule that includes three daily newscasts, music shows, live performance programs and more than 150 local and remote sports broadcasts a year was difficult under any circumstances; and the station felt that its product needed more focus on its audio luster.

Mike Pavlichko is the broadcast administrator and advisor for WRSU. "Our main studio was done (rebuilt) 10 years ago, but nothing else had really been touched in 30 years," he said.

There were three 2-inch conduits interconnecting the studios; the conduits were full of wires, many of which weren't connected to anything after years of patches upon patches being applied to equipment to keep the station on the air.

Nick Straka's company NS Engineering had done projects for WRSU including a news production studio and a transmitter upgrade; he was called in to help plan what would come next. Straka is an SAS field applications and sales engineer, with much of his work done in the greater New York City area (there are large SAS installations at iHeart NYC, New York Public Radio, CBS News Radio, Fox News Radio and ESPN). Straka also heads broadcast integration company DNAV, along with Daniel Hyatt.

"The more we went through the planning phase, said Straka, "the more it became obvious to put the station on auto-pilot and gut everything out."

MASHED AND SMASHED

For two and a half months over the summer break in 2019, the station played recorded programs on the air while every bit of legacy analog wiring between the three studios was removed. WRSU transitioned from an analog plant with some digital sources, to an AoIP plant with some analog sources.

At the beginning, they found that legacy wiring was unlabeled, and used nonstandard connections.

"We found daisy chained distribution amps; each (audio) bus had a different AGC looped on it. By the time the audio got to the Orban Optimod 8600 at the transmitter, it had been mashed and smashed," Straka said.

After the removal of analog equipment and installation of the AoIP architecture, all audio between the studios (newsroom, production and air) is now carried on one Cat-6 cable in one conduit.

The heart of WRSU's facility is an SAS Core64 Audio Engine. Straka says the Core64 provides dependable flexibility and expandability for future expansion (up to 512 by 512 channels). "If more AES67/Dante capacity is needed, it's easy to slide in another card in the frame," he said.

When WRSU wanted to add a second preparation-and-playback personal

(continued on page 8)

Studio photo courtesy WRSU; signage photo by Paul Kaminski

Program Director Kelly Brecker, Music Director Bennett Rosner, DJ Blake Lew-Merwin, GM Justin Sontupe, Jake Ostrove (sports) from left, on the night of the first broadcast from the new FM studio. Station Advisor Mike Pavlichko said, "We played a legal ID followed by 'Suite: Judy Blue Eyes,' which also was the first song that we played when WRSU switched from carrier current AM to FM in 1974, followed by 'Turn Your Radio On' by The Suburbs."

Photo by Paul Kaminski

RCS Zetta automation and RCS GSelector training in the production room at WRSU. The automation and software gives the music programmers flexibility in scheduling, and helps maintain the station sound in certain dayparts.

LPFM

(continued from page 5)

mission's rejection of proposals to allow LPFM stations to increase power above 100 watts, which was suggested in REC Networks' petition.

REC Networks has asked the FCC to reconsider 250-watt stations (LP-250). Under its proposal, Bradley said, LP-250 would only be available as an upgrade to already licensed LP-100 stations and be considered a minor change. In addition, any LPFM station proposing LP-250, FM translator relief or LPFM-to-LPFM short-spacing would be subject to an interference remediation rule similar to the one recently adopted by the FCC for FM translators.

"REC's LP-250 proposal has been refined for many years, taking into consideration the input of NAB, EMF [Educational Media Foundation] and other opponents, and is statutorily sound," Bradley contended.

Numerous LPFM broadcasters, filing comments on the current petition, also brought up a desire for LP-250 to better serve local communities.

Sharon Scott, president of WXOX(LP), a volunteer community radio station on 97.1 MHz in Louisville, Ken., commented on her support for the boost to 250 watts.

"While reviewing LPFM rules, we hope you will consider increasing our maximum allotted power from 100 watts to 250 watts of effective radiated power at 100 feet height above average terrain. This modest increase would greatly improve our ability to deliver the diverse voices of our community to those whom it matters the most," Scott wrote.

Park Public Radio, which holds the license for KPPS(LP) in St. Louis Park, Minn., wrote, "Proposed rules do not substantially help the needs of incumbent LPFM broadcasters, and further reforms are necessary to address the unfavorable rules that LPFM operators face versus FM translator operators." KPPS' Jeff Sibert said he believes the commission should reconsider its tentative rejection of an LP-250 service.

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RUTGERS

(continued from page 6)

computer in the air studio for the morning show, the installation was no more complex than downloading a driver for the PC and connecting that PC to the SAS crosspoint map. That process took two minutes.

In the Main and Production studios, SAS 28.3 iSL consoles (bearing the Rutgers scarlet color) are installed in custom furniture from Studio Technology. Each of those consoles are connected to SAS Rio Bravo IP engines. All of the 24 main sources have their own faders, which makes training and operation easier for WRSU's students and community volunteers. Now any audio source in the plant can be called up for broadcast, and the consoles can be reconfigured quickly to meet programming requirements.

Photo by Paul Kaminski

The WRSU Air Studio was reconfigured when the legacy analog equipment, wiring and technical racks were removed. Custom furniture by Studio Technology and increased space allow guests and operator to face each other in the studio.

out during football and basketball seasons. Telephone connections are made through a Comrex STAC phone system.

The audio from the Student Center Studios feeds an STL consisting of a Harris Intraplex T1 as the main feed with Comrex BricLink as the backup. The STL feeds Orban Optimod 8600 processing. From there, WRSU uses two GatesAir FAX3 transmitters (main and standby) with ERP of 1,400 watts from a 190-foot tower on Rutgers property off Route 1. The station broadcasts from its original tower, three-bay antenna and concrete block building dating from its FM sign-on in 1971.

The cost for the upgrades for WRSU were estimated to be around $250,000.

The flexibility, digital wizardry and remodeling that went into this rebuild do more than future-proof the facility; they give the students an idea of what they may face in the broadcast environment off campus.

"That's what we want to give them, the real-world experience. They're going to go out and they're going to have a leg up for that internship. They're going to know how to use an automation system and audio over IP."

Paul Kaminski, CBT, has been a Radio World contributor since 1997. Twitter: @msrpk_com *Facebook:* PKaminski2468

Photo by Nick Straka

The Core64 connects WRSU's Air, Production and News studios through a single length of Cat-6 cabling. The Core64 allows operators and engineers to fine tune program source selection and intercom/talkback choices on the fly.

For more flexibility, Henry Engineering Multiports are installed in each studio, so programmers can connect their audio sources from personal music collections, and play those sources through the console. Denon DN-C635 CD players were recycled from the previous installation.

The 50-year-old space in the Student Center is concrete block, so moving walls to facilitate the installation wasn't possible. Technical equipment was installed in the main studio. Once that equipment was relocated, Straka says Studio Technology took custom measurements to design and build an air studio that, for the first time, allowed guests to sit across from the hosts.

General Manager Justin Sontupe said, "We are kind of the college radio sound. If you go on Spotify, you can find different playlists, top 40, etc. Here, we have some of the not-as-popular music, not as mainstream. What you hear on 88.7, you're not going to hear elsewhere." To help Sontupe and the music department support that content, WRSU installed an RCS Zetta automation system with RCS Gselector music scheduling software.

Photo by Paul Kaminski

With one of these Henry Engineering Multiport Audio Interfaces in both the Main and Production studios, programmers of specialty shows can bring their own music on a jump drive or laptop. The bi-directional interface makes it easy to aircheck as well.

Automation is used to run overnights and assist with live programming. The RCS system is being loaded with a library of tens of thousands of songs to reduce the reliance on CD playback, or worse, streaming a song from YouTube. Once the library is in place, students will learn voice tracking to fill the overnight hours.

Connections to the outside world are made with Comrex Access and Access NX codecs, which get a work-

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Shulz and Nordstrom Made a Difference

Remembering two engineers and mentors who were friends and respected colleagues

BY TOM VERNON

Not long ago, two very well known broadcast engineers left us, both part of the U.S. radio technical community. Their lives were intertwined; and they died within days of each other.

Radio World gathered memories from friends and colleagues of Warren Shulz and Jeff Nordstrom.

"TOUGH, BUT FAIR"

Warren Shulz, chief engineer of WLS(AM/FM) and WFYR and WKFM(FM) in Chicago, passed away at the end of 2018 at age 72, following a long battle with prostate cancer. He was a 1964 graduate of the Chicago Vocational High School. Shulz later earned a bachelor's degree in electrical engineering technology from Purdue University. He retired in 2012 after 50 years as chief engineer of WKFM, WYFR and WLS(AM/FM).

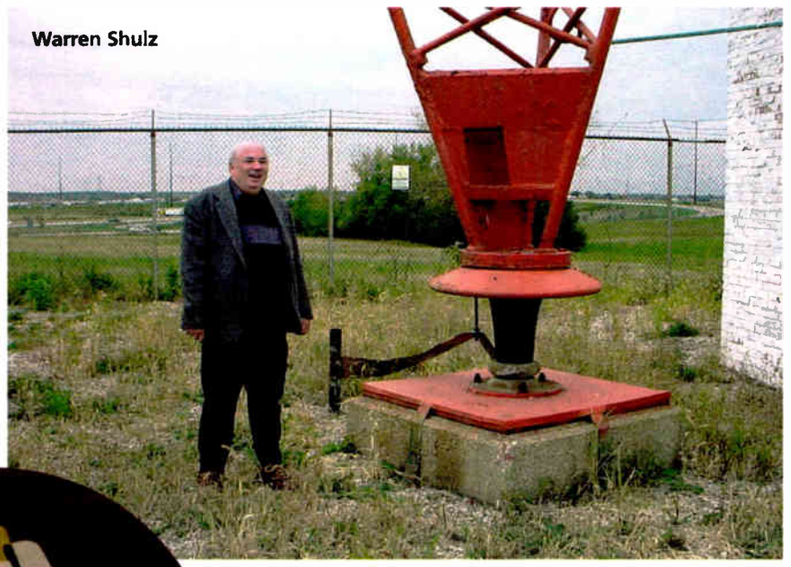
Shulz was a lifetime member of the Institute of Electrical and Electronics Engineers and the Society of Broadcast Engineers, a member of the National Association for Radio and Telecommunications Engineers and the Audio Engineering Society. He was also a past board member of the Federal Emergency Management Agency (radio division) and ham radio operator WA9GXZ. He enjoyed camping and riding his homemade electric bicycle.

Linda Baun, vice president of the Wisconsin Broadcasters Association, recalled Shulz as a regular at their annual Broadcasters Clinic.

"Warren would travel from his home to attend the clinic in his RV. I always received his posts after the conference, commenting on the caliber of the educational sessions — he was tough, but fair."

Colleagues remembered Shulz acting as a mentor to those less experienced, always willing to share his time and expertise.

Art Reis of RadioArt Enterprises said, "Warren was a mentor to any who needed assistance. He famously helped out the CE at KFI Los Angeles, who was having problems with his Continental 317C, by sending him all his notes and documentation on the 317C he had here at WLS. The knowledge he got helped him greatly in solving his problems.



Warren Shulz

Warren Shulz was rarely without his plastic pocket protector, with at least one screwdriver inside. Family members sent it to friend Mark Heller, president and owner of WGBW and WLAK in Green Bay, Wis.

"Warren always had or took the time to help others, and he could go on for an hour or more on the phone helping out. I know because I was the beneficiary of quite a number of those phone calls. His knowledge was beyond that of almost anyone else I knew in the business back in the day. One of our compatriots in the business once told me, 'If you're going to get help from Warren over the phone, my advice is to pack a lunch.' That was true, but we loved it. Sitting and learning at Warren's proverbial feet was a true treat and a gift."

Shulz was also known for the sound quality and competitiveness of his stations.

Bob Gorjance, a former Harris sales rep, recalls a story involving Shulz and Gary Shrader, then the CE of WCLR(FM).

"Gary bought a solid-state FM exciter and audio processor from me. Several days later, Warren calls and said he wanted to see me ASAP. When I stopped by his office, he asked me if I'd seen Gary lately. I nodded silently, yes. He then asked me if he had bought something from me. Again I silently nodded 'yes.' He said, 'I want the same thing.' I filled out the order form and silently pushed it over to him and he signed it.

"Warren had heard a big difference in the sound of WCLR, and wanted to stay competitive with Gary. A few days later, Gary called, asking if I had visited Warren."

RICH CAREERS

Jeff Nordstrom got to know a great number of engineers through his work as manager of the satellite equipment sales division of Harris/Allied. He suffered a heart attack last December at age 67, just a few days before Shulz passed away.

The two were close friends, first becoming acquainted through Nordstrom's work for Harris/Allied.

Nordstrom started his radio career at Racine Park High School, and was an alumnus of the University of Wisconsin-Stout in Menomonie. He was a member of the Society of Broadcast Engineers since 1973. He did a vari-

(continued on page 13)

Courtesy Eric M. Wiler

Jeff Nordstrom

World Radio History

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World Radio History

BTS

(continued from page 1)

ranging from IP connectivity to network security, remote monitoring, emergency alerting and regulatory matters.

Frank Foti led off presentations on a day of the conference devoted primarily to radio, with an update on the initiative by the Telos Alliance to assist broadcasters in moving to all-IP transport platforms.

"I just recently finished up some pretty cool research work that I want to share that ties in with (the transport of) the FM multiplex signal," said Foti. "Moving from multiplex over AES 67 to IP is a natural progression, and (this) technology slashes the amount of bandwidth needed for distribution by nearly 84 percent to a remarkable 320 kbps. It's a remarkably efficient payload."

Frank Foti. "With this [µMPX] technology we're able to get that 1 dB loudness legally."

Foti said that the µMPX technology was designed for FM transmission applications and was devoid of traditional psychoacoustic artifacts, with those that were generated being masked by the FM reception process. He also noted that by using the technology, which supports the embedding of the pilot, FM broadcasters could gain 1 dB greater loudness in their signals.

"In the FM stereo system (with) 100 percent modulation, it's basically 90 percent audio and 10 percent pilot," said Foti.

David Layer. "We needed to characterize the performance of MP11 before it's supported by manufacturers of receivers and transmission equipment."

"In this system we're embedding the pilot instead of adding it. The equivalent would be modulating at 110 percent to get that added loudness. With this technology we're able to get that 1 dB loudness legally. I'm not up here to (push) loudness, but we live in a competitive world. This is dense audio; you shift it 1 dB and the program director says 'Wow'! In an age where broadcasters are fighting in every way to retain listeners, I think added loudness is a benefit to the industry."

MP11

The NAB's David Layer teamed with Xperi's Harry Chalmers to provide a report on testing of a high bitrate (100 kbps core and 48 kbps non-core) HD Radio operating mode that was defined in the NRSC-5 IBOC standard but had not been tested until now.

Layer noted that the testing was a cooperative effort of Xperi, Nautel and NAB Pilot, and utilized the Pilot radio test bed set up at the Cavell, Mertz & Associates offices in Manassas, Va.

Some 120 broadcast engineers, equipment manufacturers, academics and students traveled from as far away as Japan and South Korea to attend this year's BTS Symposium.

As explained by Layer, this MP11 mode accommodates hybrid analog/digital broadcasting and operates within the same RF bandwidth (193.3 kHz) as the established MP3 transmission mode.

"We needed to characterize the performance of MP11 before it's supported by manufacturers of receivers and transmission equipment," said Layer. "The first five modes of FM HD radio have always been supported, but there was no software written for this sixth mode (MP11)."

The main objectives of testing were to determine the impact of the MP11 digital sidebands on the mainstream FM analog audio signal and the RDS component, as well as the possible effect of the analog FM signal on MP11 digital sidebands.

Layer said that part of the testing involved using real-world program formats (including classical, country, urban and others) in addition to periods of silence (no modulation) and discrete tones (for measuring signal-to-noise ratio). The testing utilized six different FM receivers (a mix of analog-only and HD Radio-capable) and compared performance of the MP11 mode with established MP1 (no extended sidebands) and MP3 (some extended sidebands) modes of operation.

Chalmers revealed that the signal-to-noise performance of one of the receivers used was inconsistent with that of the others, and that the analog-only receivers involved were most affected by the MP11 signal.

"We spoke with the manufacturers, and they said that this was correctable," he said.

Layer said that in listening tests, any differences in analog component performance that might have been caused by the MP11 component were not noticeable, and that the study to determine effects of the analog FM signal on the MP11 signal was equally encouraging.

"The results were quite positive," he said, adding that iHeartMedia is now doing some field testing, with station WTUE in Dayton, Ohio, acting as host.

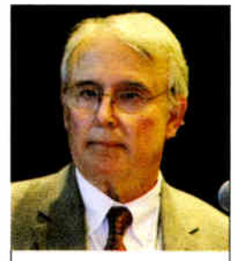
Alan Jurison, senior operations engineer, engineering and systems integration with iHeartMedia and chair of this IEEE Broadcast Symposium session, said that iHeartMedia "did a driving test from Cincinnati to Dayton and the results were good. At the time of the symposium, WTUE has been operating (with MP11) for some 90 days and there have been no listener or automobile manufacturer complaints."

Harry Chalmers. "As a result of this study, Xperi is planning to commercialize this technology. We're now including MP11 in all chip uploads that we give to manufacturers."

Chalmers added, "As a result of this study, Xperi is planning to commercialize this technology. We're now including MP11 in all chip uploads that we give to manufacturers."

AM PROTECTION CONTOURS

In the conference devoted to regulatory matters, the FCC's 2018 Second Further Notice of Proposed Rule Making (NPRM) addressing "revitalization" of the AM broadcast band came under the spotlight, with a report by Tom Jones of the Carl T. Jones Corp. consulting firm.



Tom Jones. "The tradeoff is pushing noise away from your transmitter while creating interference elsewhere."

He said that this second NPRM focused on changes to protection contours of existing Class A 50 kW stations, and would affect their protected operating contours during all operating modes (daytime, critical hours and nighttime), and reported that a large amount of feedback had been received during the comment period.

"Numerous thoughtful and informative comments were received in response to this 'Second Further Notice,' both in support of, and in opposition to, the proposed changes in interference protection afforded to Class A stations." He said the most complete technical comments opposing the rule changes had come from a group called the AM Radio Preservation Alliance, and the most technical comments had been filed by several engineering consulting firms.

Jones presented a list of the various pros and cons offered by the two dissenting groups, which include "adoption of the proposed change to the daytime contour for Class A stations would potentially allow other Class B and D stations on the channel to substantially increase their daytime power and thus better serve their communities" and "failure to protect a Class A AM station's 0.1 mV/m daytime groundwave contour would eliminate massive amounts of current AM service, while only resulting in modest gains for non-Class A stations."

He said that some of the strongest comments opposing the rule change came from the Federal Emergency Management Agency. FEMA said that such changes would "decimate the system developed and funded by FEMA, under the mandate of Congress, for a robust communications distribution network (allowing U.S. citizens to receive) under all conditions, a presidential message in time of national emergency."

FEMA added that millions of dollars had been invested on this network, "which is reliant on skywave signal coverage by Class A AM stations."

Jones said, "I would advise anyone interested to review these comments, which are on the FCC's website." If the changes were to be enacted, "the tradeoff is pushing noise away from your transmitter while creating interference elsewhere."

World Radio History

ENGINEERS

(continued from page 10)

ety of jobs in radio, from disc jockey to chief engineer. Nordstrom worked at stations in Washington, Wisconsin, Illinois and Indiana. In 1983, he joined Allied/Harris Broadcast in Indiana. He started working for Clear Channel Colorado in 2000, and later Westwood One, from which he retired in 2018.

Like Shulz, he was a frequent attendee at the Broadcasters Clinic and made regular presentations.

Nordstrom also loved gardening and a bit of farming. He enjoyed the Denver Botanical Gardens and looking at antique radio equipment, and was an active member of the Rocky Mountain Chapter American Theatre Organ Society. He also enjoyed riding his motorcycle.

Industry veteran Chuck Kelly recalled that Nordstrom had a great sense of humor, which sometimes extended to practical jokes. "I was always in awe of the technical operations at the Chicago stations. I on the other hand was employed by a poor AM-FM combo where nothing worked right, including the directional AM antenna system. I constantly lived in fear of an FCC inspection.

"One morning, the receptionist buzzed my office, letting me know that the FCC was waiting to speak with me up front," Kelly continued. "I briefly thought of running out the back door, but finally decided to head up to reception and face the music. I was surprised to see Jeff Nordstrom in his motorcycle jacket, laughing in the lobby, when I came out. I don't think he ever knew how petrified I really was."

In this industry, paths tend to cross many times, Kelly said.

"So it was with Warren and Jeff. They both continued to impress me not only with their technical knowledge and skill, but with uncommon humility and warmth in careers lasting nearly 40 years. Losing these two friends leaves a void not easily filled."

Mark Burg, assistant engineer, recalls Nordstrom for his attention to detail.

"My very first contact with Jeff was a phone call I initiated to him following a highly detailed parameter chart I made up to track legal and out-of-parameter readings of a three-tower AM directional near Oshkosh that Jeff had been engineer-in-charge of in the 1970s and early '80s. It was during that discussion that he informed me that I had made a mistake and had made the chart too broad in the parameters. He highly suggested that I needed to trash that chart and start over.

"Ever since that moment, I have every effort to double-check my math, the facts and spellings. Jeff's point has always stuck in my mind: Double check what you're doing, even if it looks correct and great on paper. It's the 'practice' and the implementation of that information that really matters."

WBA's Baun reflected, "Success has many meanings. In my opinion, success is measured in your willingness to give of yourself. Growing, caring and sharing with others that need your time and expertise is never a waste. The rich careers of Jeff and Warren made a difference to many in this ever-evolving industry."

Read several past commentaries by Warren Shulz at www.radioworld.com/author/warrenshulz. *Comment on this or any article to* radioworld@futurenet.com.

Courtesy Eric M. Willer

"Minions" moment with the Dial Global team in 2012. Jeff Nordstrom is third from left at rear.

World Radio History

They Don't Call Capacitors "Old Sparky" for Nuthin'

Also, Kevin Wagner shows how to restrict building cooling space and save money

WORKBENCH
by John Bisset
Email Workbench tips to johnpbisset@gmail.com

We've written about electrolytic capacitors lately. I found a funny video of what happens when you mistakenly connect the "+" voltage to the negative terminal of an electrolytic in a simple flasher circuit. Take a look online at *https://tinyurl.com/rw-work-cap* (and don't try it at home).

No identities of where this submission originated. After all, we've all probably experienced this or seen it happen to someone not respecting that "+" symbol.

While we're on the subject of capacitor education, have you heard of ultra-capacitors? A brief tutorial explains the ultra-capacitor and its ability to store tremendous amounts of energy. Watch it at *https://tinyurl.com/rw-work-cap2*.

Also discussed is ESR, Equivalent Series Resistance, which we've covered in this column. ESR is a small internal resistance that limits current. In the case of the ultra-capacitor, the ESR is an amazingly low 7 milli-ohms! This means the ultra-capacitor can discharge hundreds of amps.

Capacitors of this size are used to dump hundreds of amps quickly; one application is handling the sudden stops and starts in electric cars. In the experiments in the video, you can see them used to vaporize bits of metal and circuit board traces. These are powerful components, not to be played with, as you will see. In addition to explaining some capacitor theory, the video demonstrates how dangerous innocuous components like capacitors can be.

SDRplay has released a software update that allows you to scan a wide swath of bandwidth using a software-defined radio.

Paul Sagi writes from Malaysia that the company SDRplay has released a software update that allows you to scan a wide swath of bandwidth using a software-defined radio. For those new to this technology, SDRs replace traditional components like mixers, filters and amplifiers inside a receiver using software on a personal computer to replicate those component effects.

This new software permits rapidly scanning in 10 MHz (or less) chunks over the SDRplay's frequency range. It's a software-defined spectrum analyzer! See *www.rtl-sdr.com/tag/spectrum-analyzer-2* for more info.

Paul writes that years ago he had equipment on the bench and physically adjusted tuned circuits. Now that function is all handled in software, which makes sense; tuning a filter simply changes the mathematical function of the filter, and computers now have the capability to perform the math quickly enough.

Fig. 1: Home Depot has a clamp assortment every engineer can use.

My Telos colleague (and SBE board member) Kirk Harnack found a virtual bonanza for engineers at Home Depot! It's a 22-piece reinforced spring clamp set, made out of fiberglass nylon. The best part? The set costs less than $10 for 22 clamps! These aren't cheap clamps, either. They have non-slip grip handles and vinyl tips to protect the work they are gripping.

At *homedepot.com*, enter 302755768 in the search field to find this.

Readers who have seen my Workbench presentations for the SBE may remember using the spring clip on a clipboard to hold components while soldering. With the variety of sizes in this set, there's a clamp for any size job.

You know how important it is to conserve your resources, even if it's

(continued on page 16)

World Radio History

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NEW AM Monitor Receiver

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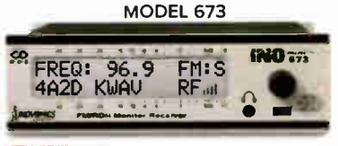

NEW FM/RDS Monitor Receiver

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MODEL 661

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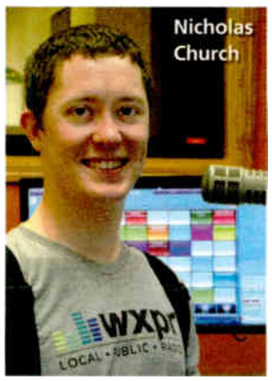
They Have Their Eyes on Engineering

Ennes Educational Foundation Trust names recipients of scholarships

The Ennes Educational Foundation Trust recently awarded four scholarships for 2019.

The Harold E. Ennes Scholarship, Robert D. Greenberg Scholarship and John H. Battison Founder's Scholarship are awarded to individuals interested in continuing or beginning their education in broadcast engineering and technology. The Youth Scholarship is for a graduating high school senior interested in broadcast engineering as a career.

Each scholarship awarded is for $1,500.



This year the Harold E. Ennes Scholarship recipient is Nicholas Church of Rhinelander, Wis.

"In May 2019, Nick began working as the director of operations and technology at WXPR(FM), the public radio station in Rhinelander, Wis.," the trust stated in the announcement.

"He has a B.A. in music with a management studies concentration from St. Olaf College and is drawn to technology including amateur radio, microcontrollers, programming and creating efficiency through automation. After earning his SBE Certified Radio Operator, Nick began his broadcast education towards achieving the SBE Certified Broadcast Technologist and Certified Broadcast Networking Technologist certifications."

The Robert Greenberg Scholarship recipient is Chris Gamelin of Middletown, Conn.

"His interest in broadcasting began when he was 12. He learned how radio worked and started his own internet radio station and collected money to build a professional studio. He has improved his radio skills at WNHU(FM), the University of New Haven (where he met John Ramsey) and WQUN(AM) at Quinnipiac University."

Gamelin is a student at the University of New Haven, hoping to finish his part-time schooling soon. Ramsey encouraged him to get involved in the engineering part of broadcasting. "He

has since worked as an assistant engineer at Entercom, and is now a maintenance technician at WFSB(TV). He has since learned to operate UAVs as well."

The John H. Battison SBE Founder's Scholarship has been awarded to Sadie Levy of New York. She recently graduated from Fiorello H. LaGuardia High School of Music & Art and Performing Arts, where she worked on various school productions as a Digital Media Department intern.

"Additionally, she was awarded scholarships to study digital electronics in pre-college programs at both The Cooper Union and New York University. This past summer, Sadie completed a media internship in a New York City government office. These opportunities made her realize that she would love to contribute to the exciting field of recording and new media. She plans to major in electrical engineering, with an interest in media production, at Northeastern University in Boston."

Sadie Levy

Andrew Marcus Heller

Andrew Marcus Heller of Two Rivers, Wis., received the Youth Scholarship. His father owns two AM radio stations; Andrew was the first person to turn on WTRW's solid-state transmitter (at age three) and then again, now WGBW's 12 kW transmitter at Denmark, Wis., when he was 11.

"Andrew has been involved in his high school audio/video efforts, and was the director of the student daily announcements his senior year. With a 3.9 grade point average in his senior year, Andrew was accepted to the Science and Engineering program at the University of Minnesota-Twin Cities. He selected Minnesota because of its strong engineering emphasis."

SBE President Jim Leifer, CPBE, said, "These four rising engineering talents have earned their educational awards through the Ennes Educational Foundation Trust, and it's an honor for us to help them achieve their educational goals in broadcast engineering."

WORKBENCH

(continued from page 14)

cool air. Kevin Wagner is the operations director for Eagle Communications in St. Joseph, Mo. Not long ago, Kevin invested in a new, smaller transmitter, and the upgrade left him with a large empty room.

The snag was that he was now cooling all that empty space. He needed an inexpensive means to reduce the size of the conditioned area. Sure, he could have built a wall, but what if a future tower lessee required the empty space to be cooled again? Fig. 2 show's Kevin's solution.

You see these plastic flaps used in refrigerated storage areas in supermarkets; they keep the cool air contained, but the overlapping flaps can be parted to permit entry into the cooled area. Plus, the fact that the plastic flaps are clear, you can see if someone enters the building while you are working.

These freezer curtain strip sets run between $80 and $200, depending on your size requirements. Search "freezer curtain strips" on Amazon or Google.

Readers enjoyed the EAS loop antenna project we told you about from Ken Beckwith, EMF field engineer. Several readers have inquired about the physics behind the wiring method used; Ken has been gracious enough to explain.

The question dealt with grounding the shield of the conductors. In Ken's design, the shield on the wiring is the *primary* of a transformer that actually receives the AM signal. The wire conductors form the *secondary* of the transformer, and provide the signal to the RF connector going to the receiver. If the shield was not grounded, there would be no voltage generated in the loop.

Not everyone knows all the tricks and tips you've used for years. Share your ideas in the pages of Workbench — help other engineers while you qualify for SBE recertification credit. Send tips and high-resolution photos to johnpbisset@gmail.com.

John Bisset has spent 50 years in the broadcasting industry and is still learning. He handles western U.S. radio sales for the Telos Alliance. He holds CPBE certification with the Society of Broadcast Engineers and is a past recipient of the SBE's Educator of the Year Award.

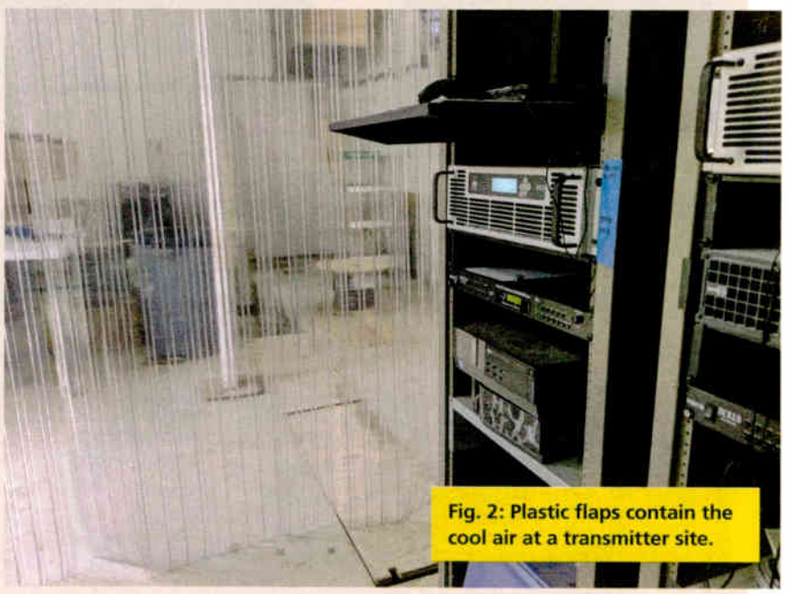


Fig. 2: Plastic flaps contain the cool air at a transmitter site.

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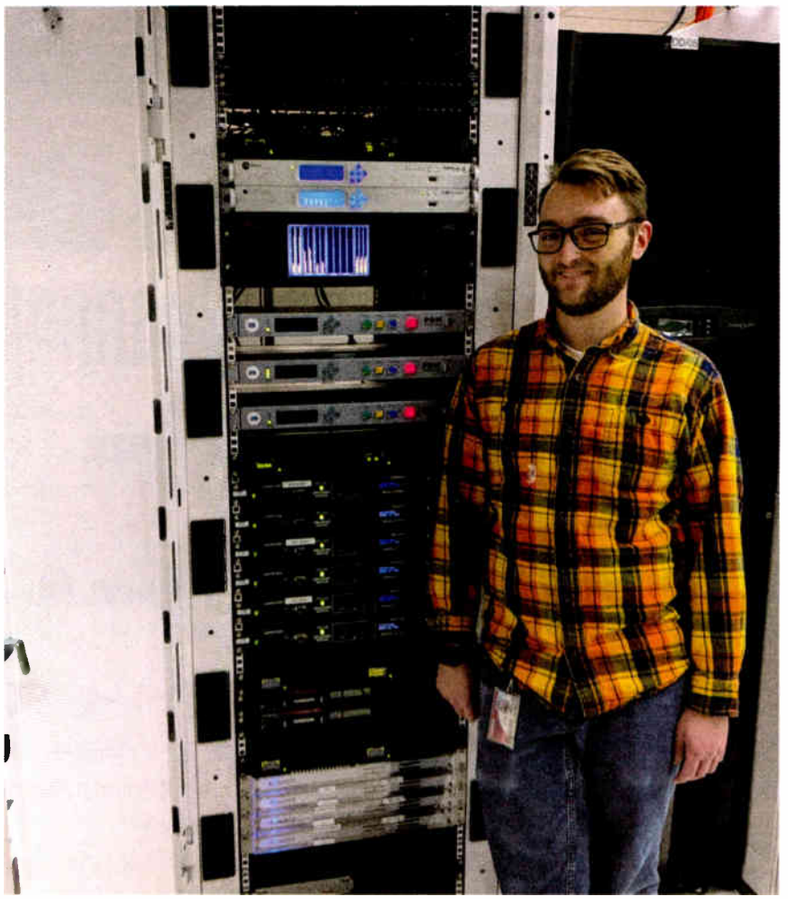
World Radio History

Sweet Dreams, Sweet Streams

Wisconsin Public Radio finds reliability with Telos Z/IPStream R/2

USERREPORT

BY ERIC BARTOS
Broadcast Engineer
Wisconsin Public Radio



MADISON, Wis. — It's undeniable that streaming radio, something that has been around for quite a while, is steadily becoming more and more important in our daily lives. Especially when you consider the huge influx of smartphones and smart speakers in the market over the past five years.

Until recently, it has required quite an investment to stream your radio station online, both in terms of equipment and in the time it takes to configure the server properly. Let's face it, streaming can be a bit of a pain to get going for engineers of any skill level, even with the most basic setup possible.

When we started discussing how to improve our streaming configuration at Wisconsin Public Radio, I was tasked with finding an easy-to-use, robust and reliable solution that would integrate with our new audio over IP installation. I had considered using a custom-built system with custom software to run the stream, but the problem with custom solutions is that 90% of the time they are not easy to use and not as reliable as they need to be. Ruling out custom solutions led me on the search for a mysterious box that did it all, one that had the reliability, ease of use and tight integration with our AoIP system we were looking for.

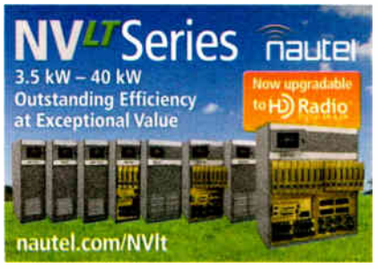
This search ended with the Z/IPStream R/2 from The Telos Alliance, the streaming encoder that satisfied all of the requirements and more. The R/2 allows us to reliably integrate directly with our AoIP network with a simple web interface while leaving the option open for analog or AES inputs.

There were several things that set the Z/IPStream out from the competition. Most notably is the option to have Omnia.9 processing built into the box, letting you really get full control of your station's streaming sound. If you don't need the full power of the Omnia.9, there is an Omnia-based three-band processor available in the box as well.

Another factor that sets it apart is the ability to run multiple different stream-encoding settings with the same audio source with multiple different output types like Icecast, SHOUTcast or RTMP servers without even having to think about if you are running the correct software. I can honestly say the R/2 lets me sleep better at night. I know that if we need to change streaming providers, all I have to do is set up the stream in the easy-to-use web interface, and we will be up and running in minutes rather than hours or days if we had to configure or build a new streaming box just to change providers.

I believe it is critical to invest in a proper streaming infrastructure; it may be just as important as a transmitter in the coming years. While streaming radio is changing the way radio stations work, there is one thing that will never change, whether the equipment is analog or digital, living at a transmitter site or in a datacenter: Engineers will always need a solution they can rely on for critical applications. For Wisconsin Public Radio, the R/2 is just that. It has been running in our datacenter for close to six months and it has been exactly what we needed for a reliable and powerful streaming solution.

For information, contact Cam Eicher at The Telos Alliance in Ohio at 1-216-241-7225 or visit www.telosalliance.com.



TECHUPDATE

ORBAN OPTIMOD-PC 1101E SIMPLIFIES RADIO STREAMING

The Optimod-PC 1101e audio processing card is designed for use with digital transmission media such as radio streaming channels.

The unit comes with a variety of presets, speech/music detection and PreCode Technology to minimize artifacts caused by low bitrate codecs and, according to the company, is easy to set up.

It also features a digital mixing function, which Orban says is "crucially important for an internet radio broadcaster who needs to control commercial content and insertion."

Optimod-PC lets users mix an analog source, two digital sources and two WAV sources. For example, the processor allows users to run a playout system on one's computer while using the three hardware inputs for a live microphone feed, commercial insert and network insert.

Alternatively, operators can run the commercial insert playout software on the same computer as the main playout system, using Optimod-PC's second WAV input to separately route the outputs of the two playout systems to the card.

Orban adds that Optimod-PC is useful for users with multiple streams because it allows them to load one computer with as many Optimod-PC cards as there are free PCI slots, each card handling one stereo program.

For information, contact Orban in Germany at +49-7141-2266-0 or visit www.orban.com.

World Radio History

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World Radio History

StreamGuys Helps Atunwa Digital Help Broadcasters

Streaming services and tools maximize digital revenues for international audiences

USERREPORT

BY MAC MAISON, PARTNER
AND MAMUNA OYOFO, PARTNER
Atunwa Digital

NEW YORK AND GHANA — Headquartered in New York with key personnel based in Africa, Atunwa Digital is a digital network that advises media enterprises on monetization strategies. We develop full-scale digital marketing and advertising strategies, helping clients from planning to execution and analytics.

Two years ago, we launched our initiative to help African audio content publishers better leverage digital distribution and advertising opportunities to get the most monetization value from their content. We find that while a lot of African media enterprises have loyal, global audiences listening to their content regularly, they do not possess the in-house technical expertise nor advertising capacity to fully realize its built-in value.

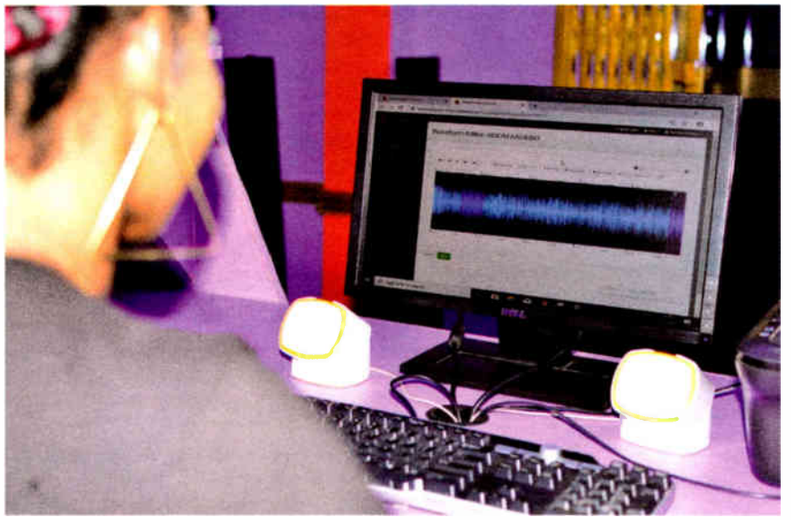
We were seeing a trend where many of these organizations were leaving revenue on the table by receiving only a small percentage back from their streaming or podcasting service provider.

COLLABORATION

We set out to address this issue by helping creators of African content reach both their local and diaspora audiences through online streaming, with the ability to serve geo-targeted advertising to their listeners, all while taking control of their digital future.

To do this, we needed to find an audio streaming technology provider who could supply not only the tools and infrastructure needed for online delivery, but also the support and expertise that our customers would need as they develop their own digital media autonomy. We wanted to work with a company that we could depend on for support, while collaborating with us to design the optimal streaming workflows for our clients.

A recommendation from one of our partners led us to StreamGuys, and we determined that they would be an ideal fit. In addition to having great tools, technology and support, they were willing to deal with us on a collaborative level. We now use the complete suite of StreamGuys services and solutions, from their robust content delivery network to their analytics tools.



At Atunwa, our advertising offerings span both programmatic and direct sales approaches, as we have established relationships with both multinational and local brands looking to reach the African demographic globally. StreamGuys' integration with industry-leading ad platforms allows the insertion of dynamic, server-side, targeted advertising into our clients' live streams and podcasts.

The targeted addressability of the ads is particularly valuable in capitalizing on revenue opportunities from the African diaspora living in the United States, Europe and other markets, as that audience receives spots that are relevant to them.

Another significant challenge faced by African content providers has been unauthorized redistribution of their content. It is crucial that content owners regain control of their streams and have visibility into their daily earnings. Unauthorized usage leads to revenue being taken away from the original content owners.

StreamGuys' tools including the SGPassKey system enable our clients' streams to be restricted to authorized distribution partners and are also integrated into StreamGuys' embeddable SGplayer media player, giving us end-to-end security for both affiliate and consumer delivery.

The SGrecast live stream repurposing system enables our clients to turn live productions into on-demand podcasts, with automatic template-based publishing ensuring they are submitted correctly to aggregators. The fact that StreamGuys' dynamic advertising capabilities are unified across both live streams and podcasts is advantageous; rather than managing two separate systems, podcasts just become a seamless extension of live operations.

The results of working with StreamGuys have been impressive. As an example, they have enabled us to deliver over tenfold growth in the monetization of radio content online for respected Ghanaian media organization Multimedia Group Limited, as well as significantly growing their digital traffic by taking back control of their content. Across five key MGL stations, monthly total listener hours increased by 152% and monthly cume by 96% in their first month of full operation with StreamGuys, and both metrics more than tripled over the past 18 months.

There has always been significant value in African content providers' programming. Our goal with Atunwa is to build a digital network whereby we become the most trusted monetization source for African content publishers and the resource for brands/advertisers looking to connect with African audiences globally. StreamGuys' streaming technology and expertise have allowed our clients' digital media operations to become more independent, unlocking that value through the power of digital advertising.

For information, contact StreamGuys at 1-707-667-9479 or visit www.streamguys.com.

TECHUPDATE

INOVONICS 610 MONITORS THE INTERNET

The Inovonics 610 Internet Radio Monitor is a hardware solution providing uninterrupted monitoring for quality and performance of an online internet radio stream.

Unlike a consumer-grade "internet radio," the 610 provides balanced analog and AES digital outputs, self-logging alarms that constantly check for audio loss, stream loss and Internet loss. A tuner decodes audio and displays live metadata for MP3, Ogg Vorbis and AAC formats.

The front panel displays left and right audio metering, local LED alarms and an OLED screen with jog wheel for advanced control and editing of tuning and monitoring parameters. Rear-panel alarm tallies provide local alarms, and online notifications alert personnel with email or text messages when any of the three alarms occurs.

The 610's web interface allows setup and control of the unit from your PC, tablet or smartphone, and reliable two-way connectivity is ensured with a built-in Dynamic DNS utility.

For information, contact Inovonics in California at 1-831-458-0552 or visit www.inovonicsbroadcast.com.

World Radio History

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World Radio History

StreamS Shines for Family Life Radio

Broadcaster likes in-house control and lite platform

USERREPORT

BY ETHAN GEERDES
Broadcast IT Manager
Family Life Radio

TUCSON, ARIZ. — At Family Life Radio, we have developed a strategy to put more resources into our online streaming platforms. We explored many fine products, providers, services and distribution methods; but in the end, we opted to host the online radio stream ourselves so that our product wouldn't change if we changed provider.

My colleague Michael Bové introduced me to a friend of his, John Schaab at Modulation Index, which is turning our vision into a reality.

When I saw that the StreamS encoder was Windows-based, I initially was turned off by it due to the notorious reputations of some Windows updates. However, upon further discussion, I learned that Modulation Index uses a professional specialized, slimmed-down version of Windows 10 called LTSC [Long Term Servicing Channel] with which they then utilize a script eliminating even more unnecessary functions, making it more of an OS skeleton to house their product.

Modulation Index uses a professional specialized, slimmed-down version of Windows 10 called LTSC.

The StreamS encoder does not need the same maintenance as a typical computer would, which alleviates the problem of installing updates upon a reboot of the machine.

After we got our demo unit, the configuration process was easy to accomplish with the documentation provided. There was minimal troubleshooting, and the expertise at StreamS-Modulation Index got us up and running quickly.

We have a stream set up securely sending an HE-AACv2 HLSdirect stream at 32 kbps via FTPS to a cloud-based server we rent from VULTR and have leveraged Cloud Flare as our CDN. The changes we are implementing are not only driving our financial overhead down but this solution consumes less bandwidth for our listeners, allowing for them to listen longer on their mobile devices or favorite music platform. We are still in the process of launching our new product and we have never been more excited.

For information, contact John Schaab at Modulation Index at 1-940-206-7702 or visit www.streamindex.com.

TECHUPDATE

NEW AOIP STREAMBLADE FROM WHEATSTONE

Wheatstone now offers a streaming appliance for its WheatNet-IP audio network that addresses psychoacoustical characteristics of lossy codecs to get the best possible audio performance across streams.

StreamBlade is a 1 RU blade unit that features AoIP, audio processing and selectable codecs including Opus and AAC for targeting a range of user devices and players. It is controlled via a web/network interface (see screenshot above).

Unique to StreamBlade, Wheatstone says, are a two-band final limiter section made for streaming that removes hard limiting or clipping from the processing chain; a stereo width management section that produces a perceived stereo field without big swings in dynamic L–R that can skew the codec algorithm; and a five-band AGC designed for streaming applications that eliminates aggressive RMS attack times, which can interfere with codec performance. Bass boost and monaural bass features are onboard for optimizing the quality of the bitstream.

The result, the company says, is a fuller sound with crisper highs and deeper bass. StreamBlade accepts eight input sources of native IP audio directly from a WheatNet-IP audio IP driver, each capable of four outputs for a total of 32 total output streams. StreamBlade is cloud-ready and compatible with standard CDN and streaming platforms, including Icecast.

For information, contact Wheatstone in North Carolina at 1-252-638-7000 or visit www.wheatstone.com.

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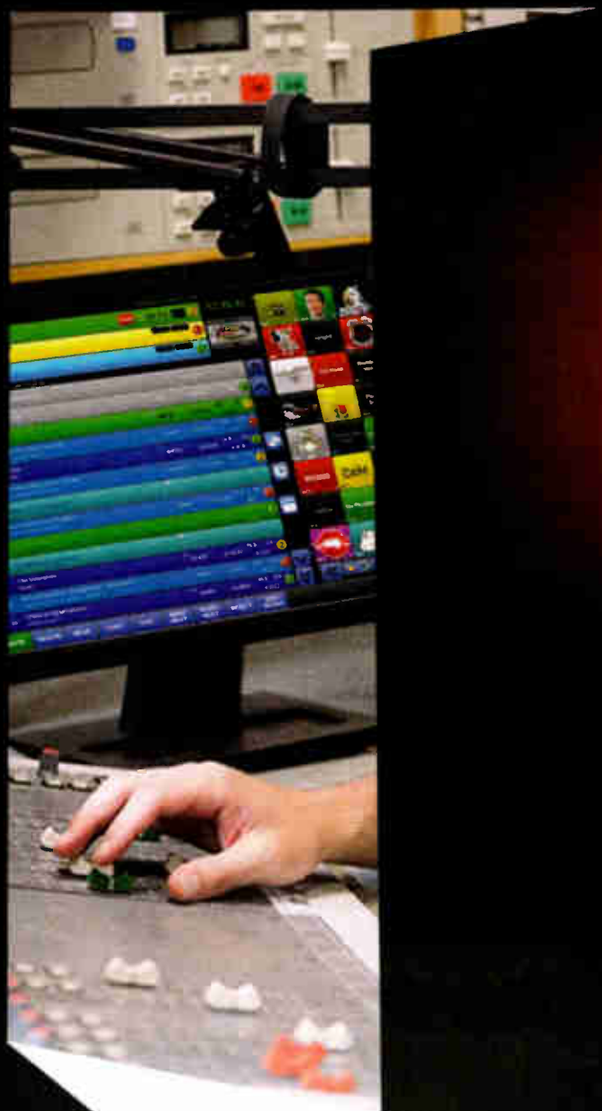

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World Radio History

TECHUPDATES

COMREX ACCESS NX RACK AND ACCESS MULTIRACK OFFER STREAMING FEATURE

Comrex is now shipping Access NX Rack, the newest codec in its Access line. Comrex is also accepting orders for Access MultiRack, a new AoIP multichannel codec capable of five full-duplex connections.

Both Access NX Rack and MultiRack feature AES67-compatibility, redesigned hardware and a new HTML5-based user interface. Access NX Rack has the option of analog, AES3 or AES67 audio I/O. MultiRack has the same options for the first codec, while codecs 2–5 must be delivered via AES67.

Access NX Rack and MultiRack are designed to send and receive audio over IP networks in real time. The company says they're often used for live interviews, to establish STLs, for remote broadcasts, along with other applications that require live audio transmission.

Importantly, they also offer the ability to act as a source feed for both SHOUTcast and Icecast servers — with a single unit, users can expand their radio presence to the internet without the need for a dedicated PC.

Both Access NX Rack and MultiRack can be configured as a streaming server. They can deliver multiple streams to computer-based media players that support HE-AAC — up to 40 streams over a T1 internet connection at once. Both codecs can connect to Wi-Fi and 4G modems, and support a range of connection protocols and audio encoders. They are compatible with all Comrex IP audio codecs as well as the Comrex FieldTap smartphone app.

The units are built around Comrex CrossLock technology, a proprietary reliability layer. CrossLock features a suite of tools that solidify connections over IP networks, including forward error correction, AR and what Comrex describes as the industry's most advanced adaptive management engine.

For information, contact Comrex in Massachusetts at 1-978-784-1776 or visit www.comrex.com.

TARGETSPOT OFFERS PODCAST TOOLS

Targetspot says that its Podcast platform is a turnkey solution for podcast creators to distribute, monetize and manage their content.

The Podcast platform imports a user's podcast episodes by ingesting old RSS feeds or by syncing through cloud storage providers like AWS. Transcoding and normalization needs are automatically met in accordance with regional standards. Content management is handled within the platform through an intuitive interface and point-and-click functionalities.

To facilitate monetization, the company says, Podcast platform allows users to stitch ads into their content as they are downloaded from a content delivery network while maintaining high download speeds. The UI allows users to position ad breaks manually within their content or algorithmically through tone detection. Courtesy of proprietary audience targeting platform Bluebox, the ads benefit from the Targetspot's targeting capabilities, the company says. Users have access to a suite of dashboards for keeping track of their audience growth and monetization. The Podcast Platform allows users to upload, list and distribute their podcast across a large range of players like Apple Podcasts, Google Podcasts, Spotify and Soundcloud.

For information, contact Targetspot in New York at 1-212-631-0500 or visit www.targetspot.com.

PRODUCTS & SERVICES SHOWCASE

World Radio History

WideOrbit Provides Podcasting for Federated Media

Services integrate well with other modules from WideOrbit

USERREPORT

BY KRYSTAL VIVIAN
Director of Digital Content
Federated Media

Krystal Vivian

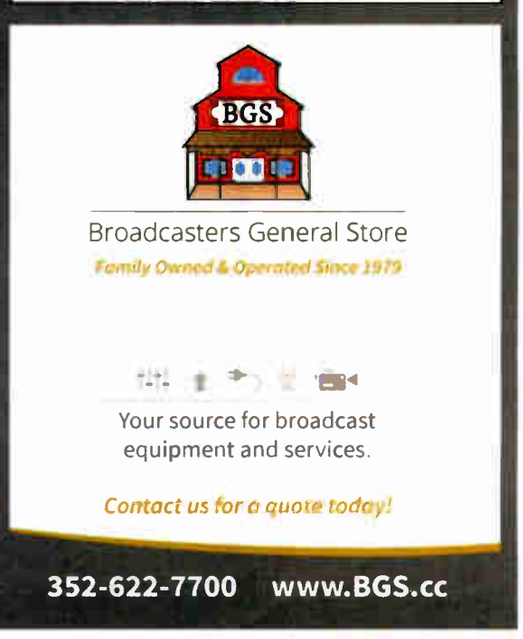
MISHAWAKA, IND. — In the summer of 2016, we launched our podcasting network to augment our growing linear and live streaming businesses. As our network grew, we had several opportunities to monetize our podcasting content with deeper sponsorships and requests to target ads across episodes and devices. While our existing podcasting solution was sufficient for basic functionality such as hosting multiple podcasts, organizing content by station, and uploading feeds to podcast directories, it lacked the advanced functionality to keep up with the growing popularity of podcasts and the associated demand from advertisers. Furthermore, our staff felt the existing monetization software was not intuitive or user-friendly and required complicated, manual ad insertion.

In 2019, after testing multiple alternate podcasting solutions, we decided to expand our relationship with our long-time media operations partner, WideOrbit. Their WO On Demand product could provide Federated Media the necessary advanced monetization functionality to scale our podcasting business immediately. Transitioning over to WO On Demand was simple because WO Streaming had been our live streaming platform for many years and, on the linear broadcast side of the business, WO Traffic was our system of record for some time.

Because our staff was already comfortable with the WideOrbit interface and workflow, training for WO On Demand was simple and quick. The workflow is a natural extension from WO Streaming for both our end users as well as our engineers. In addition, we have the flexibility to manage and monetize our content in many new ways. Today, we can offer: ad insertion for podcasts at the show, station or network levels; streamlined file management to update intros, promos and sponsorships; Dynamic station ID tag insertion for an enhanced listening experience; and "Broadcast-to-Podcast" ability to auto-create podcasts from previously recorded original content.

WideOrbit has been a trusted and reliable partner on many levels. They continue to evolve their products as the media landscape shifts and I'm looking forward to improvements such as repurposing on-air content into podcasts with separate dynamic ad insertion; adding an embeddable player for our website, blog and social media; and reducing ad load by optimizing ad placement and balancing with content.

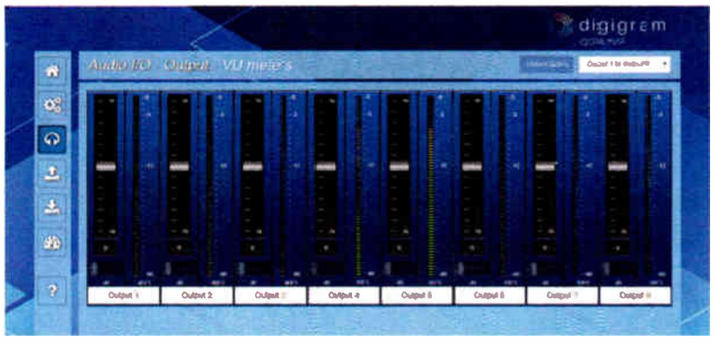
For information, contact WideOrbit at 1-415-675-6700, Option 2, or visit www.wideorbit.com.



World Radio History

TECHUPDATE

DIGIGRAM IQOYA *VIP EASES IP RADIO



Digigram says its IQOYA *VIP software brings flexibility to the way users manage, connect and deliver content for radio.

A scalable solution, IQOYA *VIP provides comprehensive audio routing along with IP audio streaming, encoding and decoding. It helps telcos and content delivery networks (CDNs) to design end-to-end IP audio transcoding and routing functions, opening doors to "radio-as-a-service" solutions.

In addition, says the company, by offering easy integration of IP streams, it adds value to automation system providers and radio stations.

IQOYA *VIP is hosted on a server in the cloud and brings studio facilities to one's fingertips. It features simultaneous encoding/decoding, with transcoding capabilities, encoding of multiple audio streams, multiformat IP live streaming (including RTP/UDP, MPEG-TS, and Icecast/SHOUTcast) and stereo audio or multichannel I/O.

IQOYA *VIP runs under Windows or Linux. The service can be operated through a web GUI or a web service API. Once setup, it's autonomous, hidden inside the system. When used as part of an automation system, IQOYA *VIP works just like any standard audio device.

For information, contact Digigram in France at +33-4-76-52-47-47 or visit www.digigram.com.

ABOUT BUYER'S GUIDE

Radio World publishes User Reports on products in various equipment classes throughout the year to help potential buyers understand why colleagues chose the equipment they did. A User Report is an unpaid testimonial by a user who has already purchased the gear. A Radio World Product Evaluation, by contrast, is a freelance article by a paid reviewer who typically receives a demo loaner. Do you have a story to tell? Write to **brett.moss@futurenet.com**.

NEXT MONTH:

Antennas; Transmission Line & Support; Power Protection

BROADCAST EQUIPMENT EXCHANGE

RADIOWORLD November 20, 2019

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CCA FM8000G Trans 107.9, great cond; 4-Bay Jampro antenna w/deicers; 3-bay Shively antenna FM. D Brockman, 606-965-3436.

AUDIO PROCESSING (INCLUDES ON-AIR)

WANT TO BUY

Teletronix LA-2A's, UREI 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.

Wanted: real plate reverb. abgrun@gmail.com.

MICROPHONES/ HEADPHONES/ SPEAKERS/AMPS

WANT TO SELL

1934 RCA 77A double ribbon microphone, originally used by Arthur Godfrey at WFBR Baltimore. 100% perfect condition. Contact Bill Cook, 719-684-6010.

WANT TO BUY

RCA 77-DX's & 44-BX's, any other RCA ribbon mics, on-air lights, call after 3PM CST, 214 738-7873 or sixtiesradio@yahoo.com.

MISCELLANEOUS

WANT TO SELL

UPGRADE consoles to international specs with world standard Weston 30B illuminated 4" vu meters. 4 in like-new condition. GramOphone@earthlink.net

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 is from the 1950's – 1970's, BO. Must purchase entire collection. Contact Ron, 925-284-5428 or ronwtamm@yahoo.com

WYBG 1050, Messina, NY, now off the air is selling: 250' tower w/building on 4 acres; 12' satellite dish on concrete base; prices drastically slashed or make offer. 315-287-1753 or 315-528-6040

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MISCELLANEOUS

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Wanted: ITC interconnect cables between ITC cart machine and record amp. Manual and idlers for Harris CB-1201 turntables. Don, k8drs1@gmail.com

Equipment Wanted: obsolete, or out of service broadcast and recording gear, amplifiers, processing, radio or mixing consoles, microphones, etc. Large lots preferred. Pickup or shipping can be discussed. 443-854-0725 or ajkivi@gmail.com.

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

I'm looking for KFRC radio special of Elvis Presley which aired on January 8, 1978. I'd be willing to pay for a digital copy. Ron, 925-284-5428.

I'm looking for KTIM, AM,FM radio shows from 1971-1988. The stations were located in San Rafael, Ca. Ron, 925-284-5428.

I'm looking for the Ed Brady radio show in which he did a tribute to Duke Ellington, the station was KNBR, I'd be willing to pay for a digital copy. Ron, 925-284-5428.

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 SanFrancisco 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 KSFX radio shows, Disco 104 FM, 1975-1978. R Tamm, 925-284-5428.

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

RECEIVERS/ TRANSCEIVERS

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

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1960s-vintage MacKenzie Repeater machines, magazines, spare parts and manuals, complete or "parts" machines considered, James, 870-777-4653.

Schnader telescriptions 16 mm musical films produced in the early 50s. Bill Cook, 719-684-6010.

Large or small collections of 16" transcriptions or 12" transcriptions, not commercial LPs. Bill Cook, 719-684-6010.

Standard Short-tune series. Bill Cook, 719-684-6010.

(2) LPFM radio stations for sale, located in the NW part of central Florida on the gulf coast, covers the county, get out of the cold weather, come to Florida, call or write for particulars, 352-613-2289 or email boceey@hotmail.com or Bob, PO Box 1121, Crystal River, FL 34423.

RF CONNECTORS

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RF CONNECTORS & GADGETS – Parts, Products & More! www.W5SWL.com

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BE 35kW FM, and QEI 3.5kW FM. Make an offer on either or both. All working when removed. Steve Tuzeneu 704-973-0438 (9 a.m. to 4 p.m., Monday-Friday) or stuzeneu@bbnmedia.org

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World Radio History

How D-C Cranked Out All Those Tapes

Looking back at the production of automation music programming media at Drake-Chenault

TECHHISTORY

BY HANK LANDSBERG

The author was director of engineering at Drake-Chenault Enterprises Inc. from 1974–1989.

A recent Tom Vernon article ("The Time Has Come to Talk of Many Things, of Reels and Carts and Carousels, and Automation Things," Oct. 23, 2019) touched on the history of automation. At the invitation of Radio World, I'd like to share thoughts about my own experiences that readers may find interesting.

Drake-Chenault Enterprises was a successful producer of music formats for automation, with about 300 clients stations across the country. The production of music programming tapes for automated radio stations at Drake-Chenault evolved into a highly regimented process that produced a polished, consistent product week after week, month after month. A typical automated broadcast station could be airing tapes that were anywhere from one week to one year old. There needed to be absolute consistency in programming, studio engineering and tape duplication in order for the final product to sound seamless on the air.

Dan Musselman loads the Tape Duplicating System.

Closeup of custom audio console (designed by the author).

Terry Tretta in Studio E.

In 1974, Drake-Chenault produced music tapes for several formats: XT-40 (Top-40), Hit Parade (AC), Solid Gold and Classic Gold (Oldies) and Great American Country. There were two "house announcers" who did the voicing for these formats. Billy Moore voiced XT-40, Hit Parade, Solid Gold and Classic Gold formats; Bob Kingsley voiced Great American Country. Once a week, Billy and Bob would come to the studios and record the voice tracks (VTs) for all the music reels to be produced that week. The music librarian would pull the LPs and 45s that were needed for each reel. The studio engineers would then mix the music from records with the VT tape to produce a finished master reel. The masters were recorded using 1-mil tape, so we got up to 90 minutes, usually 20–25 songs, on a 10-inch reel.

ONE SECOND EARLY

Broadcast automation equipment of the '60s and '70s was usually limited to "easy listening" music formats, because the hardware of the era wasn't capable of executing a tight, fast-paced pop music format. With easy listening, it was OK if there was some silence between songs; not so with Top-40! Top-40 needed tight segues, jingles, spots, time announce, weather and other elements in rapid succession. The problem was how to make an automation system run tight and quick?

The answer was developed by D-C: We put the 25 Hz "cue" tones at the end of each song *one second early*, so the automation equipment had a "one-second head start." This would compensate for the start-up delay of the reel-to-reel playback decks, and yield tight segues without any "wow-in."

The next challenge was to figure out how to put those inaudible 25 Hz tones at the end of each song, but *precisely one second early.* The answer will explain why we used multitrack mastering decks in the D-C studios.

Master tapes were recorded at 7.5 inches per second on custom three-track recorders. At the end of each song on the tape, a cue tone was recorded *on a separate track.* However, it *wasn't* the usual 25 Hz cue tone and it *wasn't* recorded one second early. It was a 1 kHz tone that was recorded in "real time," i.e., at the logical segue point for the song, *not* one second early. Because this tone was audible (through a "cue" speaker) and was on a separate track, it was easy for the studio engineer to place it at the proper segue point, tight against the end of the song. The cue tone could be re-recorded as necessary until it's placement was appropriate to the song ending. The one-second advance would happen when the master tape was duplicated.

Drake-Chenault's standards for technical quality were absolute, and our studio engineers were perfectionists. We carefully watched levels, double-checked cue tone placement, fixed fades and *manually edited out tics and pops!* The studio staff would spend *hours* with a razor blade removing tics, pops and other noises that were common on vinyl records. LP tracks were often used (after editing, to match the 45 "hit" ver-

World Radio History

Closeup of a three-track mastering recorder.

sion) because the quality of LP vinyl was usually superior to the poly-plastic used to press 45 rpm singles.

To ensure technical consistency, a full set of Level, EQ and head alignment tones were recorded at the head and tail of each master tape. We went to great lengths to be sure that there was no phase error in the audio, which would cause a degraded signal when a stereo station was heard on a mono receiver. All audio was checked using a vectorscope to ascertain mono-compatibility. We would often discover phase error in 45s and LPs; it was corrected before transferring the audio to a master tape. The turntables were equipped with Shure V15 cartridges and Marantz "audiophile" preamps. The audio path was clean and direct, without any "house EQ" or level compression. Voice tracks were recorded using Shure SM7 microphones.

Custom three-track heads used on mastering recorders.

DUPLICATION

Once a master tape was produced, we made second-generation copies that were shipped to our client stations.

Tape duplication was done in-house, using 25 Technics RS1500 two-track recorders. The system ran "tails-out" so the audio was actually being recorded in reverse. A three-track master deck was used to play the master tape, which had left, right and cue channels. When the system sensed a 1 kHz cue tone on the master tape, it triggered the 25 Hz tone, which was injected into the left channel audio. When the 1 kHz master cue ended, the 25 Hz tone generator would *stay on for one additional second*, hence "stretching" the 25 Hz cue tone so it started exactly one second *before* the 1 kHz cue on the master. This one-second pre-roll was controlled electronically, so it was exact and consistent.

The duplicating system produced copies that were flat to 15 kHz, and typically had less than 30 degrees of phase error at 10 kHz. To achieve this level of quality, *each* "slave" recorder was hand-aligned to *each* new "pancake" of tape *before* the duplication process was started. The duplicating engineer would align the record head of *each recorder* for zero phase error. Then the master tape would be started and the duplication process would begin. After duplication, *each* tape copy's alignment tones were checked on a special "QC" deck. We again verified level, stereo balance, EQ and phase (head alignment) before the tape was shipped.

Drake-Chenault produced about 1,000 music format reels each week. In the 15 years I was there, we never missed a deadline!

For more details, visit *www.drakechenault.org* and click on "Behind the Scenes in the Production Dept."

ALEXA

(continued from page 30)

The second product may have a ring of familiarity to it: Alexa-enabled glasses. Now, if this sounds a little like the ill-fated Google Glass from a few years back, we're thinking along the same lines.

These Amazon glasses — dubbed **Echo Frames** (shown below) — allow you to converse with Alexa without having to take your phone out or look at your wrist. As Wired suggests, this might allow you to interact with Alexa in places that are phone-inappropriate — movie theaters, gyms or at a restaurant (although that rarely stops people these days). Unlike Google Glass, you can get a prescription filled with Echo Frames, so you can actually see what's in front of you while chatting with your favorite voice assistant. The price? $180 is the number, and Amazon will be beta-ing these eye wearables this fall.

And the other new Amazon gadget that resonated for me, sort of, is **Echo Loop** (shown above). I've tested similar products at CES these past few years, where you put a "ring" on your finger, wave it around, and things happen (the TV volume goes up and down, etc.). Amazon's ring product is a little different. It has two mics and you speak into it to connect with your bud, Alexa. That seems a bit odd — speaking to a ring, but then again, Dick Tracy spoke into a watch, and now many of us do every day.

But Amazon isn't just thinking gadgets with Alexa — they're focused on personality. The Amazon team also announced that Samuel L. Jackson is now the first celebrity replacement voice for Alexa on Echo-embedded devices. At a cost of just 99¢, the star of many Quentin Tarantino films and endless Capital One commercials can tell jokes, set timers and even play music. It turns out there's a clean and an "explicit" version of Jackson available, depending on your sensibilities and whether there are children or bosses around.

This is apparently the beginning of a personality program for Alexa, as other voices from the worlds of sports, entertainment and music — like Cardi B and Harrison Ford — will be available in Amazon's updated version of ring tones for Alexa devices.

Echo Frames and Loop photos courtesy Amazon.com

FANCIFUL NOTIONS

Amazon's rush to "productize" Alexa makes you wonder what other products they're cooking up that would go well with voice commands. That might mean connecting Alexa with things we do several times a day — eat. And thus, it's not surprising there are rumors of food-related applications in the Echo pipeline, designed to combine some of our favorite activities.

Echo 'Za is one of these — a clever way of enjoying your favorite music or radio station while you scarf down a pepperoni pizza. You can definitely see a bidding war breaking out between Domino's, Little Caesars, Pizza Hut and Papa John's to see who will nail down the Alexa naming rights.

But my favorite rumored Alexa beta product is all about how many of us start our days — and no, I'm not talking about turning on a radio station. Perhaps the most mind-blowing Alexa application is rumored to be embedding its voice technology into coffee cups, items that many people carry around all the time, from Seattle to Sarasota.

I'm thinking **Echo Caf** could be the next breakout product for Amazon's growing line of Alexa items, a unique way to combine our addiction to caffeine with our addiction to giving voice command orders to invisible devices and hoping for a positive result. Alexa, order me a "Skinny grande frappuccino."

At CES in January, we'll be on the lookout for the next line of Amazon Alexa products, with an eye — and ear — on how Google will respond, hopefully with clever, innovative products of their own. Maybe Amazon's Echo Frames will signal the resurrection of Google Glass, which would make me happy. Mine has been gathering dust since I took the plunge back in 2014, spending an obscene amount of money to be one of the first to try on a pair of these techie specs. My Google Glass is still in great shape, hardly used, and well-maintained.

Make me an offer.

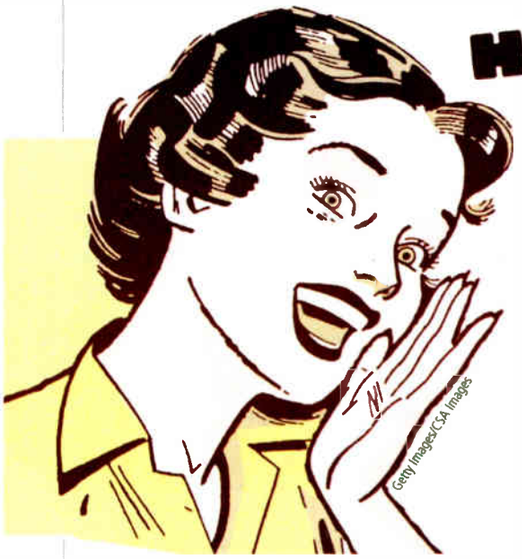
If you're still reading, I made up those last two Alexa products. Who in their right mind would embed a voice assistant in pizza boxes or coffee cups?

This article originally appeared at https://jacobsmedia.com/blog.

World Radio History

Alexa Is in My Ears and in My Eyes

When it comes to Alexa devices, Amazon may have outdone itself in September



COMMENTARY

BY FRED JACOBS

The author is founder of Jacobs Media.

It used to be Apple's big announcements were what captivated the tech industry — and the rest of the world. And not to take anything away from iPhone 11, but Apple's been making a pretty cool phone with most of these features for some time now. There hasn't been a lot of *whiz-bang, oh wow!* news coming out of Cupertino lately.

The action is happening over at Amazon, where new Alexa-ish products keep on rolling out. Surprisingly, media coverage of Amazon's recent media event in Seattle paled in comparison to what Apple gets out of their new product extravaganzas.

But when it comes to Alexa devices, Amazon may have outdone itself in late September.

KEEP AN EYE ON VOICE

Of course, everything revolves around Amazon's voice products as it continues its drag race with Google in this space. Oddly enough, Google does well outside the U.S. But here in America, it's an Amazon-dominated landscape. (And where's Apple when it comes to voice?)

That's why it's important for everyone in radio to keep pace with how "voice" is growing and changing — in much the way the industry was hyperfocused on social media and mobile just a decade ago.

That's because "voice" is moving fast as a discovery/usage engine, and yet, many radio brands and companies are not thinking about it all that much. But they should be.

We've talked about Amazon's Echo Auto product — the cheap (under $25) aftermarket add-on that brings Alexa into vehicles. It's being distributed by "invitation only" (whatever that means). I haven't gotten my hands on one of these yet (although I ordered mine back in the winter), but I know a number of you have. And you've been kind enough to give me your reviews of this new device.

KUPD's visionary head of programming, Larry McFeelie, shot me a note after his Echo Auto showed up. Here's his take:

"Quite frankly, it was a clunky experience and I'm not sure I understand the necessity for having Alexa available in the car. The unit comes with a mount that magnetically holds the Echo Auto and connects to your air conditioner vent. Then you have a power cable that sticks out of the side and they even include a cigarette lighter power charger with extra USB ports in case you have other items to charge. Even still, this felt like I was plugging things into things into things with cables hanging off of stuff. It just felt too 'after market' for my taste.

"The Echo Auto uses your phone (and Alexa app) for internet access and if your phone connects via Bluetooth, the Echo Auto can transmit its messages directly through your phone's audio. So it's not like it's taking up your connection in the car, it just needs to be there to transmit messages through your phone. If you don't have Bluetooth, they included a 3.5 mm auxiliary cable you can connect directly into the unit.

"Other than requesting 'Flash Briefings' and ordering more garbage on Amazon, I wasn't able to find too many things that the Echo Auto could do ... that my iPhone couldn't. It's nice to tell Alexa to 'play 98KUPD,' but I can just as easily hit the 98KUPD app on my phone. The unit came with a free audio book from Audible, but again, why couldn't I just use the Audible app on my phone?

"Anyway, that's my short, quick review on the new Amazon Echo Auto. I don't think it will be taking the world by storm. Just my two cents."

At times, it seems like Amazon may be throwing techie spaghetti at the wall to see what sticks. That became evident at September's event where several new "Take Alexa with you wherever you go" products were introduced. It's hard to say which, if any, will still be around in a year or two. But that seems to be part of the Amazon game plan.

LIFESTYLE TOOLS

The first of the these new Alexa-powered peripherals is **Echo Buds** (shown below) — earbuds that instantly connect you with Alexa (and apparently even Google Voice and Siri).

Yes, this is how Alexa gets in your head — literally. The buds are wireless, of course, with Bose noise reduction technology. (You can tap a bud to cancel the feature when you're ordering a latte.) The price? About $130, shipping in time for the holidays, oddly enough.

(continued on page 29)

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meet RUBY

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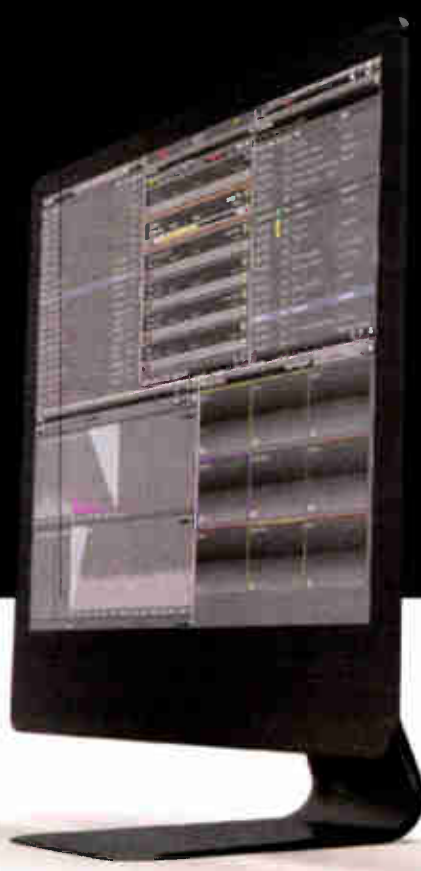

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