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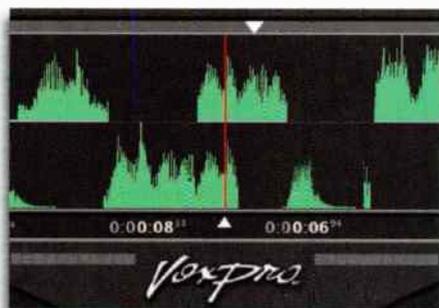
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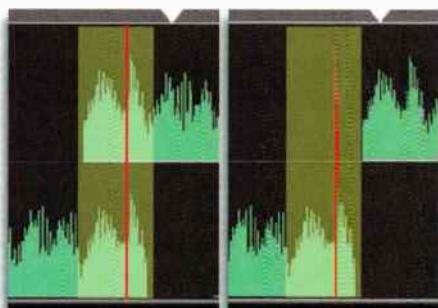
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5 Surprising Places for IP Audio

It's getting late. Do you know where your audio network is?

Your audio network could be going places and doing things you might not be aware of, from remote sportscasts and for STLs to hanging out in malls, convention centers and auditoriums.

Modern audio networks are being used for a slew of new applications because of newer, smarter I/O units. For example, WheatNet-IP BLADE-3s combine integrated control with audio tools such as mixing and audio processing at every connection point in the network for a multitude of possible uses.

It's almost like having a complete studio in 1RU wherever you need one.

And with AES67 now promising to interface your network to just about any audio device out there, there's no telling where IP audio will be off to next.

For the entire story... INN28.wheatstone.com

AoIP Tip: Gaming the System

If you are doing some serious sports coverage this season, here's a tip.

You can create a map of all your sports venues through one customized Screen Builder interface for your WheatNet-IP audio network, and click between them to bring in feeds, set processing, and call up mic presets.

All you have to do is arrange faders, knobs, buttons, clocks, timers, meters, events and other widgets in a drag and drop environment. Then link widgets to hardware such as microphones, codecs, and consoles located in the network and determine what each widget does using a simple Script Wizard.

For the entire story... INN28.wheatstone.com



Clearing the Air on Loudness

Did we hear you say, "Let's start an audio cleanliness war?"

"I want to start an audio cleanliness war...Who is with me?"

It was music to our ears when we saw these words posted on the Facebook "I Love Broadcast Audio Processing" discussion page recently. If only!

In many ways, we at Wheatstone have been slowly working our way toward that day when ears no longer bleed and modulation monitors look like they're glued to 100%.

So while we've built into our audio processors the tools you need for both a loud and an open and clear sound on the dial, so much more can be done. Even with so many AirAura's, VP-8's and FM-55's in the field, it's time to talk about what it takes to create clean audio on the radio -- something that can be applied no matter what type of processor you use.

For the entire story... INN28.wheatstone.com



He Who Listens, Likes!

You're going to love how BestRadio Brazil measures listenership, and we think you'll like the studios too!

What's not to like about independent online station BestRadio Brazil in São Caetano do Sul, São Paulo, Brazil?

The music is eclectic, the sound is distinct, and the studio is magnificent. BestRadio Brazil is using WheatNet-IP audio routing and control with an IP-12 digital audio console, which pulls double duty for live webcasts as well as for production purposes.

For the entire story... INN28.wheatstone.com



MAKING THE ABSOLUTE BEST IN RADIO FOR OVER 35 YEARS

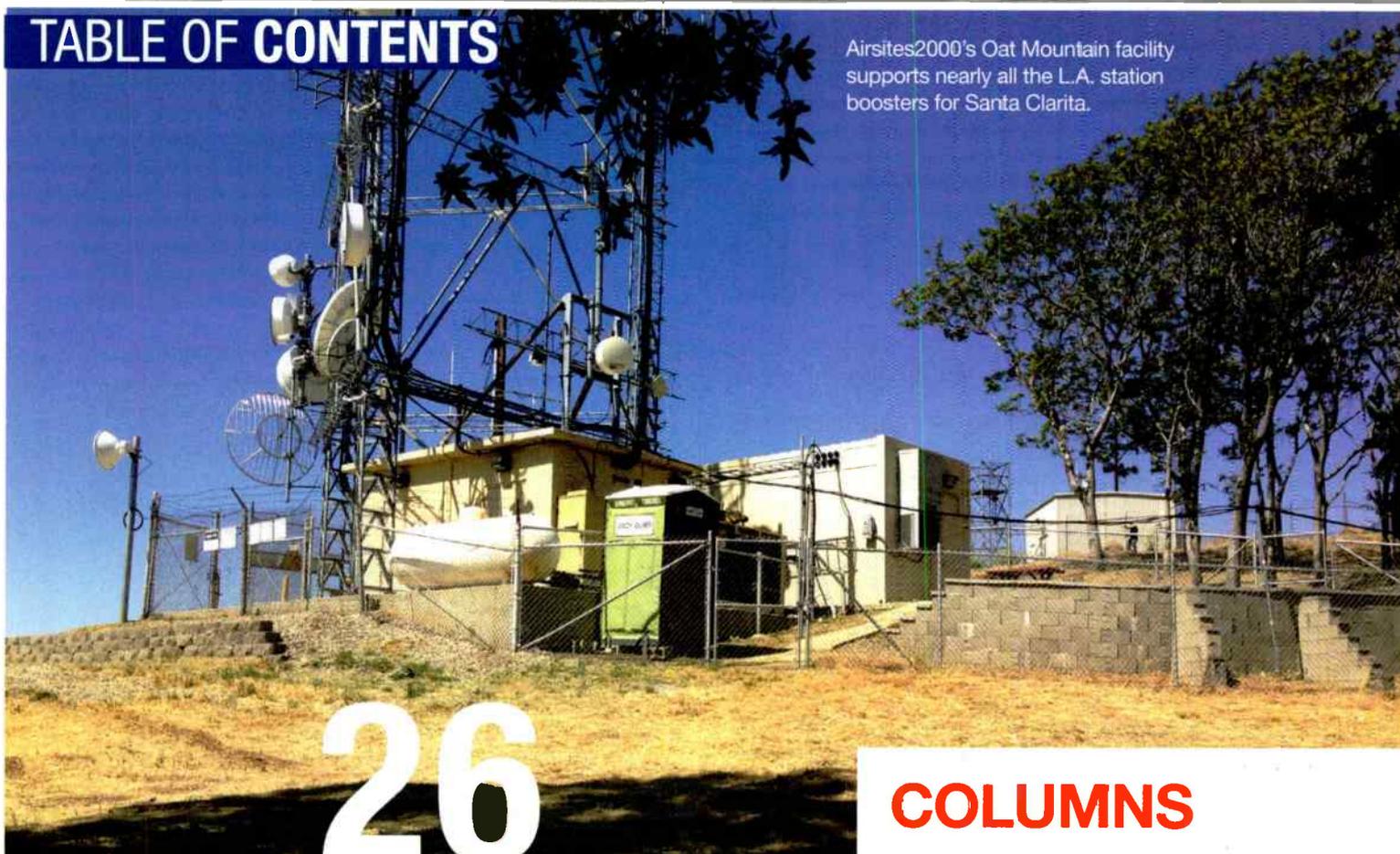
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World Radio History



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On the cover: At over 3,500 feet in elevation, the booster antennas cover Santa Clarita exceptionally well.

FIND THE MIC AND WIN!

Tell us where you think the mic icon is placed on this issue's cover and you could win a **Hosa UXA-110 Tracklink USB interface**. Send your entry to radio@RadioMagOnline.com by **December 10**. Be sure to include your guess, name, job title, company name, mailing address and phone number. No purchase necessary. For complete rules, go to RadioMagOnline.com.

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Broadcast Engineering: Beyond the 9 to 5



Broadcast engineering is an occupation that, to a very large degree, defines who a person is. It's different than so many other jobs because of its 24-hours-per-day, seven days-per-week schedule.

I hesitate to say it's like being a fireman or police officer because an engineer does not need to put his or her life at risk every day as those professionals do. Still, it is similar, at least, in that you can be called to action at any time, and your employer expects you to respond. It's not a

9 to 5 job, by any stretch.

That makes the field a difficult one. At Radio, in addition to writing about the technology you use, we're also talking about the job's important work life aspects.

One of the most frequent comments that came in to us during this year's Salary Survey touched on a fear that many of us have: No one is getting in to the business behind us, ready to take over when necessary. This month, as a follow-up to October's Salary Survey results, we have an article about younger people who have gotten in to this crazy field, by differing means and for multiple reasons. While lamenting the dearth of new engineers, are you sure a new one (or two) isn't standing at your office door a couple of times daily?

Another way to make your life easier is to let a remote control do your bidding whenever possible. It's not enough just to have remote access: You can give that remote control some power to take decisions at those hard-to-reach-in-the-middle-of-the-night sites. This month we're looking at ideas on how to set up what I'm calling a "mini NOC," the idea being that no matter how many (or how few) stations you maintain, the same techniques for monitoring and control can be used.

Our Facility Showcase for November features a new transmitter site build in southern California that had its share of problems along the way. "Energy and persistence conquer all things," according to Ben Franklin. That was proven true during this project.

Jeremy Ruck is back this month with a great read on the issue of FM versus LTE interference. Eighty percent of the U.S. is now covered by LTE — but new sites are still being constructed. What sort of problems can their presence make for FM broadcasters?

Tech Tips is the first in a series about the rehabilitation of old transmitters. Is that transmitter shoved in the corner just "parts" or is it worth fixing up? We'll help you decide.

Chris Wygal has taken a serious look at BSI's Stinger. Version 3.1 is now available. Chris has used older versions for years, and gives the new iteration a thorough test drive.

Lee Petro — our man keeping an eye on the FCC — writes this month about the so-called AM Revitalization plan. It's my hope this has a beneficial effect for AM stations, and we'll be following it closely in the months to come.

Our own curmudgeon, the Wandering Engineer, does his best to shoot holes in our cherished notions once again in Sign Off. Are radio engineers really a dying breed?

Thanks for continuing to read Radio. Please share it with others around the station, and remember we're also available online, with some features you won't see in the print version. 0

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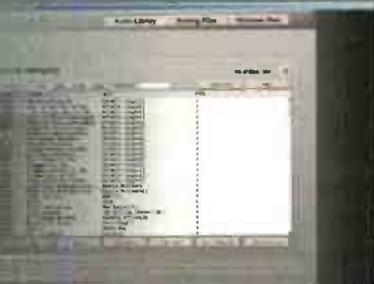
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World Radio History



by Lee Petro

AM Radio — Revitalized

The FCC moved forward with its effort to revitalize the AM band by relaxing certain technical rules and announcing a filing window for AM licensees to acquire and move FM translators up to 250 miles. The resolution comes after a compromise was brokered by Commissioner Clyburn and will offer four different opportunities for AM licensees to acquire an FM translator.

FILING WINDOWS

First and foremost is the plan to open two filing windows for AM stations to move FM translators up to 250 miles.

There had been much debate whether the FCC should open a filing window for AM licensees to file for a new FM translator to pair with its AM station. There were concerns regarding fairness with respect to other classes of broadcast stations, and the FCC's capacity to conduct an auction in light of the complex incentive auction that is slated to commence in March 2016.

The compromise establishes a two-phase filing window with Class C and Class D AM licensees getting the first cut at finding and acquiring existing FM translators within 250 miles. Applications submitted during

the six-month window will be processed on a first-come, first-served basis and the FCC will limit licensees to only one FM translator application per AM station.

After the first window, all AM licensees (including Class C and Class D stations that took a pass in round one) will have an opportunity to file to move one FM translator during a subsequent three-month filing window.

The applications proposing the change in site location will be treated as minor change applications, and Matoon Waivers can still be used. The FCC will require that the FM translator rebroadcast the AM station for a minimum period of four years. The FCC will also waive the construction period of existing, unbuilt FM translator authorizations to ensure that there are a sufficient number of FM translators to be acquired during the windows. The applicant may request a waiver of the construction period deadline on the condition that it commits to "promptly" construct the modified FM translator station.

After both rounds of minor change application filing windows are completed, the FCC will open two filing windows for the submission of applications for new FM translators pursuant to the FCC's auction authority. The first filing window (circa 2017) will be reserved for Class C and Class D AM licensees

that did not participate in the minor change filing windows, and then a second filing window will be for all AM licensees that still do not have an FM translator after the first three rounds.

OUTREACH

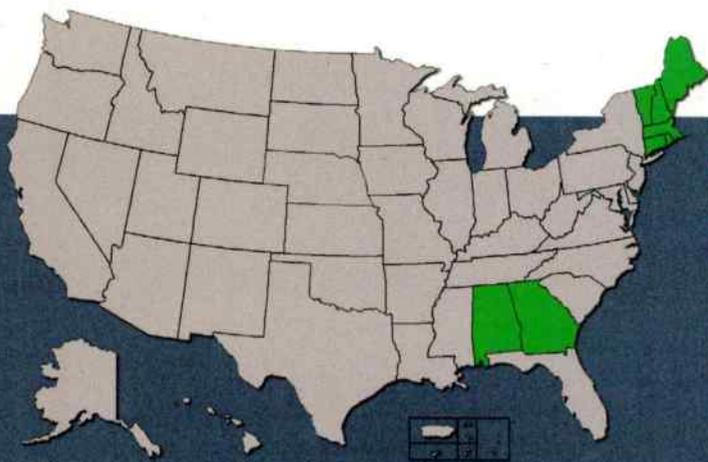
The FCC directed the Media Bureau to conduct outreach to AM stations to advise them of these opportunities, and a public notice was released immediately that provided more information on these efforts. The bureau will conduct a three-month effort of emailing and advising Class C and Class D AM stations of the upcoming filing windows and the procedures for filing applications.

The bureau also set up a dedicated AM filing window email address — AMmodification@fcc.gov — for licensees to submit questions regarding the window process. The bureau estimates that the first modification filing window — for those lucky Class C and Class D AM stations — will open the first quarter of 2016, with the second window opening immediately thereafter.

The FCC also adopted several of its proposed modifications to the AM technical rules, including relaxing the community of license coverage requirements for existing AM licensees proposing to make minor changes, eliminating the "Ratchet Rule" and reducing the minimum effective field

strength values by 25 percent to permit AM stations to take advantage of shorter antennas. The FCC also teed up several proposals for further review and comment. We will cover those in a subsequent article once the filing deadline for comments is established. **0**

Petro is of counsel at Drinker Biddle & Reath LLP. Email: lee.petro@dbr.com.



DATELINE

Dec. 1, 2015 — Noncommercial broadcast stations in Alabama, Connecticut, Georgia, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont must file Biennial Ownership Reports (FCC Form 323-E).

Dec. 2, 2015 — All commercial broadcast stations must file Biennial Ownership Reports (FCC Form 323) with data current as of Oct. 1, 2015.

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Implement Your Own Mini NOC

by Doug Irwin, CPBE AMD DRB

I cannot think of one piece of equipment used at a radio station that hasn't been affected by the ubiquitous nature of IP communications — except, perhaps, the coffee pot. Remote controls are no exception; and in fact, the case could certainly be made that remote controls have been made far more useful because of IP connectivity.

There are about a half-dozen companies offering remote controls, but in this particular article, we're going to focus on remote control products that can be configured to operate within a network operations center system.

Simpler remote controls are also important, of course; take a look at an older review of Broadcast Tools, Circuitwerkes and Sine Systems in this article: www.radiomagonline.com/misc/0082/remote-site-control/33631.

NETWORK OPERATIONS CENTER

The NOC is a centralized location, usually manned on a 24-hours-per-day basis, in which parameters and alarms are collected from remote sites, by way of IP-based communications.

NOC personnel would typically have all the remote access credentials needed to browse in to devices at the far end; however, when you consider that dozens or even hundreds of stations are being monitored, it becomes clear that the monitoring functions must themselves

be automated. Use of Simple Network Management Protocol is an industry-standard technique for doing so; site alarms can be collected via SNMP traps from the remote end or via "polling" from the near end, usually by way of SNMP.

In the context of radio broadcasting, analog parameters would include:

- Transmitter power output
- Transmitter room temperature
- Outside temperature

Alarms would typically include:

- Over-the-air silence
- Loss of PPM encoding
- Summary alarms from a transmitter
- Fire alarm and unauthorized access alarms

These are the most basic types of information collected and are essentially the same things that engineers have needed to know about since remote controls came in to common use. Modern transmitters, modern STL receivers, AoIP codecs and even some air conditioning systems (ones usually meant for NOC applications) make innumerable parameters accessible to the end user, and the engineers that configure the NOC systems make the choices about which parameters they want.

The remote controls we're discussing in this particular article can all be scripted to take action on their own, whether it is to simply

change STLs or to change transmitters or even transmitter sites, as the situation warrants.

Nevertheless, NOC personnel will be alerted to the fact that *something* happened at the far end. The NOC would either alert local engineers regarding a problem, or perhaps would mobilize members of an engineering team that support transmitter sites over a wide area. Major tower owners and cellular telephone carriers use the same methodology; it's commonplace in those businesses. I know of at least two major broadcast organizations that use the NOC concept, and I'm sure there are many others.

This methodology has finally found its way in to radio broadcast organizations for the following reasons:

- **Transmitter reliability.** Solid-state transmitters don't require as much maintenance as vacuum-tube transmitters historically did. Many also support remote access.
- **IP connectivity to sites.** It's far easier to keep track of remote sites by IP than it was in the days of simple telephone communications, or four-wire data circuits before that. Plus, much of the configuration, operation and troubleshooting of systems is done remotely.
- **Fewer personnel.** Taking the first two points into consideration, it's clear that fewer people can be responsible for more remote sites.

DEVELOP YOUR OWN MINI NOC

Perhaps at this point you are thinking "Well that's all fine for the big boys — but I'm a one-man/woman band. This concept is of no use to me." To that I would reply: Have an open mind to new technologies — you can apply the same *ideas* to your own group of radio stations, thus providing better service while making your own life easier. Whereas group owners might be monitoring dozens or hundreds of stations, you can take a similar approach to your own group, no matter its size.

Let's take a look at your equipment choices for the implementation of a mini NOC (or a full-size one, for that matter).

DPS-100D True RMS Digital RF Power Meter

- Models available for all EIA transmission line sizes and include Type N and 7/16"
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- Proprietary 3 Strike reflected power protection algorithm



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Here's the Burk Auto Pilot user interface for KOST(FM) in Los Angeles.

Burk Technology is a long-time manufacturer of remote controls for broadcasters. Their flagship product is ARC Plus Touch, although they offer the ARC Solo and ARC Plus SL, as well. Some of the ARC Plus Touch's basic features are as follows:

- It's an IP-based system
- Designed for scalability, supporting up to 256 metering and status channels, 256 relay pairs and 512 virtual channels
- Multiple sites can be connected together via IP, providing the basis for NOC systems

Operator access can be gained through front-panel touch screen; a PC; or via IP, on a PC, smart-phone or tablet. Telephone access can be gotten through the optional Recordable Speech Interface.

- Email alerts and alarm reporting
- Uses a distributed input/output architecture; input and output panels "talk" to the main unit via IP. This allows for placement of the i/o devices where needed (as opposed to the legacy IP-8 panels, which needed to be close to the ARC-16).
- Plus-X IIU is the single-RU device for metering and status. It has 16 status channels plus 16 channels that can be either metering or status
- Plus-X ICRU provides eight pairs of relay

outputs, configurable as momentary or latching

- Plus-X 600 is a combination unit, providing 16 status inputs, eight metering inputs and 12 relay outputs
- The Plus-X 300, also a combination unit, provides eight metering or status inputs and eight relay outputs

Burk's PlusConnect is a single-RU device that provides a simple means by which a transmitter can be connected to the remote control system, with use of a single Ethernet cable. Communication between the remote control and the transmitter is carried out via SNMP and includes all control and metering. Burk has interfaces for GatesAir Z and ZX series transmitters, as well as the 3DX, the HPX-series and the Flexiva series. In addition, Burk has PlusConnect for Nautel's V, VS, NV, NVLT, GV, XR and has recently added the NX-series as well.

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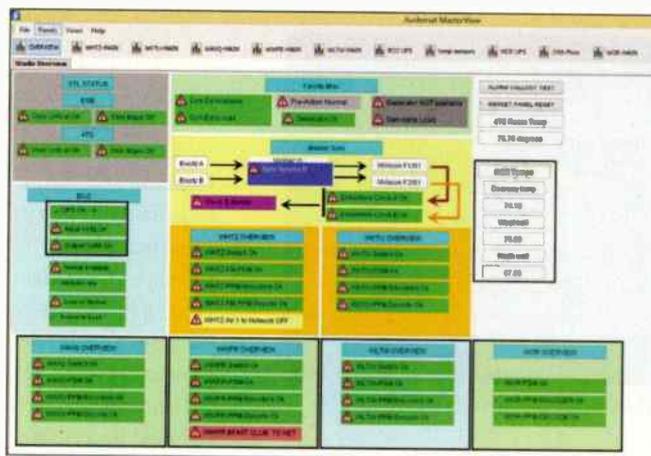
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AutoPilot is the software that allows for the monitor and control of multiple remote sites from a single PC. It facilitates the development of custom user-interfaces, and gives the end-user the ability to manage alarms and logging. And importantly, for the NOC application, it allows for automation of the sequences of events, defined by the end-user, that execute changes at the far end, such as the switchover to a backup transmitter, or antenna or STL system.

Jet Active Flowcharts are a software tool that allows for the control sequences to be designed with simple flowcharts.

Worldcast Systems' Audemat Control Modular (formerly known as IP2Choice) is a system for site management and monitoring. In its more familiar role as a remote control, it can be configured to connect with any equipment at a site through traditional status and metering inputs and commands (relays).

Additionally, the Audemat Control Modular



Audemat features a "dashboard" style user interface for iHeart-Media's New York City cluster, using Masterview.

is capable of advanced connections to other equipment using serial protocols or via SNMP on an IP network. All units connected to the Audemat Control Modular can thereafter be monitored and controlled locally and remotely.

Audemat Control Modular can be configured with up to 12 modules. The module combinations could include as many as five analog metering boards (40 inputs total); eight digital input cards (128 inputs total); eight command relays boards (64 relays total); one audio card with two inputs; and three RS232-port boards with three ports per board.

As the "brains" in a mini-NOC system, the Audemat Control Modular can also take action locally, based on scripts created in Audemat's Scripteasy graphical facility control software. Scripteasy makes use of logic inputs, thresholds on analog inputs, logic gates (OR, NOR, AND), timers and clocks, configured by the end-user. The main function of scripts such as these is to engage backup and alternate systems, and to send alarms to the radio station personnel, letting them know *something* has happened, and action was taken when warranted.

Another important aspect of the Audemat Control Modular is that it acts as both an SNMP agent and an SNMP manager, meaning that two units can literally "talk" to one another across an IP link, allowing site-to-site control as well. A typical application would be the automated use of a backup transmitter site.

Masterview is the application that allows remote users to display data and control equipment in multiple *custom* views (also created by the end-user). Each view can contain as much information from the remote site as desired. MasterView is now available as a Web application; views are created using a standard Web browser and viewed from any PC or mobile device.

Davicom offers a line of remote controls: the DV-Micro, the DV-Mini, the DV-208 and the DV-216. Looking at the DV-216 in detail, we see it includes 16 metering inputs, 32 status inputs and 32 SPDT relay outputs. All of the input/output connectors are on the rear panel of this 2-RU device; so a "build-out" to accommodate connections to external equipment

would, for all practical purposes, be necessary. Some of its other salient features are as follows:

- Differential input, analog metering ranges of +/- 2.5 V, +/- 10 V and +/- 20 V
- Audio detection available on metering inputs
- 10 audio monitors available over dial-up, and 10 available via streaming over IP
- Two Ethernet ports
- SNMP agent functionality built-in
- SNMP manager functionality built-in (up to 96 SETS, 96 GETS and 96 traps)

The DV-series of remote controls has built-in virtual logic gates that provide the user with decision-making features and commands for such actions as antenna pattern changes, program chain switching, backup transmitter switchover, generator exercising and many other things limited only by your imagination and circumstances. As you would expect, you can interrogate the unit by remote access, using a PC running the DavLink software, with a Web browser or SNMP manager, or by telephone to check signals and status, monitor live audio feeds and execute commands.

For your mini NOC, Davicom offers DavNet, a Windows-based software application that runs on a single computer and communicates with DV-type remote controls at the remote sites via IP or dial-up. DavNet manages the way you make use of remote alarms; it also continually measures network integrity by communicating at fixed intervals with DV units in the field, thus confirming their correct operation.

At the heart of DavNet is a Microsoft Access database, which supports the following features:

- View Reading allows you to view the full alarm message including levels and status

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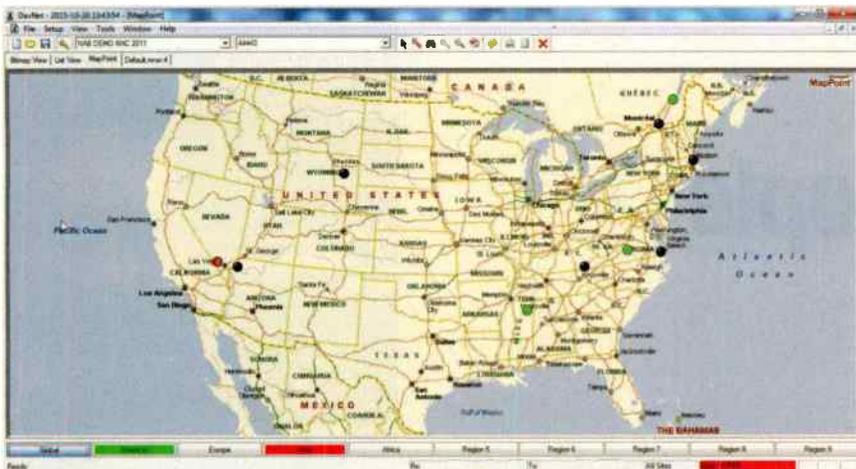
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This graphic shows the DavNet Software Sites View with MapPoint.

of all inputs / outputs

- Site Schematics can display equipment layouts and schematics to obtain a dynamic functional block overview of any particular site. Schematics can be imported as DFX files from a CAD system and stored in the database
- Site Memo allows users to make personal notes related to a specific site that can provide an information flow between different duty personnel. In addition, the user can open a Site Information file for each location which can store details such as station ID, frequencies, contact numbers, equipment model and serial numbers, etc.

Once alarms are acknowledged, they can be archived in the database, where they can later be accessed and exported, and reports can be created with an automatic report generator.

Suitelife Systems offers *Axess*, which is a software and a suite of products meant to facilitate the automation of operations (such as in a NOC) used to monitor and control devices across a widespread network.

Axess provides rules-based filtering to identify problems as they occur and helps to resolve them in a timely manner. Additionally, it provides analytic information for trend analysis in order to prevent system downtime. Logical, visual overlays were developed for *Axess* so that NOC operators have visual references for signal flow at multiple, widespread equipment locations.

The days of each radio station having its own jocks or board-ops manning the controls 24/7/365 are largely ancient history. The day your station was automated during overnights and on weekends was the day you needed a better remote control; and as the number of stations increased, the need for scripting and remote access did as well.

I hope some of these ideas spark your imagination. It is possible to make your life as a broadcast engineer at least a little bit easier. 



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Let's Get New People in the Business

At the end of our 2015 Salary Survey (the results of which are in the October issue), we provided a place for respondents to comment. While the topics varied, there was one subject that stood out: the need to get younger people in the broadcast engineering industry.

Here are some of the more telling comments:

- Being able to bring in and train an assistant to pay forward and prepare the properties for my eventual retirement
- Find more young people interested in broadcast engineering and convincing companies to hire them before all of us “experienced” guys are not around to mentor them
- Would be nice to be able to mentor younger folks that want to get into this business
- We need more young engineers. Many of us are close to retirement!

There were more, but clearly, many engineers are concerned that there is no next generation who will carry the radio-engineering torch. What can be done to mitigate this problem?

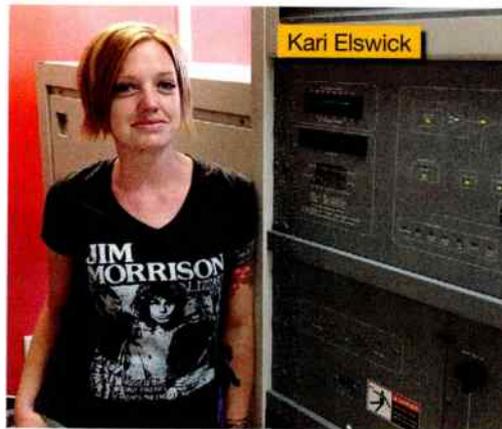
Let's look at how three younger engineers broke into the business. Consider this: Maybe the future engineers are already there, but you just haven't taken notice.

UP THROUGH THE RANKS

Jason Ornellas is the director of engineering for CBS RADIO in Sacramento — KHTK(AM), KNCI(FM), KSFM(FM), KYMX(FM) and KZZO(FM).

“While I was at the University of Indianapolis working for a non-com [88.7 WICR(FM)], they needed someone for remotes. After a few months, I was hired as the ‘broadcast technician’ and became responsible for live broadcasts, and I was put in charge of all the studios,” Ornellas said of his entry into broadcast engineering.

“I built my first studio ever, which is still in service today. We used the Axia SmartSurfaces



Consoles and AudioVault for Automation. It was truly a learning experience building my first digital studio. I remember that I used to sit in the TOC at the college station and just make wires for practice, draw signal flow charts and what not.”

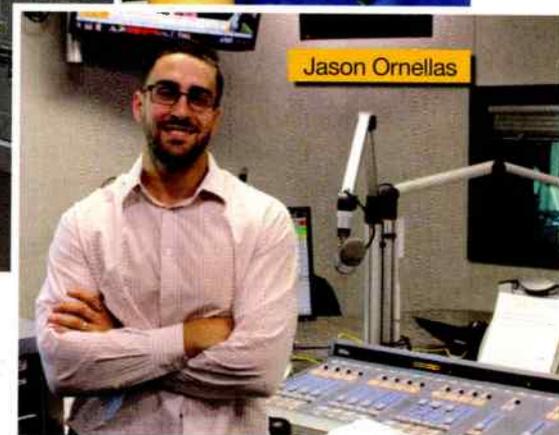
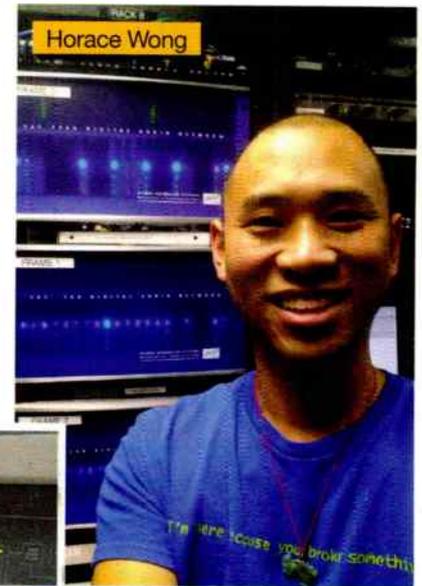
CHASING A DIFFERENT DREAM

Horace Wong is a staff engineer for Entercom Communications in San Francisco — KOIT(FM), KBLX(FM), KGMZ(FM), KUFX(FM) and KRBQ(FM). He started out working in the promotions department at KYLD(FM).

“I was always told that I have that ‘radio voice.’ That really propelled me into the industry. However, my goal was never to be on the engineering side. I happened to land in engineering after an opening became available, and I realized my career goal to be on-air wasn't moving in the direction I had hoped.”

Wong got hired to take on remote broadcasts for Wild 94-9, and his technical background was enough to begin.

“I did a lot of custom car audio installations prior to getting into radio — and engineering was like that, but on another level. The idea that I could build a custom studio to my own design was exciting. The equipment that I could work with was more exciting than making a



custom subwoofer box. I've always liked working behind the scenes. In the eyes of listeners, radio is all about the jocks — but in the eyes of everyone in the industry, the engineers make it all happen. That was the attraction for me.”

FALLING IN LOVE WITH THE BIZ

Kari Elswick is a staff engineer for iHeartMedia in Los Angeles, which includes KIIS(FM), KBIG(FM), KOST(FM), KRRL(FM), KYSR(FM), KFI(AM), KLAC(AM) and KEIB(AM). She also started out in a different department.

“I have no background in engineering or electronics, other than working with our standard equipment for years. I started as a promotions intern at WTFX in Louisville and just fell in love with the business and the type of people it attracts. I'd worked for Clear Channel [now iHeartMedia] for 14 years in almost every department when I moved to Los Angeles. I got stuck as a board-op on the FMs for a while; but since I get bored when I'm not learning anything new or doing anything productive, I started

pestering the engineer [whose office was by the studio] for things to do to kill time during my board shifts — and it just escalated from there.”

RELOCATION

Elswick, Wong and Ornellas have all moved around the country for their work.

“I’m really thankful for the experience traveling provides because most markets just do things one way — their way,” said Elswick. “Being exposed to different approaches helps me come up with alternative solutions to issues I encounter here in Los Angeles.”

Wong is slightly more philosophical. “There are three other markets that are ‘bigger and better’ than San Francisco. That notion has been with me since I started engineering. In order to be the best, I’d have to make it in the best — so when an opportunity to work in New York came up, I’ll admit that moving was an easy decision.” Another, even better opening was presented to Wong about three years later, and he came back to the west coast.

Like Wong, Ornellas has moved coast-to-coast twice. “I left San Francisco for New Jersey as I felt it was the right move at the time to take the next step in my career. Now looking back, I realize it was absolutely the best decision. The hands-on experience I gained throughout all our projects — as well as Mother Nature’s disasters with Hurricane Irene, snow storms and Hurricane Sandy — prepared me well for future disasters.”

PEER GUIDANCE

This is perhaps the most important question: What advice would you give to engineers looking to bring others into the fold?

“Be prepared to take a step back and teach,” said Ornellas. “Engineering has certainly changed since I started and will continue to do so. Have new staff dig right in, take notes and ask questions. If they want to do the work or take the job — that is already a step in the right direction.”

Wong had this message: “Older engineers need to realize that when they say something — or explain something — that the younger ones are listening. Your knowledge is more valuable than anything else. What you say is likely not available in books or on the Internet.”

Elswick said, “Most engineers aren’t approachable, and some can kind of be protective of knowledge, which I always found weird. I’ve had engineers in other markets, when asked how to do something, treat you like you’re stupid and then

just do it for you. I bet if you polled your board ops right now there are many that want to do more and are interested in learning.”

ON MENTORING

“When I started, I had a lot of people that were a wealth of knowledge,” said Wong. “The idea that I would be as smart as them was never a possibility. I soaked in as much information as they had for me and made my own way. I knew with time and experience I would succeed, but I still never thought, at the beginning, that this would be my career path. My first boss was my best mentor: He was patient, informative, a good teacher, open to my ideas and trusted me.”

From Elswick: “If you’d told me a year ago that in the near future I’d understand wiring, a behemoth routing system, how to build a studio, or that I’d be learning — and understanding — basic physics, I would have laughed really, really hard. But it turns out I

really enjoy this stuff, all of it. It’s a challenge, and I’ve gained skills that carry over outside of radio.”

And finally, Ornellas: “I’ve been lucky everywhere I’ve been, from iHeartMedia San Francisco [Clear Channel when I was there] giving me my first full-time gig as a station engineer to Greater Media where I got my first chief engineer job. I’ve been fortunate enough to have great people help me along those stops. I continue growing within CBS RADIO as part of their engineering department.”

Perhaps the next generation of broadcast engineers is already here; you just need to recognize them, and give them a chance to succeed. **O**

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by Jeremy Ruck, PE

Resolving FM Interference to LTE Broadcast Requires Cooperation

An interesting spectrum phenomenon has reared its ugly head over the past few years. The ubiquity of mobile devices, the desire for faster data speeds, longer battery life and increased features have brought us to later-generation standards such as LTE, which stands for Long Term Evolution.

Originally, it was believed these new standards would be potentially susceptible to harmful interference from adjacent

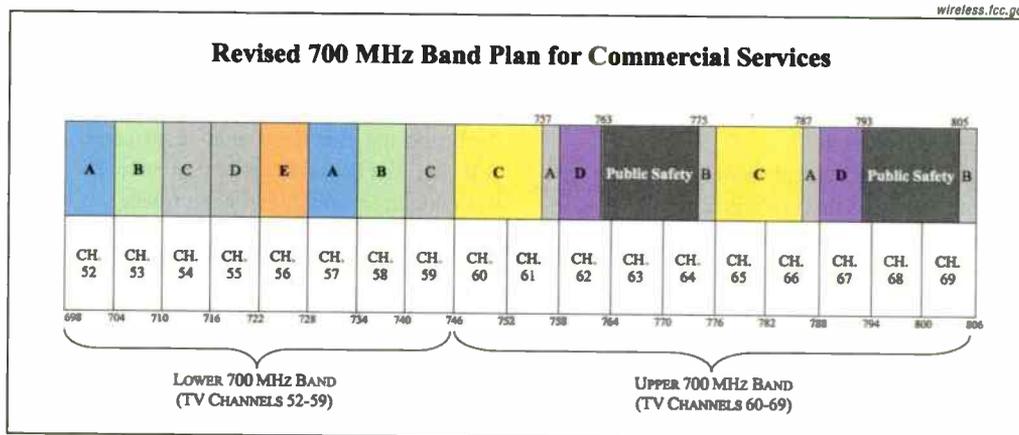


Figure 1: Basic spectrum layout for LTE and public service radio channels. A, B and C blocks are paired providing for full duplex communications, while the D and E blocks are unpaired.

television stations.

As it turns out FM stations instead pose a problem, and in particular their seventh, eighth and ninth iterations.

Say what? Yeah.

SOME BACKGROUND

LTE is built on the GSM and UMTS standards. It was originally proposed a little over 10 years ago in 2004, and was finalized some four years later.

The first publicly available LTE service was launched in Norway and Sweden, which is not surprising given the trademark is owned by the European Telecommunications Standards Institute.

The first LTE phone was available at the beginning of the third quarter of 2010, with its smart cousin appearing on the scene a few months later in February 2011.

The standard has taken the world by storm.

In four short years, the United States has managed to achieve close to 80 percent LTE penetration.

South Korea leads the way at nearly 100 percent — not surprising, given that the first LTE phone and first LTE smartphone were designed and manufactured by a major South Korean company.

Due to the novelty of the design, however, the LTE wireless interface is not compatible with the existing 2G and 3G networks, and as a result, LTE must be run in different spectrum.

TV REPACK REAL ESTATE

This real estate became available during the last television repack, and occupies 698 to 806 MHz, or what used to be television Channels 52



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through 69. Many of the frequencies being utilized by the larger carriers are located in portions of the 700 MHz band.

The LTE regions in the 700 and 800 MHz bands reside in a slice of spectrum that includes the seventh, eighth and ninth harmonics of the FM broadcast band.

Even though the harmonics are going to be very low in magnitude, it is important to realize that the LTE received power can be very low, as well.

At the fringe of LTE service, the signal level can be as low as -120 dBm, and still be usable. Because of this, the mobile carriers are looking for FM stations to attenuate their harmonics by more than 100 dB, and are seeking received power level of harmonics in the -110 dBm range.

Attenuation at 100 dB is well in excess of what is required by the commission, which is described in Section 73.317. There we find that emissions must be attenuated by the

lesser of $43 + 10 \log_{10}(P_{Watts})$ below the unmodulated carrier or 80 dB. As it turns out, the crossover point is approximately 5 kW, so TPO values in excess of 5 kW have the more stringent requirement of -80 dBc.

PLUG THE LEAK

Generally, transmitters nowadays will meet those requirements, especially at the RF output.

Of course, transmitters meet those standards because they are designed and constructed to comply with FCC rules, not to mobile phone standards.

The problem is that, most of the time, when this harmonic issue pops up, it is not found at the output, and by extension not transmitted up the pipe to the antenna; usually when this issue is identified it is found to be leakage from the cabinet around door seals, air vents and other points where the metallic structure housing the transmitter has a gap of some kind.

Nautel has published a very good article

about this issue and potential solutions online at <http://www.nautel.com/support/technical-resources/tips-n-tricks/11-18-2014/>. And other, additional informational articles are available through a simple online search.

Hardware cloth, foil and various mesh and screen are all solutions that have worked in plugging the "holes" through which RF leaks.

Of course, care must be taken when employing these solutions to avoid unintentional contact with circuitry, dust accumulation and reduced airflow.

LAST ON, YOU'RE IT

Fortunately, the FM harmonics versus LTE problem tends to be limited to circumstances in which the two types of facilities are co-located or are in very close proximity to each other. Typically, for licensees that are in compliance with its rules, the commission follows a "last on" policy.

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that occurs is usually the responsibility of the last licensee to come to the site or the last one to make major changes.

In a situation where new LTE infrastructure is built out near an existing FM station, the mobile carrier typically would have the responsibility of solving the problem, if the FM is operating according to the rules.

However, even though the carrier would have to fix the problem, it does not absolve the FM

Of course, document everything, and if there is any question run it by your consultant — or better yet, have them be present for the measurements.

WHOSE SIDE ARE YOU ON, ANYWAY?

Sometimes the carriers will exhibit more bravado than is necessary. The initial contact often seems to be a thinly veiled threat to notify the commission.

you discover the issues have been an ongoing problem for months.

While the rules and the timeline may totally be on your side, it is important to realize that Congress has codified that wireless phones are acceptable emergency communications devices. As a result, the cell carriers do have a certain degree of leverage.

Remember also that about half of the commissioners, as well as some current and former members of the staff, are less interested in broadcasting than broadband.

In the end, spectrum is a finite resource with increasing and competing pressures. These pressures sometimes manifest themselves in odd ways.

Although the LTE issue is not one of our doing, it is one where cooperation is required. It is also one that may become more prevalent in the future. **0**

Ruck is the principal engineer of Jeremy Ruck and Associates, Canton, Ill.

It is always good policy in a potentially contentious situation to make the measurements jointly with both parties present. This way, both sides are protected from each other.

from cooperating with them.

In the event your FM station gets built out after LTE is already established at a site, you could consider a preventive measure, such as installing the transmitter in a screen room. It's the most brute-force solution, and the most costly, but it may be necessary if your station is "last on."

It is important to know whether a problem really exists before taking time and using resources to solve it.

The reality is not all FM frequencies are potentially problematic for LTE operations.

Additionally, FM stations are generally not problematic for the LTE downlink frequencies, only the uplink, or those from the handset to the site.

FM frequencies from 99.9 to 102.3 appear to be most problematic in terms of the seventh harmonic; for the eighth harmonic, 87.9 to 89.5 and 97.1 to 98.3 look to be problematic in the 700 MHz Band; and, 101.7 to 106.1 may be an issue in the 800 MHz bands. The 800 MHz bands also may have ninth harmonic issues with 90.5 to 94.3 MHz.

If your frequency does not fall in one of those ranges, you are *not necessarily* out of the woods — that would depend on how the public safety licenses are assigned in your area.

If you are contacted by one of the carriers, do not ignore their communication; engage them, but do not take any of their information or data for granted.

It is always a good policy in a potentially contentious situation to make the necessary measurements jointly, with *both* parties present. This way, both sides are kept honest, and more importantly, are protected from each other, and in some cases from themselves.

(I suppose this is understandable, considering that from their perspective, the FM station is impinging on their turf.)

Most of the time, however, such a full-frontal attack is unnecessary — especially if

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FIELDREPORT

Stinger Is Ready and Raring To Go

by Chris Wygal

Broadcast Software International has been in the business of developing broadcast playout software since the late 1980s. In 2001, the familiar BSI Automation morphed into Simian. In addition to radio automation, BSI's WaveCart and Stinger have found homes in radio, TV, PA and athletics venues. Plus, Natural Log and Natural Music are powerful traffic, billing and music scheduling solutions that interface with most automation systems. All in all, BSI has a feature-rich and popular line of products.

At the 2015 NAB Show, I visited with BSI's Alec Lively and asked him what was new, and he began to tell me about some upcoming features concerning Stinger, the well-established hot key audio player.

The more Alec said, the more excited I became about Stinger. The features he forecasted indicated BSI was about to launch a software rocket.

LET'S LOOK AT IT

By way of familiarization, the main Stinger v.3.1 screen is made up of a collection of "sets." Each set is home to up to 72 buttons.

Earlier editions included six rows of six buttons on eight available sets. Audio on each button was loaded by dragging and dropping from the "files list" window. Buttons could be renamed and given a different color. Buttons were triggered by clicking or using the Keyboard HotKeys. (The HotKeys feature could be disabled.)

The audio output device for Stinger defaulted to a single sound card output.

All of those Stinger features still exist, but with much more horsepower.

NEW BELLS AND WHISTLES

For starters, the revamped buttons on the Stinger sets are much more flexible. Right-clicking on each opens the options to change the background color, font color, button caption, icon and size. Changing button sizes allows for larger font sizes and artwork. JPG, BMP, GIF and ICO images can be assigned to



each button for a more user-friendly experience. A Bugs Bunny quote, for example, can be labeled with his picture.

From an audio handling perspective, Stinger uses the drag-and-drop approach from a file selector window to load audio files onto the buttons. User-defined paths to certain directories make for quick navigation to audio file location on the PC. Audio on each button can be assigned to any of up to six playout devices and an additional audition device. Having used Stinger for many years in sports broadcasting, I was the most excited about this feature. I had always wished different buttons could play out on different audio devices. Now they can and crossfading is a snap.

Additionally, the audio on each button can be looped and start/end points can be specified to

tighten up audio clips that may have silence. For more intense editing, right clicking on a button and selecting "Edit Button Audio File" will open preferred user-defined audio editing software. For fine-tuning on the fly, this feature is priceless.

Each button has a green speaker icon that hovers in the upper right-hand corner. Clicking on the speaker will play the audio assigned to the button on an audition channel. The buttons always display the audio file name and time remaining in the playout.

SYSTEMS OPERATIONS

As one might expect, there is an "options" selection for controlling Stinger's global settings. Items like scrubbers and level meters can be activated on all the buttons for accurate cueing and level metering. Font style and size can be adjusted as well as the button and tabs options.

Here, the user can choose to display up to 16 sets per collection. The sets are the groups of buttons, and the collection is where all the sets live. With as many as 72 buttons per set on as many as 16 sets, a user-defined collection of 1,152 audio files is possible at the touch of a button. A collection called "Morning Show," for example, would hold all of the sets of audio needed for the morning crew. A set within a collection could be called "Daily Interviews." The collection/set possibilities are limitless.

Additionally, through the use of the Secondary Playback Window, as many as 144 buttons can be displayed on the desktop space at once. Stinger is also very touch-screen friendly and ELO users report great success.

For logging purposes, Stinger features an Event Log. The Event Log can export a list of all the audio files Stinger has played in ASCII or Microsoft Access formats. This is highly useful to stations who submit detailed reports showing on-air playout.

ONE LAST BIG ITEM

Along the top display bar, Stinger now has a "record" button. When the record button is pushed, and a button on a set is selected, the button turns red and is ready to record. When recording is stopped, the button is immediately

ready for playback. When recorded audio is needed immediately, this is an invaluable feature.

Since its inception, Stinger has been a handy tool for hotkey-type playback. New features like assignable outputs and recording have given

Stinger a more effective foothold in the broadcast environment. When user-friendliness and feature-richness are a must, Stinger fits the bill. **0**

Wygal is the operations manager for The Journey Radio Network in Lynchburg, Va.

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How to Evaluate an Old Transmitter

by Doug Irwin
CPBE AMD

In the pages of Radio I've written many times about the importance of having a second (and even a third) transmitter. Usually, the context for this is ways and means to buy a new transmitter.

However, we all know simply buying a new one is not always possible.

Several times, early in my career, I found myself in this situation: I took on a new station (or client) and found that they had one working (main) transmitter, and another that was not functional, for some unspecified reason. The previous engineer either thought the transmitter was beyond repair, or in some cases, just didn't have the time or inclination to make it work.

If you work as a contractor, you likely have mixed feelings about this: If the client doesn't want to pay to have you rehabilitate said transmitter, then they can "pay the freight" when the station is off-air due to a (one and only one) transmitter failure. That's understandable; it's a business decision on the owner's part.

If you work as a regular employee for a station with a similar situation, you should evaluate this transmitter to determine whether or not it is worth the space it takes up. Let's consider how to do that.

AGE AND AVAILABILITY OF PARTS

You shouldn't look at the repair of an old transmitter as a loving restoration, like a ham radio project or the restoration of a car. The point of the exercise is to have a working transmitter that you can trust. If the unit is so old that parts are simply not available, then it's pointless to consider repair.

In some cases, there are parts around for older transmitters — many times, the site may

have a box filled with spares, or you might find them hidden on a shelf, behind other, newer stuff. If you are lucky, the station has another version of the same model transmitter — one that was taken out of service when the new main was put in place. Your predecessor may have planned to carry out a restoration eventually.

The electro-mechanical parts like pushbutton switches and door interlocks are items that age poorly; the former wears out, and the latter get very dirty over decades of use. If you have no access to front-panel pushbuttons, I would be wary of proceeding. Old relays can have pitted contacts. You can consider substitutions — just be sure that whatever you put in place of older parts are adequate in terms of the voltage they can withstand and the amount of current they can pass.

Other items that can be difficult to replace are parts associated with the doors on RF enclosures, such as RF gaskets or finger stock. They tend to lose their spring tension over

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Larry Wood



A retired transmitter provides a wealth of parts for the restoration of another of the same make and model.

time; they get burned; or they simply break off. With VHF high-gain amplifiers, you will need to have replacements available.

“Older” transmitters usually rely on vacuum tubes as their amplifiers. Always check to see if new or rebuilt tubes are available for the transmitter before you get started. Don’t count on older tubes that you find sitting around, unless you can get them evaluated (at minimum) or rebuilt before deciding whether or not to proceed.

Make sure you have access to the technical manual of the transmitter under consideration. This has been made much easier by

the Internet, of course. Many older manuals have been put online as PDF files and are easy enough to find and print.

Another important item is the factory test data for the actual transmitter you are considering; that’s the best way to know, at the end of the project, if the unit is functioning correctly. Twenty or 30 years after the transmitter was delivered, those documents can be very hard to find. The manual will usually have “typical” readings that will suffice.

Next month we’ll take a look at the restoration of high-voltage power supplies, as part of a transmitter rehabilitation project. 

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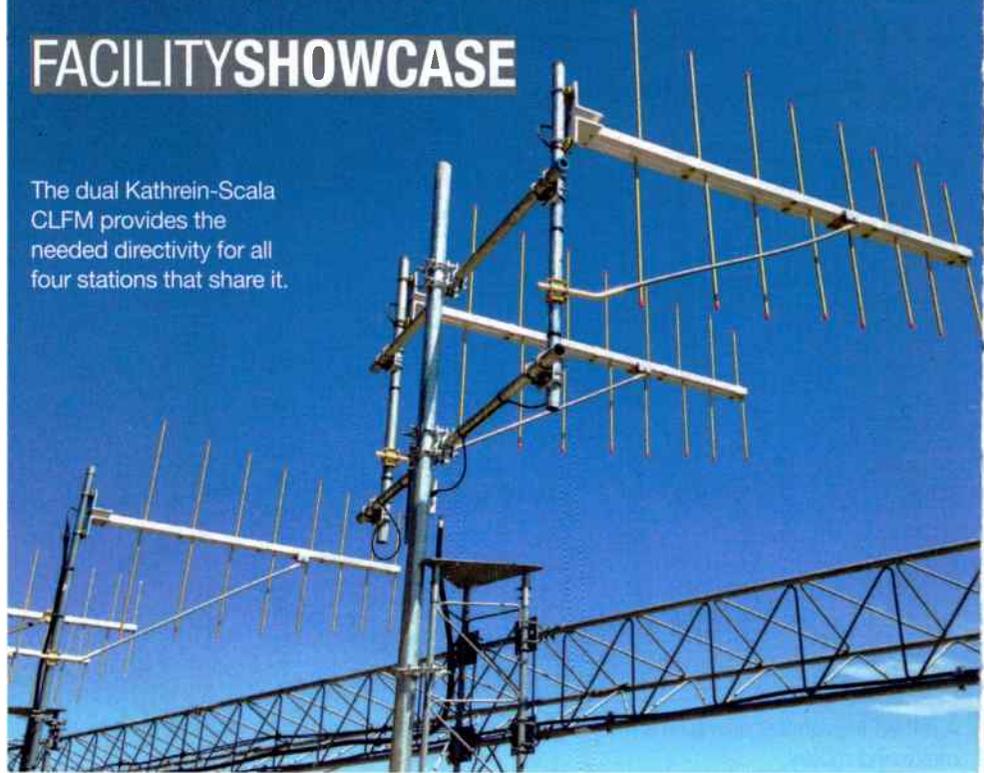
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iHeartMedia Gets Valley Coverage With Santa Clarita Booster

by Dennis L Sloatman

Located in the Santa Clarita valley, 35 miles northwest of the city of Los Angeles, is the affluent bedroom community of Santa Clarita. It's the third largest city in Los Angeles County, with a population in excess of 200,000. The valley takes the shape of a large "V," the sides of which are formed by mountain ranges running westerly, and northerly.

It's this local topography that prevents iHeartMedia Los Angeles' Mount Wilson signals (KIIS-FM, KOST, KRRL and KBIG) from having any meaningful coverage there. We have addressed this lack of coverage in Santa Clarita with a mountaintop on-channel booster that employs the latest in 2015 broadcasting technology.

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Why do we need the booster? Presumably, the booster will serve listeners who are not already served by your existing "main" signal (due to terrain shielding, etc.)

What sort of mutual interference will result from the booster once on-air?

With respect to mutual interference, what technical solutions are in the toolbox for use in its mitigation (at least to an acceptable level)?

And of course, what sort of budget is there for the project? A booster, like any other project, may run the gamut from a "base system" using an FM receiver feeding an exciter, to what amounts essentially to a small transmitter site with program delivery systems, audio processing and remote control.

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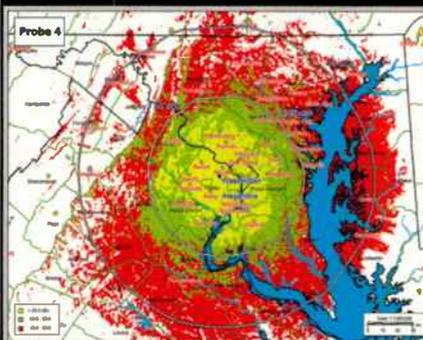
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The RF Engineering Employment Act of 2015

By the Wandering Engineer

It seems almost too quiet. By almost all accounts, the broadcast RF spectrum, specifically for UHF TV, will soon be massively re-allocated.

Last month, the FCC released preliminary bids to buy back TV spectrum. The reverse auction starts with an offer price and if a station is interested, it applies to participate. The number declines until just the right number of stations go off the air or move to VHF to satisfy the need. By any account, the opening numbers are awesome, with many stations looking at opening bids of around a half-billion dollars.

When someone is willing to pay the price, the people and material appear.

Broadcasting is a great business, but TV (more so than radio) is less about passion and more about business. Certainly most will at least apply to participate in the auction.

During the DTV transition there was great gnashing of teeth over the limited engineering services, tower crews, manufacturing capacity and the like required to complete the transition on time. In the end, much like World War II, the manufacturing and support world ramped up. It's also true that some work dragged on, but not so much that anyone really remembers. One benefit of capitalism: When someone is willing to pay the price, the people and material appear.

The same cautionary note has been raised this time regarding the repack. There are fewer transmitter makers, consulting engineers in TV, tower crews and all than there were at the end of the DTV transition six years ago.

Unlike radio, where transmitters are replaced every 15 years or so (when the aux is 30 years old), only the earliest DTV transmitters have reached that 15-year end-of-life locus. Domestically, radio transmitter replacement has been the transmitter business for the last six years.

HELP WANTED

What about the people who actually install, test and commission these new transmitters? Broadcast RF engineers often run the gamut: AM-DAs to UHF translators and Class A FMs. Current broadcast RF engineers are often circling the age of retirement and almost to a man bemoan the "fact" that there is *no one* in the wings to do what they do... assuming, that is, if RF is even *needed* in the next decade.

Broadcast RF engineers never fully retire. They all have some transmitters they are taking care of, often at some otherwise forsaken transmitter site, for little reward beyond that of being valued and the joy of playing with shiny things.

A real RF guy/gal loves the massive steel (sometimes sitting on a chunk of glass), high power and the magic of blasting a signal sometimes unimaginable distances.

I'm often told that if I want to continue along the broadcast career path, I will need to move over to streaming and IP distribution. I would rather become a dog trainer. (Seriously, there is no understanding people's passions or love.) When the world doesn't need RF engineers, I'll train dogs and play ham radio. Not devoid of IP, but IP as a component, not a world unto itself.

Other than stacking the same box over and over and plugging it in the same way over and over, IP distribution "engineering" is being awake late at night huddled over a computer screen (maybe at home) trying to get someone on another continent to help work



Will the TV repack will make for one last hurrah for RF engineers otherwise readying themselves for retirement? Sites like 1WTC and 4TS, shown above, may soon see a flurry of activity.

around the faults in their discount code. Yes, computers are an amazing thing, and there are lots of folks who just love to maneuver the same one-foot-square set of typewriter keys all day long. They even get a delight out of a successful configuration. Not an RF engineer.

For a broadcast RF engineer, the repack is maybe the RF Engineering Employment Act of 2015. There is a certain serendipity in this. Those grayhairs out there may have magically timed their careers to be there to do the last big RF project — after which they can teach kids habituated to sitting in front of a screen to take loving care of what they built. **Q**

The Wandering Engineer is an industry stalwart who has been in broadcasting since the days of Marconi and Tesla. He gives his thoughts on the current state of broadcast engineering and the broadcast engineer.

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