Radio Guide

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Digital Issue Now On-Line

November-December 2011 – Vol. 19, No. 6

Enco Systems – It's All About DAD

Inside Radio Guide:

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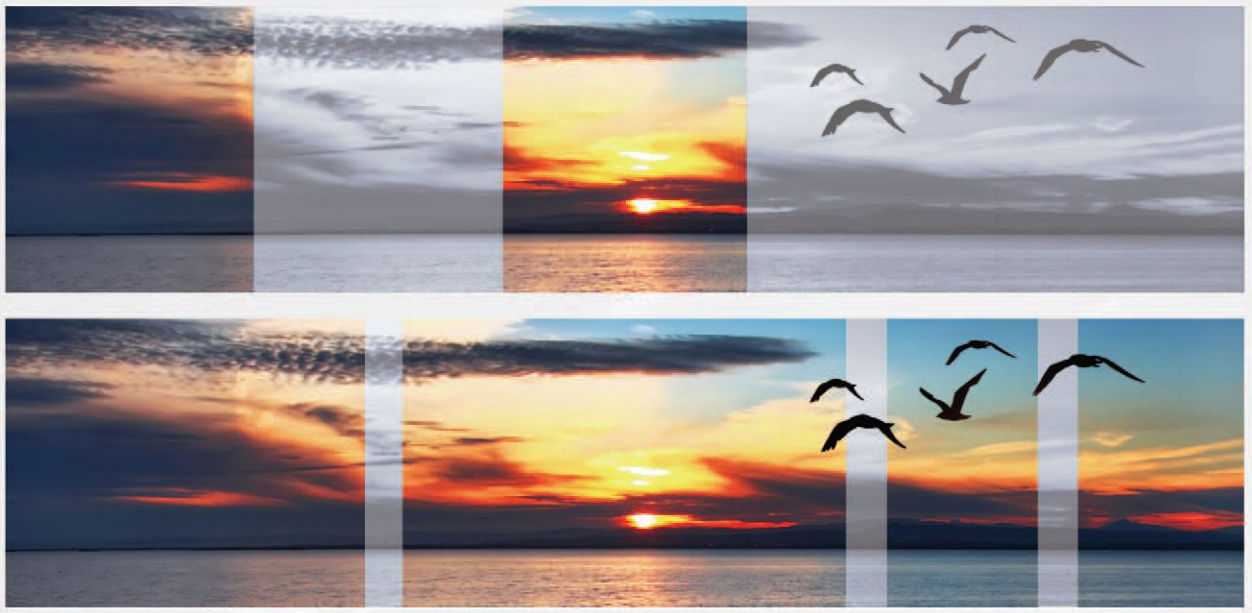

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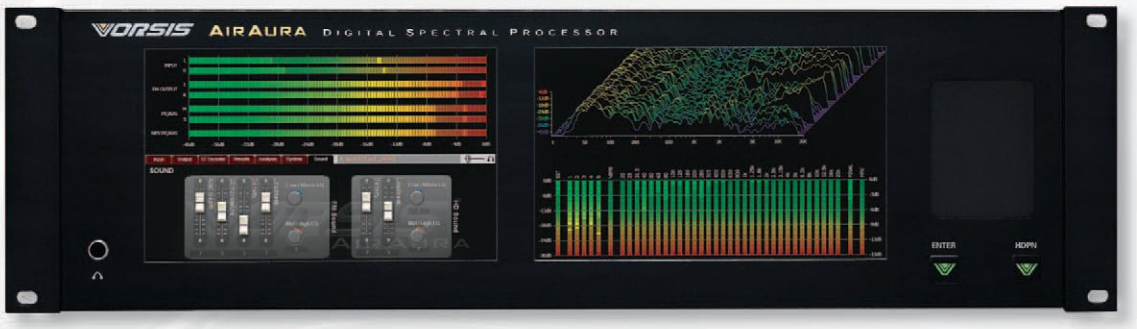

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Radio Waves

by Ernie Belanger – Editor

Happy Holidays

Wow – here we are at the end of another year. It's time now, to plan for some holiday fun. Our gifts for you in this issue: we travel to the Middle East for an *Xtreme Engineering* transmitter site build with Steve Callahan; Gary Minker has us cleaning things up in *Transmitter Site;* while George Zahn is checking out the mics in *Studio Site*.

Disaster Preparedness takes a look at what a *true* disaster this year has been, with some tips to prepare for this winter season; while in *FCC Focus,* Peter Guttman helps us prep for an FCC Inspection. Jeff Johnson gives you tips on keeping your satellite signals strong, in *Safety and Security;* and in *Operations Guide,* Chris Tarr discusses automatic RBDS message generation.

Scott Schmelling explores remotes in *Chief Engineer;* and Roger Paskvan gives us instructions on how to build a radial sniffer, in *Small Market Guide.* In *Practical Engineering,* Mike Callaghan shows us some Zephyr tips; and, finally in *LPFM Guide,* Leo Ashcraft give us his suggestions for selecting your LPFM antennas.

Ray and I want to take a moment to wish each of you and your families a *very* Merry Christmas, and a safe and sane New Year. We hope Santa is good to you, and that your Holiday Season is one without any night-time emergency calls.

To all of our readers, writers, and advertisers, a heart felt thank you for another great year. We'll be back at you again in 2012, with six more issues jam packed with interesting stories, practical tips, and a whole lot more.

– Ernie Belanger, Editor

THIS CODEC HAS BEEN THROUGH TWO WARS, MULTIPLE ELECTIONS, FLOODS, FAMINE, EARTHQUAKES, HURRICANES, MARATHONS, CHAMPIONSHIP GAMES, REGATTAS, LOTS OF CONCERTS AND WAY TOO MANY CLUB EVENTS TO ADMIT.

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Cover Story

ENCO Systems

It's All About DAD

by Ernie Belanger

The story of ENCO Systems is a story of the application of advanced technology. It's a story of dedication to the broadcast industry. It's a story of creating and supporting powerful products that enable communicators to do more with less. Most of all, it's a story of a dedicated group of individuals, coming together as one – with focus, vision and hard work to build a company that has become an industry leader in radio automation and audio delivery.

The Start

ENCO Systems was established in St. Louis, MO in 1983, by two MIT engineers, Eugene (Gene) Novacek and Judy Kane Novacek. Gean and Judy began providing computer-based process control solutions in industrial applications. Their products found themselves used on assembly lines, and in power plants and industrial waste management. ENCO grew and thrived, but as new industrial construction slowed, Gene began looking at other areas where the application of computer-controlled automation could be beneficial.

Shawn McDonnell and Mark Howington, tech support.

Influential Reunion

Around that time, Gene reconnected with an old friend, Dave Turner. It was this reunion that provided the link to a new direction for ENCO. The two had grown up together, attending junior and senior high school in Southfield, Michigan. Gene went on to MIT, while Dave attended the University of Michigan, earning a degree in Electrical Engineering, and then landing an engineering position at WJBK-TV in Detroit.

After a number of long nights, a direction was decided upon, and work began on a new product – Digital Audio Delivery or DAD. Building on a heritage in automation technology, and with an in-depth understanding of challenges faced by television and radio broadcasters, ENCO would focus on the application of computer-based automation solutions to meet these needs. The emerging power and capacity of PC computers enabled ENCO to adopt concepts of process control automation found in high tech assembly lines, and apply them to the broadcast studio.

DAD is Born

In 1992, ENCO's first DAD, was introduced. DAD was targeted at replacing error-prone, manual cart systems commonly used in broadcast, to sequence and play audio content. DAD increased flexibility and productivity for broadcasters and enabled trouble-free automated formats that could run for days without intervention. The rapid adoption, and positive reception of DAD, allowed ENCO Systems to refine their focus to working within the broadcast industry exclusively.

Designed for Television

While radio broadcasters were quick to see the potential of DAD, the original target market was actually television, as a cart replacement. During the first NAB Show in which ENCO participated, there was certainly interest from TV, but Radio interest was intense and unexpected. This provided Gene with the opportunity to establish what is now a well-known ENCO attribute – rapid response.

Engineers would see DAD at that first show and say, "I really like your system, but I sure wish it would do XXX." The next day, or sometimes later that same day, the requested feature would be added to DAD. A number of people who saw DAD at that show, and experienced that level of response, purchased DAD systems. Virtually overnight, ENCO Systems was off and running in the broadcast business.

Many early ENCO purchasers continue to use DAD to this day, having updated hardware and software a number of times over the years, but continuing the relationship built between them and ENCO. Some of these early adopters included the Weather Channel, WGUC in Cincinnati, KSL in Salt Lake City, and KUSC in Los Angeles – all ENCO clients for nearly 20 years.

ENCO and DAD Evolve

The next several years saw a number of changes, including a move from St. Louis to Farmington Hills, in the suburbs of Detroit, then a subsequent move to a larger facility in Farmington Hills with a good deal of growth in staff, users and profile. The DAD product, then called *DAD486x* (after the high-powered Intel processor) used DOS, and used an ENCO designed software that provided the framework for a rich graphic environment that didn't compromise machine or system performance.

During this period of the mid-90's, some of the most powerful features of DAD were developed, including the ability to play up to four play lists at the same time from a single computer workstation, allowing an AM/FM combo, for instance, to both run from the same studio PC. Another innovation was the DAD Command Language (DCL) which was a virtual programming language built into DAD that functioned like a macro language in a word processor, allowing long sequences of events to happen with the press of a single button.

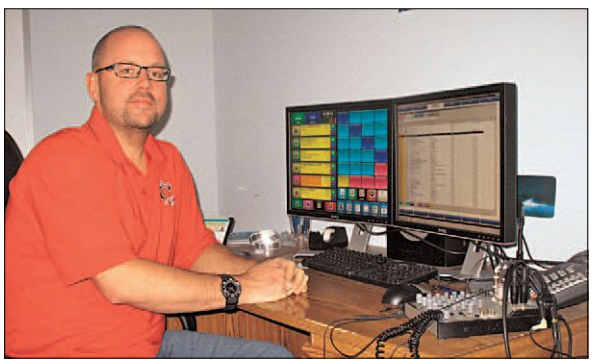
Forward-Looking Design

Another attribute that would repeatedly show itself would be the inclusion of features that were so broadly defined they could be used for the original purpose and then, well into the future, they could be repurposed to serve a completely different need. For example: ENCO support for RDS output in back in 1993 was so broadly developed that it also supported output to web sites and HD Radio, that only became popular in the next decade. The same was true of podcasting, or compiling of a full multi-event playlist into a single audio file.

A virtual GPI/GPO structure completely outside of the hardware-based GPI/GPO system was designed for a dedicated ENCO user interface, and then was able to be applied to control IP Audio systems from Axia and Wheatstone. All features that were developed in the mid-90's have been applied to entirely different technologies, as they emerged as much as 10 years later – a capability that shows ENCO's forward-thinking approach to system design.

Continued Growth and Expansion

As ENCO continued to attract large and small clients all over the world with DOS-based *DAD486x,* and the newly renamed *DADpro*, Microsoft Windows was finally evolving from a GUI front end for DOS into a true operating system with Windows NT. So, in 1997, ENCO released *DADpro32*, an automation and delivery system for the Windows NT environment that took advantage of the more powerful hardware and resources available to stations, clusters and networks.



Patrick Campion, Director of Product Development

On the Move

The 2000's brought another move for ENCO to new, larger quarters in nearby Southfield, Michigan. The *DADpro32*, got a new name and became known as simply *DAD*. As the Windows operating system continued to evolve, DAD has continued to evolve with added functionality and ancillary utilities, from Drop Box to Gateway. ENCO has written utilities that simplified the process of file ingestion and database and audio synchronization, both in LAN and WAN configurations.

DAD was selected by National Public Radio's Public Radio's Satellite System to provide the Basic Automation System to public radio stations. The selection of DAD by NPR was due in part to ENCO's Content Depot Monitor. This function provides a seamless interface between the satellite file distribution system and Drop Box, making it easier for stations to load programs. *(Continued on Page 8)*

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Cover Story

ENCO Systems

– Continued From Page 6 –

This project involved delivering automation systems to over 125 public radio stations across the country. When you add this to those systems already installed at NPR stations, ENCO has nearly 60% of interconnected NPR stations as customers.

Enter the Apps

As HD Radio was introduced, and began to gain traction, ENCO introduced *PADapult*, a software utility designed to work with any modern automation system to take "now playing" information and properly format and distribute that data to as many as 10 destinations, including RDS, web sites, billboards, and of course, HD Radio. In 2008, RAMA (Remotely Administered Metadata Appliance) was introduced. This can incorporate up to 10 instances of PADapult in a web-managed dedicated workstation. At introduction in 2008, RAMA garnered several industry awards.

DAD continued to advance during this time, and it became the first automation system to support the Axia IP Audio system, and the first to support the Wheatstone IP Audio system. Besides supporting both Digigram and AudioScience professional sound cards, it also integrates with VisiBlu WAN-enabled IP Audio for broadcast. A quite impressive list of accomplishments thus far in our story, but things were about to get even better as DAD continued to evolve in its development to meet the needs of the ever changing marketplace.

DAD Advances

One of the biggest advancements in DAD was just around the corner though, with the introduction of Presenter, an all new, fifth generation live-assist interface at NAB 2009. Presenter was designed as a full-screen interface, with buttons, icons and screen elements designed for easy use with touch screens – a panel-based display offering a number of choices for users and non-modal operation so that no operation obscures the functioning panels, Utilizing valuable input from ENCO consultant (and Scott Studios founder) Dave Scott, Presenter was, as Dave described, "What SS32 would look like today."

Utilizing the powerful and reliable DAD audio, control and command engine, Presenter was both a new look and a proven automation and delivery system. With integrated voice tracking, "button box," editor, history tool and script display, Presenter provides the most needed on-air tools in a single, easy to use full screen interface.

Presenter met with immediate success, with new automation buyers, existing users of other automation systems and existing DAD users, who could easily add Presenter to their current DAD systems, a pattern that remains to this date in markets around the world.

iDAD

At NAB 2010, ENCO introduced iDAD, an audio recording and remote control app for Apple's popular iPhone and newly introduced iPad. iDAD allowed stations to easily record and transmit audio from their mobile devices directly into their DAD and Presenter systems. Users can also control the system via DCL commands right from the phone, giving them flexibility in uploading information during a disaster or simply voice tracks from a "live" remote.

Dedicated to Support

ENCO is strongly dedicated to top drawer technical support and customer service. There is always a large amount of research and development that is constantly going on, to find the next best way to provide highly reliable and user-friendly automation and audio delivery to the broadcast industry. That, according to ENCO, makes them largest, independent pure automation company in North America.

ENCO continues to innovate with new technologies for broadcasters, like Presenter, RAMA, PADapult and iDAD. ENCO is already working on exciting new developments like Push Radio (a joint venture with Nautel), new applications of virtualized server and workstation technologies and, as always, listening to their clients to see what matters most to them.

DAD May Wake You Up

Every day, billions of people worldwide are reached by DAD-supplied content – even the scoring material and sound effects for NBC's *Saturday Night Live*. As Gene Novacek, ENCO president says, "This is what we do. It's our passion. We know that people rely on DAD and Presenter every day, as a key component of their broadcast business ... and we take that obligation very seriously."

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Xtreme Engineering

By Steve Callahan

A Really Xtreme Build

This month I have a transmitter site that really puts the X in Xtreme. Many of us will never have the opportunity to do a big installation project in a foreign country. I would personally welcome the opportunity, because of the logistical challenge and the ability to work in a different environment under unique conditions. Read on to find out how I learned about this most Xtreme site.

Shively's Dubai Build

I was coming back from a long weekend in western Maine, so I thought I'd stop by the Shively Labs in Bridgton. Angela Gillespie and Bob Surette welcomed me, and we had a chance to chat about some of Shively's recent challenging projects. They suggested that I should talk with Martyn Gregory about an antenna they installed last year in Dubai, in the United Arab Emirates.

Martyn was happy to share some of the particulars of this most interesting project. Shively had been working on this installation from August of 2009, to October of 2010, and Martyn and Matt Smith were the two Shively engineers who spent nine days on site. As with many international projects, there were many delays and finally all parties were ready for the actual construction and installation. This was Matt's first out of the country project and what a project it was.

A road less traveled – looking down from the site.

The Plan

The initial project called for a major upgrading of the existing site. Previously, there were a half dozen individual FM radio stations variously branch-combined into three separate systems. The existing antennas were two vertically polarized dipole panels. The coverage into Dubai and Abu Dhabi was both unreliable and inadequate.

So one goal was to get a circularly polarized FM signal into Abu Dhabi, which is 130 miles from the tower site. Fujairah Mountain in Fujairah, UAE is a very rough 3,000 feet above sea level. The project called for a Shively 2540-16-6, station balanced combining system, capable of handling six 20 kilowatt Nautel NV20 transmitters. The 16 element broadband panel antenna would be fed from a single, five-inch high power semiflex feed line. The antenna peak gain would be 15.8 dB and the maximum ERP generated would be 750 kW. Those are some pretty big numbers.

A Huge Problem

The first problem needing to be overcome was a lack of "line of sight." Remember, Abu Dhabi is around 130 miles to the southeast of the tower site, and even with a transmit antenna elevation of almost 3,000 feet, the direct path is completely obstructed by the curvature of the earth. However, in this part of the world there is intense tropospheric induction most of the year which can extend the radio horizon considerably.

Normal FM antenna practice in the Middle East is to use vertically polarized elements, so Shively's proposal to use circular polarization on the new antenna was a departure from the norm. However, Shively's success with circular polarized antennas in other counties in the Middle East made a very compelling argument.

The owner of the station was ready to try anything, after having to promise local officials good stereo coverage into the city, as a condition to receive the license to operate. The advantages outweighed the negatives, and the project was signed and work proceeded. Of course, there were changes and delays with a project of this complexity and magnitude, and the actual installation started almost exactly one year after the contractual documents were signed.

Welcome to The Site

After a 16 hours flight to the Middle East, Martyn was shocked to see the washed out state of the road leading almost 2,500 feet up the mountain. It was a logistical miracle for the local contractor to get 70 tons of air conditioning up the road and installed into what would later become a showplace facility. This wasn't the only problem with the project.

Work on the mountain was hampered by the constant fine dust and summertime desert temperatures reaching as high as 120 degrees.

Existing Tower

Fortunately, the tower was an existing structure and there already was power to the site. The power came to the site as 11 kV but was then stepped down to 415 VAC. However, the access road to the mountain was a nightmare. The pickup trucks rented by the local contractor needed a new set of tires every two weeks, and when the project was finished, the trucks were practically worthless.

The Antenna on the Tower

Crew Untrained

The local installation personnel were not specifically trained in contemporary broadcast installation procedures so they did what they were familiar with to get the job done. All of the transmission equipment was shipped from the U.S. to the UAE. Then the rough ride up the mountain guaranteed that all the filters in the combiner had to be checked and retuned.

This build was about as Xtreme as it can get. The environmental conditions were deplorable, with the heat and the dust. The "road" (for lack of a better description) to the transmitter site seemed as treacherous as traversing Mt. Everest. The crew wasn't trained on new broadcast construction and, to top it all off – by normal methods of RF planning – the signal had virtually no chance of reaching one of the intended destinations, Abu Dhabi. Oh, but the story gets even better – way better.

An Unlikely Cable Pull

It seems that the local installation crew used some techniques that we wouldn't even consider in this country. Instead of a ground-mounted winch, the installation crew used a Toyota pickup to pull the transmission line up the tower. The intrepid guys from Shively had to check everything done by the local crew, after they found some directional couplers full of brass filings. Extreme locations call for extreme measures.

Martyn is happy to report that the facility did sign on with one of the FM signals, and that the reception in Abu Dhabi was much better than anticipated. Shively is certainly in the forefront of antenna design and implementation when it comes to extreme sites both in the US and in foreign locations. Ultimately, after a complete inspection of every aspect of the RF systems, the new antenna system performed as designed, and coverage reports confirmed the validity of the polarity change, the tropospheric induction, and the general system design.

Success

In Dubai, there is now coverage in underground parking structures and in Abu Dhabi there is now good coverage where there previously was none. The good folks at Shively are looking forward to their next project in the Middle East which will surpass the Fujairah system in every aspect. As Martyn says, "If it was easy, anyone could do it!"

Steve Callahan is the owner of WVBF, 1530 AM, Middleboro, Mass. and can be reached at wvbf1530@yahoo.com

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David Trudrung, General Manager & Co-owner

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Alcohol vs. Nasty Chemicals

By Gary A. Minker

Flash – beedeep-beedeep – in case you have not noticed, it is not 1922, and the radio business is not new – nor is dirt. Dirt, in it's pure form, has been hanging around since before the dinosaurs. But in the modern world of electronics today, dirt takes many forms. You have dust bunnies, red silt, black silt, sooty carbon, and an entire encyclopedia of various types of filth that can ruin your day.

Dirt is not innocuous. Dirt is insidious and, for an inanimate object that relies on the wind or static coronal attraction to get around, it is the most problematic substance we have to deal with. This is especially true at most transmitter sites, because of their remote location and the infrequent visits.

The problem with dirt is how to control it, manage it, and remove it. I will mention a number of commonly available brand names here, but there are many other brands and generics to choose from.

New Times – New Tools

The simple fact is, because it's no longer 1922, there is now a host of new chemicals that can help you avoid or cure problems with dirt. The number of cleaning tips and tricks runs the gamut, depending on your specific circumstance.

Dirt can range from grime, to grease, to carbon-related soot – and these three categories pretty much cover the spectrum. If it is simple grime, general cleaners like Windex® or Simple Green® are just the ticket.

Grease and other oils can be taken care of with general cleaners, but sometimes they may require a more aggressive solution. After the use of any aggressive solution, a final cleaning with a more neutral cleaner, like Windex, is sometimes appropriate.

Carbon Related Dirt and Soot

To clean carbon-related dirt, soot, and electrostatically attracted filth, may require what I generically call a "Nasty Chemical." This is where we usually revert back to our basic engineering and whip out alcohol by the gallon, soak some rags, and rub the equipment (and our fingers) raw.

However, the surprising result of this, is that the soot is likely still there. Oddly enough, if the alcohol had any effect on the soot, a smearing action may have been observed and mistaken for a cleaner surface. But a quick check of the rag will confirm that most of the soot is right where you left it – and the rag, while now a fire hazard, is largely unsoiled.

Rethinking Cleaning

Go ahead and name at least one thing for which alcohol is a solvent. Give up? Try shellac – and only when it is still liquid. The trick is to learn a *new* trick – use the right chemical for the right job. This is similar to using the right tool for the right job, and we've all used this successful approach for a very long time.

The Trick – A Nasty Chemical

We can all admit that anything with a Materials Safety Data Sheet (MSDS) is likely to be nasty. It can also be said that anything containing some of the chemicals listed below is also likely to be nasty.

So let's define nasty. It is toxic, it removes all moisture from your skin, it is readily absorbed *into* the skin, it melts most plastics, it smells very bad, and it is an inhalation hazard. Howevere, it *will* remove grime, grease, carbon, and soot from virtually any surface. Unlike alcohol, it sucks the grime into the rag that you are using – instead of just pushing the dirt around like sand in a glass of water. And because this stuff is so strong, it really does the job.

Some of us will remember a once-common product called Methyl-Ethyl-Ketone (MEK) was one of the nastiest cleaning chemicals ever produced and was all but removed from the market place.

MEK has cleverly been replaced with a product called "brake cleaner." It is a generic product and can be found in every automotive supply shop. It is one of the daily use items in garages, much like lubricants and the air hose. It is available with or without chlorides, for the copper contaminating purist.

Safety First

Just like any dangerous tool, you must observe cautions when using chemicals. Although brake cleaner removes oils and grease extremely well, it is also very strong. Most importantly, this is a toxic chemical that is readily absorbed into the skin, while also removing all of the moisture from your skin. Make sure you use protective gloves.

It is a definite inhalation hazard – and it is flammable. The can is under extreme pressure, so be careful not to get it into your eyes. On the positive side, it is 100 percent volatile, leaving no residue behind that might be detrimental to electrical or RF conductivity. Brake cleaner will totally evaporate almost as fast as the old Freon.

Even household rubber gloves will protect you.

This wonder chemical, unlike our old favorite alcohol, will not leave behind droplets of water or take forever to evaporate after you put your transmission line back together – or create an explosive atmosphere inside, where the first bullet joint arc will cause an eye opening boom.

Use Tips

Do not (usually) spray any object directly, so as to avoid splattering dirt, and allowing capillary action to draw newly loosened dirt into cracks and crevices, where only a flow of more cleaner will ever hope to get it out. In most cases, you should only be applying cleaner to a rag. This brake cleaner liquid is *extremely* aggressive on most plastics, so any use there should be avoided.

This stuff is the best thing since the Steam Jenny for getting grime, carbon, and soot off of cavity walls, Teflon insulators and porcelain surfaces. Keep in mind that it is easily absorbed into any porous surfaces, like cracked porcelain, or any type of clamped or mated parts, so capillary action can work against you when cleaning.

If you are looking for an elusive carbon path, clean the area with this stuff, turn on the high voltage, and observe. With all of the dark grime and soot now out of the way, you'll now have a much better look at where the arcing or carbon path may actually be occuring.

Whether it is a cool new tool, or a new chemical, use it safely and enjoy your cleaner world.

Gary A. Minker is the owner of Radio Works R.F. in Lake Wood, Florida he can be reached at (561) 969-9245 or via email at Gary@Radioworksrfconsulting.com

Mint for Mice – a Timely Tip

Many of us have experienced the unpleasant situation of removing a charred mouse, mouse droppings – or worst yet – having to repair a wire harness where the insulation has been chewed through.

In a recent discussion with a professional exterminator, he relayed a story of how mice got into his engine wire harness and chewed the insulation off some wires. Of course he didn't discover the problem until the truck wouldn't start one morning.

He told me of his fix. He took a small metal container with a magnetic strip on the bottom. He punched holes in the cover to allow air to flow. He then filled the container with cotton balls and poured in mint oil. (He specified oil because it wouldn't evaporate as quickly as other materials.)

He then placed the container in the engine compartment. One little known fact is that mice don't like mint or the smell of it so it repels them Try this in your transmitter.

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RFSTX	Newark	TX	Dan	800-537-1801
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Studio Site

Work That Microphone!

Improving Your Sound With Technique and Technology

by George Zahn

If you had the foresight to equip your station with good quality microphones, or you have recently invested in mic upgrades, it's time to focus on the next level of your station's announcer sound. As with many advancements, we can throw money at the problem via technology. But first, let's revisit some technique basics because a little coaching can maximize even mediocre microphones and make your best condensers excel.

Let's tackle the basics of the microphones in your studio(s). The preferred pickup pattern or directionality of your studio microphones should be cardioid (unidirectional) or the slightly tighter supercardioid. These patterns are used to minimize multiple sound sources "bleeding" or leaking into other microphones in the room. It's the audio version of "point and shoot." You simply aim the microphone at the announcer and the microphone basically "ignores" sound coming from the back, and most sound coming from the sides.

Using cardioids or supercardioid patterns minimizes phasing, resulting from the same voice hitting two mics at different intervals and "washing out" some of the higher frequencies including the "s" and "t" sounds that make up intelligibility. Those patterns also allow the board operator to have maximum volume control over each sound source in the room.

Most radio microphones are either very high quality dynamic microphones, or very good condenser microphones. These are the two most affordable microphone families. The dynamics as a family are very durable and are low maintenance. Condensers require either an internal battery or phantom power from a console, but they can deliver a crisper overall sound. In radio, ribbon or velocity mics are rare, but can offer some of the richest bass. As a rule, the dynamics are cheaper as a family, followed by condensers, and then the more expensive ribbons.

Off-Bass Comments

So how do you get a rich ribbon sound from a moderately priced dynamic microphone? It may not be possible to totally replicate the ribbon quality, but some technique tips can help. All cardioid and supercardioid mics have a blessing and a curse called "proximity effect." Simply put, the closer we work the microphone, the more the bass is enhanced by the microphone. For those, like me, who do not strike fear in the heart of James Earl Jones when it comes to bass response, proximity effect is our friend. We work that mic close to give our voice a little more richness than we might normally have.

So then, what happens when my shift is over and the next host has the deep velvet tones I lack? That host can simply work farther away from the mic as the best option. For extreme cases, most really good cardioid microphones also have a bass roll-off switch which can reduce proximity effect for announcers who do not need it. The bass roll-off does what the name implies. It attenuates the lower frequencies reproduced by the microphone. Some mics have multiple settings, ranging from subtle to severe bass reduction.

At my station, I try to avoid having my announcers play with the easily changeable bass roll-off switches on our Sennheiser MD 421's (there are five settings, from flat to basically no bass at all). Because many announcers (including me) don't think to check the microphone setting when we come back for our shifts, the bass roll-off can make some of us sound like a prepubescent male.

In most stations, there may be few announcers that would truly need the bass roll-off. Most professionals with ample bass resonance can work the microphone at a comfortable distance and minimize the proximity effect.

Pick a Mic, any Mic

A Standing Renovation

A quick story about my second professional job (more years ago that I care to mention). I was working at WSAI-AM in Cincinnati and, to that point, most of my previous experience had been in studios designed for seated performance. I was basically undaunted by the standing position, but my PD was at times critical that my voice work could be better.

One day, he walked into the booth while I was right in the middle of a fifteen minute cast. He reached around me and moved the mic in closer to capitalize on the proximity effect, and we noticed an immediate positive difference. I had known the theory from my broadcast training, but wasn't using it in my new environment.

There are other ways to improve microphone sound without changing the microphone or announcer. As equipment costs continue to drop, there is now a fairly wide range of microphone processors and preamps that range from a few hundred dollars into the thousands. Some of these devices can have a moderate to profound effect, depending on where your starting point is.

Microphones tend to churn up a very low amount of audio, hence needing a preamplifier to be used effectively in consoles. If you have a console with built-in mic preamps, they may be good enough. But there are some very, very low cost multi-channel consoles in which the reason for their low price is that the microphone preamps are deficient, noisy, or unreliable.

Tube-Be or Not Tube-Be

In electronics, there are solid state and tube circuits. Solid state is the most basic current technology, in which the audio signal passes through a semiconductor material. Prior to solid state, a vacuum tube was used as part of the preamp circuit, and one school of thought claims that the tube preamp created a warmer and more pleasant sound from the microphone. There are even solid state preamps today that will try to replicate the "tube sound." This argument will rage on, just as we can all debate pros and cons of analog vinyl versus digital audio. In fact, there are some hybrid preamps which feature both solid state and tube options.

Can a preamp really make a difference?

If you have a good microphone and a good announcer, the preamp or processing can take you to another level. Keep in mind that any part of the equation – announcer, microphone, or preamp/processor – could become a weakest link, and the processor won't be of much help if the announcer is hopeless or the microphone is falling apart.

Preamps come in single, dual, or multi-channel models, and have various settings. Among the major manufacturers of preamplifiers are some of the names we know from audio processing including: Alesis, dbx, AEA, PreSonus, ART, Grace, Universal and many, many others. A great way to see if a preamp works is to first borrow one and try it. There are many options and styles, and your engineer, and his or her network of fellow engineers, may be a great starting point to see what might be able to be borrowed. A reason it's good to experiment before buying, is to ensure that any new mic processing is a good fit with any other station processing.

Another possible alternative to a new preamp may be located in your production studio. At WVXU, our production staff experimented quite successfully with using a simple dbx Over Easy compressor patched into our microphone channels. That compression and the proximity effect of the microphone added some extra bottom "oomph" without adding an expensive preamp. We found ways to tailor the compressor's settings for each announcer on staff to give us a unified sound, while doing minor tweaks based on each announcer's strengths and weaknesses.

Channel Surfing

Another option is a group of processors called microphone channel strips. The channel strip is basically a combination of the two technical options we've addressed so far, and then some. A channel strip is an all-in-one device that generally includes a microphone preamp (many with different settings), compression/limiting options, and other features, ranging by model and manufacturer, from basic frequency equalization to built-in de-essers to reduce sibilance issues. These channel strips also range from single to multiple inputs. Some also offer tube preamps, and the overall list price range can run from under $200 to more than $7,000.

Again, networking with other managers or engineers, or "try-before-you-buy" agreements with vendors, can help narrow down a maze of basically well-qualified pieces of gear. Just as microphone preference differs from one professional to another, you can ask twenty engineers and get twenty-one opinions, so it's best to test drive any new gear when possible to see if there's enough cost benefit – especially if the gear might chew up good part of your equipment budget for the fiscal year.

If you have a preferred mic preamp or channel strip, please let me know, and share your experience, so we can learn from it! Please remember that these devices and the techniques we've discussed this issue are the proverbial "icing on the cake" for your station sound. A decent microphone with solid announcers in front of it is really the first step to your best on-air sound.

George Zahn is the Station Director/General Manager for WMKV Radio in Cincinnati he can be reached via email gzahn@mkcommunities.org

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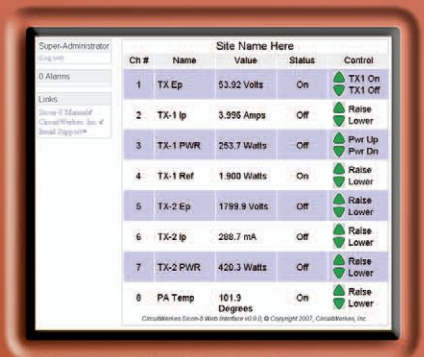

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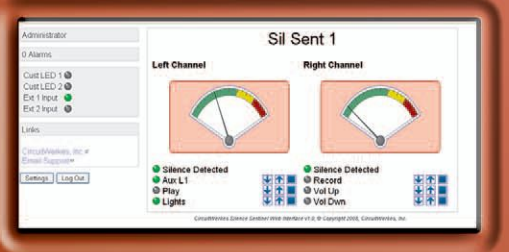

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Disaster Preparedness

Are You Winterized?

by Ernie Belanger

As we put a close on 2011, many of us will remember this as one of the worst years in memory, when it comes to natural disasters. While many of us have escaped the direct impact of the disasters – not loosing property or sustaining property damage – many of us have friends, or know of families, whose lives were devastated by nature's fury. Some of them may have been listeners of your station.

During this past year, we have used this column to pass on to you sound advice to help you prepare your station and your personnel to be ready when disaster strikes. Hopefully, your station remained on the air and you were able to broadcast vital information that helped those who were affected.

As we enter winter, there are two major threats those of us in the northern part of the country will face – Blizzards and Ice Storms. Those in warmer parts of the country face the potential of flooding, due to torrential winter rains and possibly mud slides related to that rain and flooding.

The infamous ice storm of 2009 – power was out in parts of the Northeast for up to a week.

Blizzard and Ice Storm-Ready

The biggest problems a station faces in a blizzard or an ice storm is the loss of power, loss of communications and the movement of personnel to the station to relay emergency information.

The only way to ensure your station will say on the air in the event of a power outage, of course, is to have backup power at both your studio and your transmitter site. If you're located in a city, your building may have emergency back up power. For those of us in rural areas or smaller cities, we may be stuck fending for ourselves. Chances are that, regardless of where your studio is located, you will have to provide your own back-up generator at your transmitter site.

Winter is just setting in so there's still plenty of time to arrange for back-up power to be installed. Here is an important note. Have management check with their accountant – it might be possible to deduct the entire cost of the equipment and the installation in this tax year, if the station is in a profit position, under section 179 of the IRS Code. This could be a good selling point to get needed back up power now, vs. having to budget for it in the next fiscal year.

Remote Studio

One option, if management is not willing to buy back-up power for your studio, is to be ready to take equipment to the transmitter site for live broadcasts in a disaster.

With the technology available today, pretty much all your staff would need is a laptop computer with the music archives on it – along with the stations's commercials and ID's – basically a clone of the on air studio computer.

Living in "The Cloud" is a great idea for normal everyday life. In a disaster, where power is interrupted, you can not depend on having an Internet connection, telco, or even cell service, so plan accordingly. Always have everything you need to go on the air ready to be deployed. In the case of a blizzard or ice storm there will be plenty of warning to get your gear packed up and hard drives filled with the latest spots and music.

So it may be wise now, to make yourself a checklist of everything you'll need so you're not running around at the last minute all stressed out. With any luck you won't lose power at the studio, but don't wait until it happens to think about making a plan or a checklist.

Battery Back-up

One of the most overlooked parts of a back-up power system is battery back-up. Every station that has a back-up power source with an automatic switch, should invest in a station UPS (Uninterruptible Power Supply) large enough to keep its equipment running during the ten seconds or so that it takes for the power to switch, to bring the back-up on line.

This station UPS will also buffer your equipment from any spikes and surges in AC power, that may occur immediately upon switching to back-up power.

Insulated winter woveralls are available at most sporting goods and workwear stores.

Emergency Provisions

Also of concern is having enough provisions for station personnel who may have to "live" at the station for a day or two, to provide the on air coverage until the disaster passes.

There are several web sites that provide "emergency" packs that can provide basic provisions, or you can visit a local outdoor supply store that have some of the same types of provisions for hikers and campers.

While a lot of stations may consider provisions like these to be their personnel's responsibility, a small supply of provisions kept at the station will give personnel something to eat should the need arise. These packs are also handy for you, if you have to travel to several stations for maintenance during the winter. Should you become stranded at a transmitter site or along the side of the road, you'll have food and water until you can continue on your way.

Are You Ready?

Gone are the days of being too "cool" to worry about being prepared for emergency contingencies. Many of us have lived through some of the worst disaster situations in recent years. If you haven't yet prepared your own emergency kit, this check list below should help you do that.

Personal Readiness Kit

____ Wool or insulated hat
____ Poncho
____ Insulated underwear
____ Thermal socks
____ Sweat shirt
____ Extra pants *(thermal if possible)*
____ One-piece insulated winter overalls
____ Insulated winter sleeping bag
____ Emegency blanket
____ Spare flashlight with extra batteries
____ Extra insulated gloves and mittens
____ Heat source *(butane heater)*
____ Waterproof matches or lighter
____ Heat packs *(to keep feet and hands warm)*
____ Spare insulated boots *(if yours get wet)*
____ Emergency rations.
These could be energy bars or an emergency ration kit available on the web or at a local sporting good store.
____ Emergency cell phone battery boost
____ Note pad and pencil
____ Knife, rope/cord, plastic bags, duct tape
____ Reading material
____ Toilet paper and wet wipes
____ 2 gallons of water or a case of bottled water
____ First aid kit
____ Whistle and compass

You can add to the list or subtract from it. But the most important thing is to take the time now – before winter sets in – to do your prep work to protect yourself.

Your Vehicle

Finally, don't forget to make sure your vehicle is ready for the harsh weather ahead. The last thing you need is to be driving up to a remote transmitter site on a mountain top, only to break down. Not only would this be a miserable thing to have happen in snow country, with bitter freezing temperatures, but the same is true even in the warmer parts of the country. A breakdown in a remote area, is still a breakdown.

Always remember, that just like your equipment, your vehicle should have regular preventative maintenance. Because of the beating our vehicles take, running up and down rugged mountain terrain, that regular maintenance should be more often than recommended by the manufacturer. You want to make sure you can get to where your services are needed, without loosing valuable time with vehicle problems. *– Radio Guide –*

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FCC Focus

FCC Inspections

by Peter Gutmann

Had an FCC inspection lately? If not, consider yourself lucky, since many result in a hefty fine. (And remember that the FCC makes no distinction between a struggling, stand-alone rural AM daytimer and a major market powerhouse – each gets slammed the same amount for comparable infractions.) So here are some warnings, a caution, and a few practical suggestions.

Nearly gone are the days when inspections focused on frequency drift, meter accuracy and other technical issues. Nowadays, inspectors tend to focus on three primary areas of operation: tower site, studio personnel, and the Public File.

Tower Site

Many inspections begin before a station even becomes aware of them, with a visit to the tower site that may be unattended and quite distant from the main studio. Here, the inspector will check for signs – warning of danger and posting the tower's ASR number, the presence and integrity of required fences, and the visibility of painting and lighting obstruction marking. All of this is serious stuff, since the consequences of safety lapses in this area, ranging from air navigation to mischievous kids, can be grave.

Tower sites lure inspectors with sheer efficiency, since fines (generally $8,000 or so) for a single error can be levied upon, not only the tower owner, but upon every user as well – especially when the owner falls outside FCC jurisdiction. While most tower leases contain clauses requiring the owner or primary tenant to assume responsibility for maintenance and FCC compliance, that's not the FCC's concern and won't stop the FCC from fining each party, leaving them to settle ultimate financial responsibility among themselves.

Anyone Home

Rather remarkably, one of the most frequent inspection problems involves the staffing requirements for main studios. Admittedly, not much is required to satisfy the permissive main studio rule nowadays, since all technical, sales and business activity – and most, if not all, programming – can originate elsewhere. Indeed, just about all that remains is location within a specified area, broadcast capability, maintenance of the Public File and full-time personnel.

It's truly astounding how often inspectors arrive at an alleged main studio during normal business hours to find the place deserted or the staff ignorant of the most rudimentary information – like who is in charge, how to reach them, where the license is posted and, most often, where the Public File is located.

Note that this has nothing to do with unattended operation, which is permitted, but only extends to monitoring and ensuring proper technical functioning.

The FCC's commitment to localism mandates a properly-staffed main studio. Generally, temporary absences of assigned staff, for emergencies, illness and the like, are not a problem – but if the studio is empty or knowledgeable personnel are unavailable, it can be.

Public File

Speaking of the Public File; this has become the most frequent source of fines following station inspections. In addition to missing material, or even absence of the entire file, mere disorganization can lead to a conclusion that the file appears incomplete. Chief offenders in this category are the quarterly issues/programs lists. If all of the lists (going back to the beginning of the current eight-year license term) are not present at the time of an inspection, the damage is already done. The situation is worsened if missing lists cannot be found or, if never compiled, cannot be regenerated from surviving raw material.

(Continued on Page 20)

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FCC Focus

by Peter Gutmann

FCC Inspections

– Continued from Page 18 –

Emergency Alert System

Another area in which many stations fail FCC inspections is in their compliance with EAS requirements. Particular attention is being focused on this area by the transition to CAP – compliant equipment (currently required to be completed by June 1, 2012) and publicity surrounding the November national test. Functional EAS equipment must be available for inspection – and personnel familiar with its operation and record-keeping need to be present. But even if your EAS setup is fine, there may be a further problem, as far as the FCC is concerned, if you don't have a record that EAS tests were received and transmitted – how can you proove they ever occured?

EAS tests, activations and outages must be included in the station log, that each station is required to maintain. While the FCC permits EAS equipment to be inoperative for up to sixty days, dated entries of outages must be made in the station log, which must also contain entries noting not only missed tests, but also the reasons for the failures.

In all of these contexts, it's essential to emphasize that licensees of time-brokered stations remain fully liable for inspections of their facilities. Even though many licensees view the requirement to maintain full-time managerial and other personnel at their main studios as a waste of resources, a failure to maintain the required staff presence is considered a serious relinquishment of control.

While a licensee's LMA "managers" often are far less skilled and experienced than genuine broadcast executives, it is essential that they – and the second required main studio employee – have at least a basic knowledge of the matters of concern to an FCC inspector.

A Caution

Often, a client will call, sounding greatly relieved that they had an FCC inspection and all seemed to go quite well. That is, they report that the inspector found a few problems, but offered helpful suggestions and seemed satisfied, perhaps even adding some assuring or complimentary remarks on the way out.

Inevitably, the same client is upset months later to receive a citation – and then a fine – for those very problems. Inspectors generally recognize that there's no point in being abrasive, and their demeanor is usually quite pleasant. But that doesn't mean that all is forgiven. Promptly fixing a problem following an inspection is expected, but does not excuse the lapse that occurred at the time.

Become Inspection Ready

So, what can you do to avoid unsuccessful inspections and the ensuing penalties? The best approach, of course, is to comply strictly with all applicable FCC requirements in every aspect of station operation. But that's much easier said than done. There are two simple approaches.

First, the FCC publishes self-inspection checklists on its website at **http://transition.fcc.gov/eb/bc-chklsts/** They're quite comprehensive and their sheer bulk can be intimidating, but they provide a good outline of the areas of potential concern.

Many of the items can prompt practical questions that you'll want to discuss with your attorneys and consulting engineers, who also may have more targeted guidelines available for specific areas. (For example, we have primers concerning such areas as Public Files and political advertising posted on our firm website.)

Second, many state broadcaster associations sponsor alternative broadcast inspection programs in conjunction with the Society of Broadcast Engineers or local consultants. For a relatively modest fee, a private inspector will go through a station with the FCC checklist, discuss areas of concern, offer suggestions, provide a confidential report, and afford an opportunity to make necessary corrections.

A major advantage of this program is that it insulates participating stations from a surprise FCC inspection for three years following successful completion (and in some programs once the alternative inspection has been scheduled as well).

Even so, the alternative programs do not shield participants from FCC inspections prompted by safety concerns or complaints, including those stemming from political broadcasting obligations. As with most things in life, it's far better to be safe than sorry.

Peter Gutmann is a member in the Washington, DC office of the law firm of Womble Carlyle Sandridge & Rice PLLC, he specializes in broadcast regulations and transactions. His email is: pgutmann@wcsr.com

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Safety and Security

A regular column on protecting property and persons – with a technical slant.

Let It Snow, Let It Snow – Let It!

by Jeff Johnson

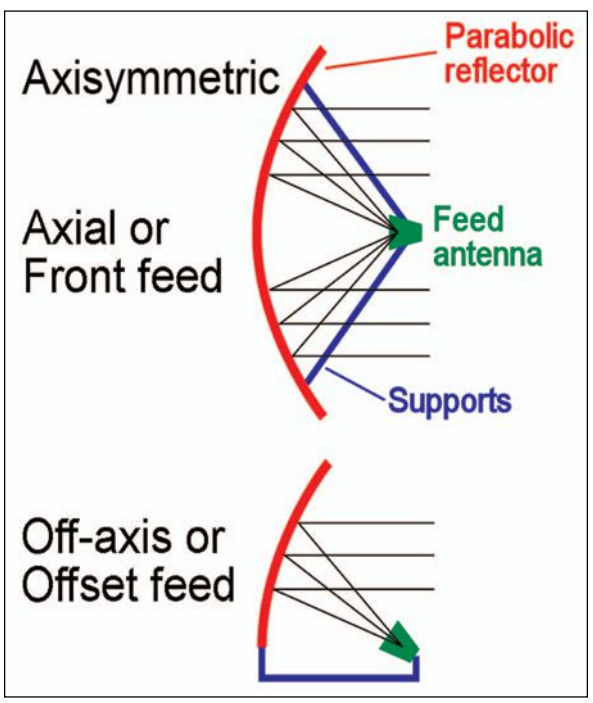
Security can also mean staying on the air during bad weather. Broadcast engineers hate to see a lousy weather forecast more than anyone, but keeping a station on the air during weather disasters better serves public safety.

Thunderstorms mean lightning, rain, hail and wind, but they pass. Snow and ice linger, especially on our satellite dishes. Winter is coming!

C Band Dishes

C Band satellite frequencies, having a longer wavelength, are less affected by water droplets in the air than higher Ku band frequencies. However, the reflective quality of the surface of the satellite dish affects both. Dry powdery snow does not stick to the dish surface. A glaze of freezing rain can be quite even, and, while undesirable, may not cause satellite signal loss if that signal has a good fade margin. The glaze of ice does not scatter the reflected signal as badly as the real bugaboo – slushy sleet and snow.

Most of us have attacked snow on a dish with that old, tried and true tool: the broom. The snow swishes down off of the dish, getting our legs and boots wet. Some dishes are high on rooftops and at remote sites, making them difficult to get to, at best. Ladders used in snow and ice are a safety nightmare. There has to be a better way.



Axisymmetric and Offset Geometries

The most familiar type of satellite dish is the parabolic "axisymmetric" – front-feed or center-feed prime focal (prime focus). Most axisymmetric dishes have the receiving device, usually an LNB (Low Noise Block down converter), mounted on struts at the focal point and which "looks" directly into the center of the dish. A type called "Cassegrain" utilizes a sub-reflector at the focal point that reflects energy to a feed located at the apex of the main reflector, perhaps behind a hole in the center of the main reflector. If this sounds like astronomy, well, remember a satellite dish is after all a radio telescope.

Photo-1: A 3.8m Comtech Dish with a DAWNco cover.

Dish Angle is a Problem

An axisymmetric dish is tilted back to "look" at its geostationary target satellite in equatorial orbit. The closer to the equator, the higher is the tilt. In middle latitudes, the tilt is logically around 45 degrees above the horizon. The satellite dish thus makes a very effective "snow bowl."

To prevent snow, slush and ice accumulation, vinyl fabric dish covers are available. These are just like seat covers in your car – they "sluff off" the nasty stuff. Stretched tightly across the front of a dish, the slick surface sheds nature's assault. *(Continued on Page 24)*

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Safety and Security

by Jeff Johnson

– Continued from Page 22 –

Whatever sticks can be easily knocked off with a few whacks from that now little used broom. The author and a colleague installed a DAWNco dish cover *(photo-1, page 22)* on a Comtech 3.8m C band axisymmetric dish four years ago. It is on a roof in the Cincinnati area, and it has never once needed attention since its installation, even during February 2011, a month of record setting snowfall.

Zig Zag Heater Tape Applied

Off Axis or Offset

A second type is the "offset" asymmetric dish. With this type, the LNB "looks" up into the dish at an angle. It is like looking into a mirror from the side rather than straight in. The dish, usually an oval, is shaped to form a focus offset from the center of the dish. With this geometry, the dish mounts in a more upright manner. With an offset dish, the LNB is lower to the bottom, plus the surface of the dish, being a shallower concave, is more readily reached than is the axisymmetric. That upright stance allows snow and slush to stick less readily. It is also easier to brush off any that does accumulate.

Heaters

More commonly seen on offset dishes, where it is more effective, due to the more vertical position of the surface, a dish heater can solve problems. The dish is heated from the rear surface – usually just the bottom half. Hot air blown into a rear shroud can be effective. It is important not to heat the dish too much, causing it to warp. A factory-supplied system will always be best, as it will be engineered for the dish. With the dish heated, there is no ice or snow build-up which causes reception issues and program interruptions.

Heat Tape

The author installed a tape-type system kit onto a Prodelin 2.4m dish recently. The system was designed for this specific dish, and should be quite effective. The project took a great deal of time to complete, so it is recommended that a factory installation be specified. The kit we used consisted of four rolls of adhesive backed aluminum foil strips adhered to a heater wire. The configuration is similar to water pipe heating tape.

A pattern was supplied for applying the tape. Each zig and zag is cut and applied over a pattern of dots placed by poking holes in the pattern and sticking a Sharpie through each hole. All of this took a great deal of time and care. The work was done in a clean and dry warehouse, flat on the floor. Applying the heater tape would be a difficult job in the field on a mounted dish.

Once the tape wa applied, pre-cut foam back cover insulation was adhered over the tape. Note: Check the resistance of the tape to be sure of continuity before applying the insulation.

The cover installed over the heat tape.

The kit includes a controller that turns on the heater only in wet and freezing weather – it has a thermistor and a hygrometer. The hygrometer is at the bottom of a shallow cup that will collect snow and rain. When the temperature drops below freezing and the hygrometer is wet, the heater comes on.

Even though it is December and winter is just a few days away, you still have time to add heaters or a cover to your satellite dish. These will help to secure your station's programming stream, keeping it safe from "Old Man Winter" and the brutal ice and snow storms that are part of the season. Happy sledding and keep that Eb/No up!

Jeff Johnson can be reached at: jeff@rfproof.com

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Operations Guide

Delivering Title and Artist Information With RBDS

by Chris Tarr

What we now know as RBDS (Radio Broadcast Data Service) started in the early 1970's in Europe, to solve a pretty interesting problem. Many of the networks in Europe consist of several small transmitters on different frequencies, (much like the translator networks controlled by Public Radio and religious stations here in the United States). Instead of having their audience try to remember all of the different frequencies, they wanted a way to command the radio to automatically tune itself to the strongest signal in the network, based on a list of alternate frequencies. With that, a standard was born.

Using RBDS

RBDS, known as RDS in Europe, is a service that runs on an FM station's 57 kHz sub carrier. It can carry all sorts of data, such as station call letters, a list of alternate frequencies that a station is broadcasting on, the current time, type of programming, station name, text, and more. Nowadays, stations are even carrying small data payloads for things like real-time traffic data and command messages to "smart" devices.

One of the biggest uses of RBDS today is to transmit title and artist information to radios. Until several years ago, stations generally used RBDS to transmit their station name and their slogan, or things like static advertising.

It was programmed, installed, and left alone. The change to providing "active" data was thought to be pushed along by satellite radio's ability to display the current song information on their radios. Audiences liked the feature, and sure enough, terrestrial radio had the tools to do it as well.

How it Works

Making the system work seems relatively easy once you know how it works. The RBDS encoder injects it's data into the base-band composite signal going to your exciter. This necessitates the encoder to be placed with your stereo generator, either at the studio feeding a composite STL, or at the transmitter site, feeding the exciter.

The RBDS encoder will have either a serial port, an Ethernet port, or both. These ports are where you'd typically connect a computer and enter terminal programming commands to it. Under "static" operation, you'd connect your computer, enter some terminal commands such as your station name or Program Service (PS) and Radio Text (RT). Once that's entered, you'd disconnect your computer and go check out your handiwork.

Well, sending title and artist information is just like that, but instead of connecting, entering in data, and disconnecting, we're connecting a computer and having it automate those commands. And instead of giving the RBDS encoder PS and RT generic data, the computer is sending new commands every time we play a new song. So the information is constantly changing, and being updated real-time, as you go through your broadcast day.

An RBDS Radio

Here's the Catch

The data needs to be sent to the RBDS encoder in a very specific way – generally using terminal commands. For example, if you just wanted to put generic info on RBDS, you might send these static commands in your terminal program: ***PS=WAAA-FM<enter>, RT=You're listening to WAAA-FM<enter>*** And you'd be done. If you wanted to change it, you'd have to log in again.

However, if you wanted to do title and artist, you'd have to send the information in the following format every time the song changes: ***PS=Title Artist<enter>, RT=Title Artist<enter>***

On top of that, you may want to make it a bit more fancy and have your slogan in there too: ***PS=Title Artist WAAA-FM, RT=Now playing Title Artist on WAAA-FM***

(Continued on Page 28)

Which is better for streaming: hardware or software?

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Omnia

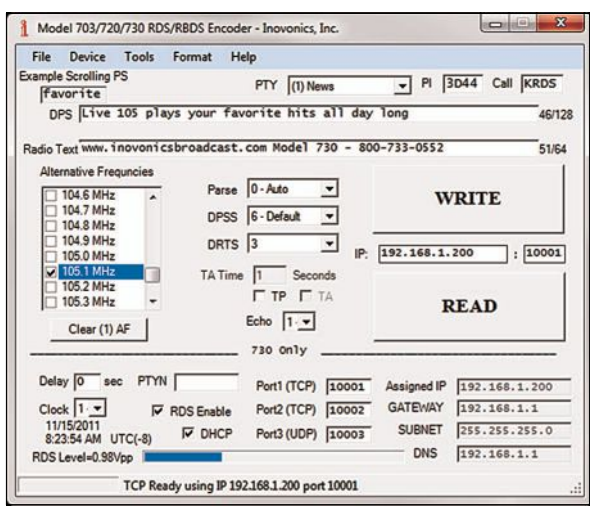
OmniaAudio.com/AXE/

Operations Guide

by Chris Tarr

– Continued from Page 26–

That would be a lot of typing to make that happen on every song! So what do we do? Fortunately, there are many solutions out there. First, and most importantly, you need to have an automation system that outputs the "now playing" information.



Inovonics RBDS encoder software screen shot.

Automated RBDS Encoding

There are many systems now that will not only send that data, but will format it for a direct interface to your RBDS encoder. That makes it very easy to get up and running quickly. If your system doesn't output the data in an RBDS friendly format, or you want to send other types of messages, there are plenty of ways to do that as well.

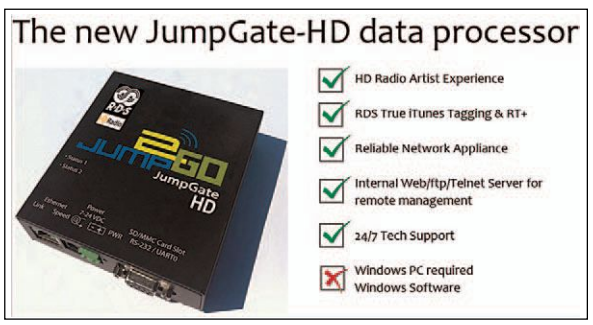
Radio Experience software (TRE) takes the data from just about any automation system and formats it for many types of RBDS encoders, as well as Twitter, XML, and HD Radio. It also allows you to send generic promotional announcements when there are commercials or non-song elements playing. These can be different, based on the time-of-day and day-of-the-week. The engineer who originally designed TRE has designed a new controller that is hardware, instead of software-based, called Jump2Go. It has many of the same features as TRE and some new ones, all in a network appliance.

There are plenty of other ways to do it too, from software such as Arctic Palm's CSRDS, to RBDS encoders with basic software built in, like the Inovonics 720 and 730. (www.inovon.com)

Setting Up the RF

There are some things you'll need to remember as you're setting the system up. First, there is a maximum number of characters that the encoders will support. You'll want to make sure that the data you're sending falls under that level. Also remember, that what you put in the title and artist fields will be there for all the world to see, so it goes without saying that you should make sure the spelling is correct and there's nothing there that you wouldn't want children to see!

Something else that comes up from time to time, is what the sub-carrier injection level should be for best performance. Early on, with static data, 2% injection seemed to work fine. If the signal got weak, the radio would generally "hold on" to the last data received until it got new data, or the tuning was changed. With dynamic data, you really don't want radios showing that data for very long, so it becomes more important that the radios "hear" the updated data. My experience has shown that 5% injection will generally overcome signal issues very well, and is a good trade-off between losing a little loudness and giving the listener a good experience. Just don't forget to give back that 2% in modulation that the FCC allows!



Finally, a note about using dynamic data on PS – PS is the eight-character display that most cars have built-in. It was never meant to be changed dynamically, and in fact the RDS/RBDS specification doesn't allow it. However, with the software trickery we can make it work. Some radios may be affected adversely by dynamic PS data, and it can also be a distraction to drivers. Instead, try to just flip artist and song through it.

Using RBDS to send title and artist information can make your listeners' radios come alive, and provide a very valuable listener service. It's easy to do, and can give you a leg up on the competition.

Chris Tarr CSRE, CBNT, DRB is the Director of Engineering and IT for Entercom's radio stations in Milwaukee and Madison, WI he can be reached via email chris@geekjedi.com or chris@entercom.com

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Chief Engineer

Remotes – From Loop to Wireless

by Scott Schmeling

I can only imagine that remote broadcasting has been part of radio since the beginning. Remotes are a chance to get out into the public, to showcase what we do, and to allow listeners to put a face with the voice. You can set up a full-blown remote studio, or just have a guy with a microphone. Of course, it can also be a chance for the sales department to generate some additional revenue.

Evolution

Like everything else in the world, the way we do remotes has changed dramatically over the years. I started in radio in 1964, working part time at KSDR in Watertown, South Dakota while in high school. Yes, that's nearly half-a-*century* ago. (It sounds like so much more when I write it down!) Back then, when the station had a remote planned, a loop had to be ordered from the phone company.

Back then, we needed nothing more than a cable pair, or "loop." It went from the remote site, through the phone company central office, with cross-connects to the studio. It was a hard-wired connection from point A to point B. We used a small Gates (now Harris) mixer, with binding posts on the back – the two loop wires connected to the posts. When the mixer was turned on, the audio was heard back at the studio. The loop method worked fine, but since it had to be ordered in advance, we couldn't do anything spur-of-the-moment.

Wireless Radio

Then we got a Marti! With a Marti unit we could go almost anywhere at a moment's notice. The Marti, of course, is a radio link. We mounted a receive antenna on top of the studio building, and the transmitter could be taken out to the remote or operated from a vehicle. We were truly mobile – and the audio quality was excellent. We still use Marti products today. They're reliable, easy to operate, and the quality is still excellent.

The only down side to a radio link is range. You have to be able to get the signal back to the studio. Sure, you can extend the range by installing fixed and/or mobile repeaters, but there are still limits to how far you can go.

Dial-Up Telco

That's where the telco dial-up unit comes in. With this, we can go well beyond the range of the Marti. We can go nearly anywhere there's a phone line. The cost of having a line installed (at an area school, for example) used to be fairly reasonable. The connection to the studio is made through the standard, switched telephone network. Like the Marti equipment, this is reliable and easy to operate, but with dial-up line, the quality is limited.

I think it's safe to say that broadcast loops are pretty much a thing of the past, but RPU and dial-up units are still widely used for remote broadcasts.

ISDN Improvements

But we've seen some developing new digital technologies come in to the field. I believe the first was ISDN (Integrated Services Digital Network), a dial-up telephone service for voice and data that was introduced in the 1980's but took nearly a decade to become widely available. ISDN requires a codec (encode/decode) unit on each end. The codecs converts your analog audio to digital for transmission over the ISDN network. I have only used an ISDN system a few times, but it allowed us to broadcast with excellent audio quality from almost anywhere. Like the old loop system, an ISDN line had to be ordered in advance.

The next advancement was when codec manufacturers started building units with "POTS" modems. By the way, how many of you know what POTS stands for? POTS means Plain Old Telephone System – your good old hard-wired, land line telephone. So a codec with a POTS modem will work on a regular phone line – no ISDN needed. This provided us with the flexibility of being able to connect from almost anywhere with studio-quality audio.

How could it be any better? Well, now that you mention it, it would be nice to be able to connect through the Internet and not have any long distance phone charges, *and* with studio-quality audio – Done!

IP Codec

A number of manufacturers are producing codec's with an IP interface – some also have built-in audio mixers. After setting up your studio unit and configuring your router to "port forward" the appropriate ports, all you have to do is connect your remote codec to the Internet and enter the static IP address of your studio unit. In seconds your connection is made and you're ready to go on the air.

(Continued on Page 32)

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Chief Engineer

by Scott Schmeling

– Continued from Page 30 –

Connecting is usually an easy process, although you might have to work with the remote's IT people if their network is "locked down." For the past few years, we've sent our KTOE Morning Blend crew to Minnesota Twins Spring Training Camp in Ft. Meyers, Florida.

They broadcast the morning show live from pool side in sunny Florida, while we freeze up here in Minnesota. But the audio quality is great. So you now have a free connection from anywhere the Internet is availabl,e and with studio-quality audio as well. Certainly, no one could ask for more – right? Au contraire – how about wireless? Well, ask and ye shall receive

WIFI Remotes

We have found and used four methods for a wireless connection for our codec's. In our first experience, we were doing a full morning show remote at a local mall. The food court had wireless broadband available. In this remote, we were using two laptop computers – one to control the on-air computer back at the station, and the other for the news director. Both computers used their built-in wireless to connect to the Internet.

On the laptop used for control, we enabled Internet Connection Sharing. That's a built-in functionality of Windows that normally is used to allow additional computers at home to have access to the Internet. At this point we could either connect our codec directly to the laptop's RJ45 connector using a cross-over Cat5 cable, or use standard Cat5's and a small network switch.

We've used this method to do remotes on a number of occasions. I'm pleased to report that each time we've used it we have met with solid success.

Provider Options

Now that 3G service is available almost everywhere (in our case from Verizon) we have even more possibilities. Our codec has an optional 3G module available. After buying a data plan and authorizing the module, connection is almost as simple as with a wired IP connection.

On the front display, we select the 3G module, press Enter, and then choose our IP connection (IP1 or IP2) – then we enter the IP address of the studio unit. Our codec's allow two simultaneous IP connections. That means we can – and often do – have two remotes at the same time.

Another connection method uses a Verizon-supplied 3G Hot Spot. This handy little (and I do mean little) piece of magic provides wireless connections to multiple, separate devices where 3G service is available. Amazingly, it can provide WIFI for up to five devices.

But it does not have an RJ45 connector, so our codec will not connect directly to the Hot Spot. We need a device called an Ethernet Bridge. I've found two options. The first was an Ethernet Bridge (model WET610N) from Cisco, as well as other manufacturers, for about $100. It's marketed for connecting your Internet-capable TV to your home's wireless network, but for us it connects to the Hot Spot and provides us an RJ45 for connecting our codec. The only issue we've had was, when there was heavy cell phone use, our connection would drop – otherwise it's rock solid.

Making a Router Bridge

Before I tell you about option #2, just let me say I love learning new things. Option #2 isn't working – yet – but sounds very promising. It involves taking an inexpensive router ($35-$45) and flashing it with different firmware.

The website www.dd-wrt.com lists a database of configurable routers and necessary software, as well as installation and setup instructions that will allow you to use an inexpensive router as a wireless client (bridge), among other things. Like I said, I don't have it working yet, but when I do, I'll let you know about it.

A WIFI hotspot and a bridge.

Today we've traced the evolution of remote broadcasting from loops to dial-up, and from RPU's to codec's. There is one more method that we haven't talked about because I have no experience with it. Just let me say, "There's an App for that!"

Scott Schmeling is the Chief Engineer for Minnesota Valley Broadcasting, a 16 station group in Southern Minnesota. He can be reached via email at scottschmeling@radiomankato.com

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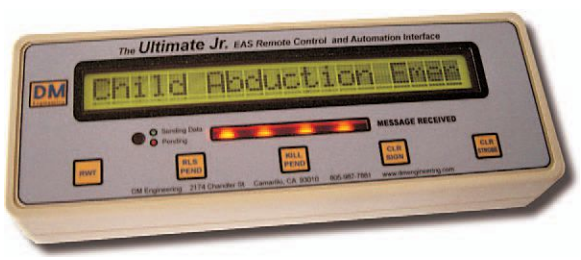
Gear Guide — DM Engineering - Enco - Omnia

DM Engineering – Ultimate Jr.

The Ultimate Jr., Remote Control and Automation Interface, features a large character, backlit LCD Sign, and one-touch buttons for the most commonly used commands for the Sage-Endec SE-1822 and 3644 Digital EAS encoder/decoder.



The LCD sign normally displays the date/time, and when an alert is sent or received, scrolls the alert header information just like a large LED sign display. A flashing tri-color strobe that changes color with the severity of the alert is also included. The one touch commands are: initiate an RWT, release a pending alert, kill a pending alert, clear the LCD sign, and clear the flashing strobe.

The unit has a small 8.5 x 3 x 1.4 inch footprint for crowded workspaces, and is supplied with loop and hook fastener material for placement on any surface. Rear supports are also provided for desktop mounting. The Remote Control is connected to the Endec by means of a supplied 50 ft. Cat 5 cable and an Interface Module, which connects to two available COM ports on the Endec.

The Interface Module also provides an Automation Interface for initiating RWT's by an external contact closure. Power for the Ultimate Jr. Remote Control is provided by the supplied power module. Complete set-up, Endec programming, and operating instructions are included.

More information at: **www.dmengineering.com**

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To order or download, go to **www.ENconveyor.com** You can try ENconveyor out for 15 days free. When you purchase it, all of the rules you create will still be active, so there's no wasted effort.

Omnia 11 – Talk Radio Presets

All over North America – and for that matter the world – FM stations are either initiating talk formats, or are beginning to simulcast their AM talk counterparts. Omnia Audio has developed some presets for the Omnia 11 which are specifically tailored to do the same thing for a talk format as our music presets do for music stations.

Most music presets are not set up to process to the density level that most listeners are used to on AM. The challenge was to develop a denser, talk style preset yet, at the same time, avoid the fatiguing, extremely dense processing common in many talk AM stations.

Recognizing that there are different kinds of talk formats, we developed seven presets specially engineered for a news format, a news-talk format, sports talk, and play-by-play.

The news presets provide a comfortable compromise between density and openness. The news-talk presets change the parameters slightly to better accommodate phone calls. The sports talk presets are denser, and have some of the highs gently rolled off, and the play-by-play preset is quite dense but gives you that very loud and "crack of the bat" excitement.

These presets were spearheaded by Omnia Audio's Ted Alexander, a long time engineer and air talent who knows broadcasting well from both sides of the mike. He has been a professional broadcaster since 1964, and also is an active ham operator W8IXY. He was inducted into the Ohio Broadcaster's Hall of Fame in November 2010. **www.omniaaudio.com**

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Small Market Guide

Building a Radial "Sniffer"– *Part 1*

by Roger Paskvan

In our last article, we outlined the spirit of cooperation that our staff from a little small town radio station in Bemidji, Minnesota went through to fix a major tower problem.

Our station needed to replace the feed line to its AM towers. This sounds so simple until you tackle the problem of getting through the 120 buried wires that provides the ground field surrounding your AM towers. No you cannot cut the radial wires – they are a very necessary part of your antenna system.

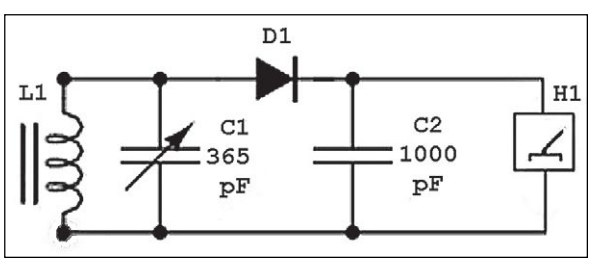
The Radial Sniffer

In this first part, of a two part article, we will expose the little meter – a "radial sniffer" that our station built to locate these buried wires. In part two, we will provide details of how to use this device – the geometry and procedure of how to locate your radial wires. This is good preparation for that unfortunate day when your engineer says "I think you have a broken coax to your tower."

For some reason, metal locators can pick up coins, nails and a lot of junk, but have trouble with copper wires. The only reliable way to find the wires is to read the radiation coming from the wire itself by utilizing an RF sniffer and a highly directional antenna. Although this may sound complex, it turns out that an old style AM radio loop antenna connected to a detector is the perfect component for this job.

The circuit is just a simple diode detector with a very sensitive meter in the 30-50 microamp range. The key to the operation is the 788 uH resonant loop, stick antenna that is turned to your station frequency. This little ferrite antenna is a very high Q coil with directional characteristics. It nulls from the ends and this is what allows you to see a change in the meter reading as you sweep over the buried radial wire in the ground.

Any non-ferrite coil will become swamped from the tower's strong signal giving a constant meter reading. The ferrite loop antenna was stolen from an old AM transistor radio we had laying around.



RF Sniffer Schematic

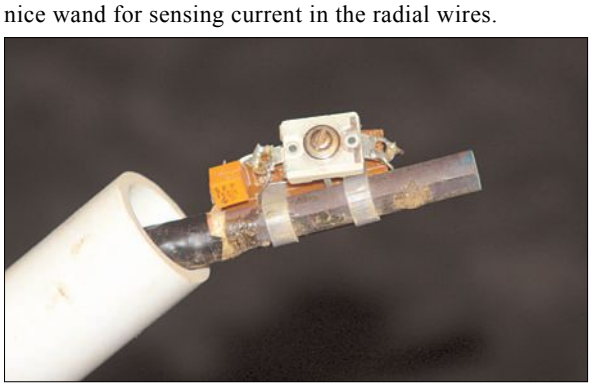
Setting Dip

Utilizing some type of indicating instrument, like a dip meter or network analyzer, adjust the trimmer capacitor across your loop stick antenna for resonance on your AM station frequency. This resonance is very important for maximum signal indication on your meter.

Easy and Inexpensive

We built the simple circuit inside an LB box and wired it to the 50 microamp meter. Our original circuit had a potentiometer to turn down the meter signal, but the signal never gets much over 25 microamps so the pot was not needed.

Cut a 3/4" PVC pipe about three feet long and mount the meter in the plastic LB box on the top end. Run two wires to the bottom of the pipe and solder these to the ferrite antenna assembly. Secure the ferrite antenna with foam rubber inside the PVC pipe with the ferrite rod end pointing down. (Frankly, that's the only way it will fit inside the 3/4" pipe.) Put a cap on the end of your pipe and you have a nice wand for sensing current in the radial wires.



The ferrite antenna at the end of the probe.

To use the device, hold the sensor pipe about a half-inch above the ground. You will get a relative 20 micro amp meter reading. As you pass over the buried radial, you will see a "DIP" in the meter reading above each wire location. Sweep back and forth to narrow your location technique and mark the wire. More on how to locate your AM tower radials in part two of this article.

Roger Paskvan is an Associate Professor of Mass Communications at Bemidji StateUniversity, Bemidji, MN. You may contact him at: rpaskvan@bemidjistate.edu

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Practical Engineering

Telos Zephyr Tricks

by Mike Callaghan

The Telos Zephyr has long endeared itself to broadcasters as one of the most reliable and favored ways to get remote broadcasts back to the studio. It's been through a number of iterations since it was introduced, starting with what is now the Zephyr Classic, and evolving to the Zephyr XStream, which is the current offering. It's available in a variety of configurations, ranging from a remote mixer to a simple rack unit, primarily for receiving remotes.

ISDN Remotes

Intended for use in a number of ways, the primary way we use it is with ISDN circuits from the phone company. Early on, the joke was that ISDN stood for "I Still Don't Know" – this isn't true any more. We do know that a pair of Zephyrs and a good ISDN circuit can do the job from just about anywhere in the world.

ISDN circuits are so inexpensive that we can keep a few in place just to have. Popular venues get used often enough, that it's worth the cost just to know the circuit's ready for use at a moment's notice. It's also possible to work out a lend/lease arrangement to use services that belong to a competing station in exchange for them using yours.

Correct Line Set-Up is Necessary

As versatile and handy as the Zephyrs are, the circuits we use with them have to be set up correctly. If they aren't, it's difficult to get through sometimes. Only experience will teach us all the tricks when this happens. Here are some of the more common ways we can get ourselves and the equipment confused.

First of all, because many of our remote locations aren't used often enough for a permanent line, it's probable you'll use a lot of lines, just once. When you reach a site with a brand new ISDN line, it's best to make sure the circuit's really active. You can do this with a Butt Set or a regular phone. Plugging it into the line, you should hear a soft hiss with a rhythmical clicking. This confirms the ISDN gear is active and hopefully ready.

Even if you are using a permanent line, it's good to arrive early and check the line. Many amusement parks relocate and reuse the same lines all over the park, and you may find a line is in the wrong location – and it's up to you to move it.

Making Your Connection

To dial the studio with the Zephyr, you'll need to know the "SPID" numbers. These identify the circuit to the equipment, and establish the connection. The numbers should be on a tag, left by the installer, or listed in the paperwork generated when the circuit order was confirmed.

These get entered into the Zephyr, along with the Local Directory Number (the seven pertinent digits in the SPID). For stereo, this is a total of four numbers that are entered – two for each channel.

Once that's finished, confirm the protocol and the data rate. The protocol is simply a name for the way the audio is coded and decoded. Both ends have to match. The data rate measures how fast the data will be sent through the circuit. Again, both ends must match for correct operation. After the SPIDs for the line(s) are entered, you must reboot the Zephyr. This is done from the front panel.

Telos' Zephyr Xtreme System

Forcing a Carrier

Depending on the circuit, you may have to "force a long distance carrier." This simply means the circuit hasn't anyone assigned to carry the data outside the local area. You can suspect this problem if you experience one of the following: The ISDN number is dialed but drops off before the connection; the line tries to connect but times out before it finishes; the line connects but won't lock; the line connects and locks but won't pass audio.

To confirm that this is the problem, try dialing the second SPID using the first SPID. If this works, but you can't reach the studio, the unassigned long distance carrier is the issue.

(Continued on Page 40)

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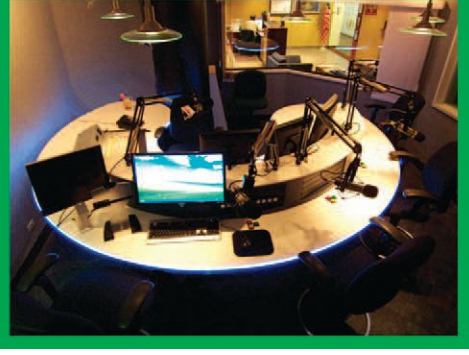

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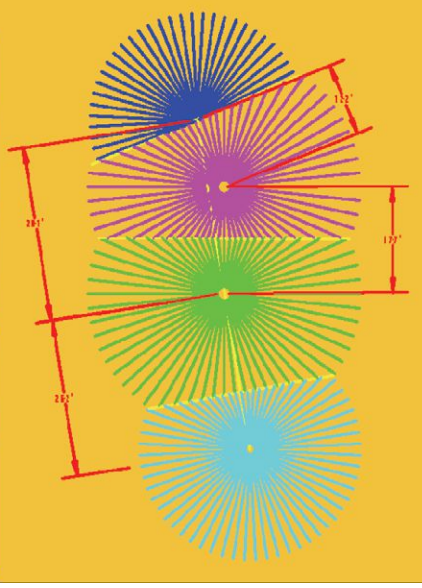

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by Mike Callaghan

Telos Zephyr Tricks

– Continued from Page 38 –

The easiest way to "force" a carrier is to dial a PIC (Primary Interexchange Carrier) using the code prefix first, like 1010333 (the one for Sprint) + 1 + the area code, and finally the number. This establishes the carrier and allows the call to proceed. If you are using both of the Zephyr channels – and you need to use a PIC for the first one – you'll need the same for the second one.

As soon as the numbers are dialed, the studio and the remote Zephyrs will "handshake," connect, and then lock. You'll see the lock light come on, and then you're ready to pass audio.

Note: If the audio protocols at the two ends don't match, after you dial, the Zephyrs won't lock and no audio will pass.

Data Rate Match

If the data rates don't match, either the unit won't lock or will lock intermittently, passing just little spurts of audio. In either case, it's time to call the studio on the phone and verify the settings.

In general, a sampling rate of 32 kHz will work best. It has less delay than higher rates. Telos recommends using 64 kbps at 32 kHz. In Los Angeles, we mostly use 56 kbps at 32 kHz, simply because many of our venues won't run at 64 kbps.

A neat trick to know is that if you need to do two different remotes from the same location simultaneously, you can "spilt" the Zephyr into two mono channels and dial up two different studio Zephyrs, with just one at the remote site. For this, the protocols and bit rates all have to match. And, as you'd expect, both remotes will use mono in each direction.

Locking Issue

If your Zephyrs connect, but won't lock, try these steps to correct the problem: call the studio and verify settings on both ends, disconnect and then call back – often, it will work the second time. If not, try a lower bit rate, for example 56 kbps rather than 64 kbps, etc.

Dropouts or Scratchy Audio

These are not unknown on initial connection. Try rebooting the studio unit for a fresh start. It may also help to do a complete power-down, a ten second pause, and a restart at the studio.

There is no power switch on the front of the Zephyr, and when it's rack-mounted it's difficult to unplug the power. We have a panel with a power switch just below ours in the rack. That makes it easy when a cold-boot reset is called for.

Line Problems

On the rear of the Zephyr, there's a green LED adjacent to the ISDN jack. It will flash quickly with no line connected; slowly right after the line is connected; and will stay on steadily after the Zephyr is finished connecting to telco. Then the display on the front should say "READY / READY" If this sequence is evading you after your setup, verify the SPIDs were entered right. If they're OK, check all the phone line connections. If the line runs outside, or has been dormant for awhile, the connections may have become corroded. Try exercising them. If you still can't connect, use a phone or lineman's handset to make sure the line is active.

When you order the line, set the install date for 2 to 3 days prior to the remote. This will give you a chance to bring a Zephyr to the location to check it, and still have time to get the line fixed if it's bad.

If the circuit stops working during the remote, the easiest way to get reconnected is to just push the "DIAL" button on the originating Zephyr. If this happens more than once, consider having the remote end record tracks, and have the studio play them back on the air. This avoids the embarrassment when an interview or contest suddenly gets cut short.

Bi-directional Remotes

A very common way for the Zephyr to be used is to have stereo coming from the studio to the remote site, with one channel feeding the pre-delay audio and the talk-back to the personality, while the other channel runs the local P.A. for the crowd. This keeps the clutter down, and the person on the air can hear directions from the studio operator, while the audience misses all the voice cues and banter.

The protocol to use depends on the model Zephyr you have. In general, G.722 has very low delay, but limited fidelity. This works well for the backhaul from the studio to the remote location.

Over the years, our team of Telos Zephyrs have done hundreds of remotes from all over the world. Versatile and reliable, they continue to be our first choice when we go on the road. Special thanks to KIIS's Jerry Burnham and Ryan Seacrest's Brian Clark for sharing their experiences and their help with this article.

Mike Callaghan is the Chief Engineer at KIIS-FM in Los Angeles, CA. His email is: mc@amandfm.com

LPFM Guide

LPFM Broadcast Antennas

by Leo Ashcraft

It never ceases to amaze me at how much thought an LPFM radio station will put into programming, marketing, studio equipment, etc., yet devote so little thought to their actual broadcast antenna – last on that list always seems to be the antenna system itself. There is a big misconception that all antennas are the same. Most people think that they all will work – and they all *will,* to some extent. The problem is an LPFM station is low power – 100 Watts ERP – with fairly low antenna height, 100 feet HAAT. With a system like that, the antenna system, including the coax, is key in coupling your hard work into the ether. While all antennas perform that function, they all do it with varying levels of efficiency.

One of the most significant factors determining the success or failure of any FM broadcast station is the quality and coverage of its signal. A station that does not provide a clean, interference free signal in its coverage area cannot expect high audience cumes, regardless of programming, equipment, etc. Here are common situations that affect the coverage of an LPFM station.

1. All FM broadcast antennas do the same thing – why not buy cheap. Although they may look alike, and have similar performance specifications, various makes and models behave in very different ways in any specific environment, due to subtle design differences.

2. Replacing an older antenna with a new one will correct most signal quality and coverage problems. Unless there is a defect in the system that developed over the years, you may be only replacing old problems with newer ones. To be safe, the replacement antenna should be selected, and its installation supervised by, a well qualified broadcast engineer – preferably using Site Specific Engineering.

3. The coverage area of any LPFM station is dependent only on the ERP and HAAT of its antenna. My experience shows that only a small portion of the actual radiated power can reach the audience using "conventional" antenna designs. Often, due to multiple lobes and nulls, part of this energy takes a different route to the audience, causing multi-path interference to the main signal. In essence, you are interfering with yourself! At your station, most of the signal may go down toward the ground or up to the sky, rather than reaching your market area or your audience.

4. Vertical/Horizontal antennas are cheap compared to Circularly Polarized Antennas. But are you really saving money if your signal is inferior, noisy with interference and "picket-fencing?" How many listeners and underwriters will you lose with that inferior signal over the years? When you add it all up, you may be losing a great deal of money.

5. Any circularly polarized antenna is the same. OK, you may understand that CP antennas are the way to go – but you still must be careful selecting these as well. If you think all CP antennas are the same, again, you are working with assumptions. Many manufacturers sell a "circularly polarized" antenna system, which is not in fact circularly polarized!

These are generally reputable manufactures, who are making an antenna which actually sends out an elliptical signal, at a single 45-degree angle. While many times this may actually work better than a simple vertical or horizontal antenna, it is not a true CP antenna. You will see better results, but you still might not be placing your signal where it needs to be.

So what do we do? Over the years we have shifted to a true circularly polarized antenna system, based on a specific design. This is a very unique looking antenna, and the signal produced by it has a true rotating vector. This signal is in *all* planes, and is able to penetrate through spaces between trees, leaves, buildings, windows, etc.

There are various manufacturers of this type of antennas. They have the very recognizable appearance of two arrows at a 45-degree angle inside one another. They are also highly effective at improving situations where interference is causing problems with your coverage. For a more in depth analysis of this design, watch for future articles in ***Radio Guide*** or visit my website.

Leo Ashcraft is CEO of Nexus Broadcast. He is a broadcast consultant with over 20 years engineering experience and an avid LPFM advocate. More information at NexusBroadcast.com or 888-732-3599

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In 1968, Paul Elliott had an idea that forever changed the power grid tube industry. At the time, Elliott was a production engineer for Eimac, formerly Eitel-McCullough, Inc. – a California-based manufacturer of a broad line of specialty electron tubes for broadcast and industrial applications that had been acquired by Varian Associates, Inc. in 1965. After 14 years of manufacturing new power grid tubes at Eimac, Elliott wondered if these tubes could be reliably rebuilt and resold.

Over the next several months, Elliott developed the technique to rebuild tubes. Convinced that he had a workable idea that would benefit his employer and its customers, Elliott pitched his idea of rebuilt tubes to the management team at Eimac. His pitch was unsuccessful, as management reasoned that selling rebuilt versions of its own products would undercut sales of its new products.

Back Row: Matt Lindsey (27 years), Debbie Baker (28 years), Maureen Corona (8 years), John Canevari (41 years) Front Row: Debbie Storz (30 years), Lourdes Ramsey (15 years)

Undiscouraged, Elliott decided to take the next step on his own – contacting several radio stations directly, and asking if they would be interested in trying a rebuilt tube in their broadcast transmitters, rather than buying a new tube. The radio stations expressed considerable interest in this idea, and Elliott provided them with free sample tubes that he had rebuilt. The feedback from this trial was very favorable, encouraging Elliott to continue to pursue his idea.

Realizing that he could not handle this new endeavor on his own, and that it would eventually have to be independent of Eimac and Varian Associates, Elliott brought in Ray Shurtz as a business partner. Shurtz was a co-worker at Eimac, and he invested the money needed to purchase new equipment to repair and rebuild tubes on their own. Both Elliott and Shurtz continued to work at Eimac, while working nights and weekends to get their own tube rebuilding business up and running.

By early 1969, Elliott and Shurtz's rebuilding business was growing so rapidly that they decided to devote their energy to it on a full-time basis. They brought in another co-worker, John Sullivan, as a third partner and investor, and quit their day jobs at Eimac. In May 1969, they incorporated their new business, Econco Broadcast Service, Inc., in the state of California, to manufacture and rebuild "high power transmitting tubes for use by AM and FM radio broadcasting stations."

John Canevari and Rafael Alcala, test console operator, check test results on tube.

Econco's business plan was fairly unique for the time: it sold products directly to end users, rather than through distributors. Econco's main customer was the chief engineer at a radio station, and the company dealt directly with that customer rather than trusting a third-party distributor to maintain that critical relationship. As a remanufacturer, the company was agnostic as to the origin of the original tube; it repaired and rebuilt tubes that had originally been manufactured by numerous companies. In addition, when early customers expressed concerns about the then-unproven life of the rebuilt tubes, Econco responded by offering a generous warranty, backed by exceptional service. Should a rebuilt tube fail, Econco was prepared to quickly provide the customer with an acceptable solution, whether it was a replacement product or a fast repair.

Within the first year, Econco's business expanded so rapidly that it outgrew its first location in Pacifica, Calif. In 1970, Econco relocated its operations to Woodland, a small town 20 miles northwest of Sacramento, Calif.

Elliott, Shurtz and Sullivan ran the business until 2004, when they sold it to what is now Communications & Power Industries LLC (CPI). CPI was the former Electron Device Business of Varian Associates, and its operations include the Eimac unit that had previously employed Econco's founders. As part of CPI, Econco enjoys greater testing and manufacturing resources and capabilities, while maintaining the "make it work" attitude and capacity for innovative engineering that has made it successful for decades.

A Brochure from 1975

For the past 40 years, Econco has provided customers with high-quality, reasonably priced, rebuilt power grid tubes. It has gained a reputation for creative engineering, finding innovative, quick and cost-effective ways to fix tubes that others had considered beyond repair. Due to this reputation, Econco received the first ever contracts awarded by the U.S. government and the U.S. Navy to remanufacture microwave devices. It has provided the U.S. Navy, one of its largest customers, with switch tubes for the Aegis weapons system on DDG class destroyers for the past 25 years, and has twice received the U.S. Navy's Award for Excellence.

Leveraging opportunities to serve a growing customer base, Econco has expanded outside the broadcast industry and power grid tubes. Today, sales of products for industrial applications account for more than half of its business, and Econco repairs magnetrons, klystrons, traveling wave tubes (TWTs) and inductive output tubes (IOTs). In addition, Econco now has new tube manufacturing capabilities, and produces new models of older industrial tubes, a proprietary line of x-ray tubes and, recently, magnetrons.

Despite this growth, Econco retains the community culture instilled by its founders. It still operates out of Woodland, Calif., although the factory has grown to cover 34,000 square feet and employs more than 70 people. Paul Elliott's son, Dave, runs the organization, and employees have an average tenure of 17 years. Moreover, the first employee, John Canevari, remains with the company, and, together with Debbie Storz, Debbie Baker, Matt Lindsey, Lourdes Ramsey and Maureen Corona, is responsible for providing Econco customers with the best service in the industry. The past four decades of success have been made possible by the efforts and collective experience of Econco's outstanding employees.

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