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September-October 2015 – Vol. 23, No. 5

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Contents

September-October 2015

Radio Guide

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In This Issue

Critical Content for Radio

Cover Story – *by Kevin Kidd - AM Ground (page 6)*

Care and Feeding of Your AM Ground System: *"Thankfully, many of the problems we encounter with older ground systems or on new site build-outs has little to do with math or science but are more mechanical in nature. Age, utility installation damage, vandalism, poor materials choice or poor workmanship can all make the hidden half of our antenna systems unstable and inefficient."*

Studio Site – *by George Zahn (page 8)*

A Boom Year for Your Studio: *"It's one of the necessary evils in our studios. Whether we have a single announcer microphone or an interview table, the microphone stand or boom is always there. The trade-off is simple. A simple desk stand takes up table space and, unless you place a small boom on the stand, it quite often can occupy the location of copy or other preparation materials ..."*

Chief Engineer – *by Scott Schmeling (page 20)*

Some Studio Add-Ons: *"I've started adding a Radio Design Labs (rdl.com) STA-1 to the studios I build. The STA-1 is a Dual Balanced/Unbalanced Line Amplifier with an advertised gain of -12 to +20 db. The console Audition +4 dB outputs feed the STA-1 balanced inputs and the STA-1 unbalanced outputs can be adjusted for a proper input level on the computer."*

From the Ground Up – *by Chris Tarr (page 38)*

Building a Syndication Network in Three Weeks: *"So the basics were this: A daily four hour sports talk show, fed to large and small stations across the state. It would be a relatively easy show to operate – no "national" spots or local ID's, just a closure to trigger local breaks and some sort of ability to record the show and upload the segments to an FTP server for stations wanting to "delay" the program."*

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Cover Story

Care and Feeding of Your AM Ground System

by Kevin Kidd, CSRE/AMD

In almost 22 years of building and working on AM Ground Systems I have had more than one raised eyebrow at some of the questions and misconceptions associated with them. In the early years of my broadcast career I would have certainly asked many of the same questions should the subject have arisen. Being a ham, and particularly enjoying the antenna building aspect of that hobby, furthered my curiosity and knowledge of the hidden half of our antenna systems.

The science and mathematics behind the ground-mounted vertical and associated ground system is far beyond the scope of this article. Thankfully, many of the problems we encounter with older ground systems or on new site build-outs has little to do with math or science but are more mechanical in nature. Age, utility installation damage, vandalism, poor materials choice or poor workmanship can all make the hidden half of our antenna systems unstable and inefficient.

I am regularly asked the same questions about AM ground systems and their care. Unfortunately, few of the questions have a simple textbook answer.

How do I know if my ground system is performing correctly? Only another series of questions can answer this one. Is there something that makes you think that it is not performing correctly? Is coverage bad or erratic? Has the system been damaged in some way? Does the antenna perimeters or performance change dramatically between wet and dry conditions? How old is the system? If a DA, are the monitor points good – not too high or too low? Are the MP's stable? A partial proof would reveal loss of efficiency, but most non-directional stations never had an as-built proof to use as a base line.

Lacking a benchmark to compare against, the performance of a ground system can best be determined by its quality and physical condition. A physical and electrical inspection is usually the best way to determine that quality. Whether you do the inspection yourself or hire someone to do it for you, is entirely up to your skill, ambition, knee and back condition, and available equipment and finances.

If there is a problem with my ground system, how much stability and coverage improvement will I see from a repair or rebuild? Ahhhh ... a simple one-word answer – some. As in, "You will see *some* improvement, depending on the overall condition of the antenna system. You *may* see a *tremendous* improvement if the ground system has major issues. Keep in mind that "major issues" can be caused by very small problems. A single missing or broken connection can render a ground system totally ineffective. On the other hand, completely rebuilding a ground system that isn't broken will probably show little net improvement. In all the years that I have been inspecting, repairing and rebuilding AM Ground Systems, I am still surprised how seemingly minor repairs can dramatically affect system performance.

How often should we have our ground system inspected? A well-constructed ground system in decent soil can be expected to last around 30 years. Some soils are very kind to copper and brazing alloys and may allow the ground system to last many years beyond this. Conversely, some soils and environments are very destructive to copper and brazing alloys.

We have found 10 year old ground systems that were totally ineffective and 70 year old systems that were almost shiny when unearthed.

General Modes of Ground System Failure: AM Ground System failures typically fall into one of these categories, roughly listed in descending order that we observe them:

1. Vandalism / Theft
2. Poor Materials Selection
3. Poor Workmanship
4. Age
5. Unauthorized Utility Installation (above or below grade)
6. Unrepaired Authorized Utility Installation
7. Site Maintenance Activities

Just a few years ago, vandalism would have barely registered on the scale above.

Vandalism / Theft: This one requires very little explanation. A low life copper thief can destroy a $100,000 ground system in hours while netting only a few hundred dollars in "scrap." Over the past few years theft has surpassed all other failure modes due to high copper prices and rampant drug use.

Poor Workmanship or Materials Selection: I find what I call "manufacturing defects" in many inspected ground systems. These defects can cause failure in months instead of years If they *ever* worked as intended.

Incorrect brazing alloy resulting in total failure of radial bonding.

Incorrect brazing alloy (i.e., low or no silver content solder) is one of the most common failures observed. Common low or no silver content, acid or rosin core solder has a very short life expectancy if used below grade. Within months, it turns to a gray power (or mush if wet) that has exactly zero electrical or physical bonding strength.

Incompatible materials (ie, steel cable or wire mixed with copper wire) is an absolute no, no. Attempts to braze to galvanized steel wire destroys the zinc protection of the wire and is almost always ineffective. Not to mention that the smoke will *KILL* you.

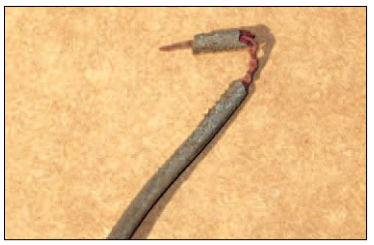
Attempts to bond radials to galvanized steel cable used as main ground conductor.

And yes, we have found galvanized steel high tensile horse fence wire employed in an attempt to build a low cost ground system.

There are many stories of barbed wire and other steel wire being used as a ground system. Let me assure you that they have been tried but in reality, the life of steel (even galvanized) in contact with soil is very, very, very short.

Age: Everything wears out, including buried copper radials and bonding alloys. As noted above, we use a rule of thumb of 30 years in most areas but certain soils, conditions (or poor materials) can accelerate the demise of a ground system. On the other hand, certain soils will allow copper and brazing alloys to last almost indefinitely.

Repairing a very old ground system can be problematic. Buried copper absorbs contaminates from the surrounding soil to the point where no amount of cleaning will allow the brazing alloy to properly flow and bond. At this point a complete replacement is typically required. As before, the length of time for the contamination to become this severe can vary from just a few years to many decades.



#10 copper wire reduced to copper thread by extreme corrosion.

Utility Installation Damage: At least once a year I get a call from a panicked utility construction foreman that has found something unexpected below grade in the vicinity of an AM station. The conversation is usually something like, "Hi this is Joe Bob from ZYX Utility Excavating and the OneCall girl said there wasn't anything here to hit but we have hit a lot of somethings as we dug between all these towers."

Oops: Telecommunications backhoe fade has been greatly reduced with the inception of the mandated OneCall system. Unfortunately, the OneCall system only covers public utilities and their infrastructure. This type of damage seems to occur most frequently when an AM operator either leases vertical space on their AM tower *or* shares horizontal space on an AM site with a cell or PCS operator. Both of these high net worth telecom entities typically have numerous megabuck phone and fiber connections from a major high profit bandwidth provider – which are installed by the absolute lowest bidders. The provider flags a path, the low bidder digs along the path, installs the required cables, fills in the trench and wonders about all these little wires sticking out of the ground. If you are lucky, the ground system is all that was destroyed. Even though the cell or utility company usually marks the trench path, the excavation contractor is usually left holding the bag for the damage.

Exactly why is that trackhoe 20 feet from my tower?

We worked on an project where a utility construction company took an unauthorized shortcut across and thru a five–tower array cutting ground system, phase, control and feed lines. Their insurance company was not amused and tried to refuse payment since OneCall didn't show anything on the site. As you might imagine, there was a lot of finger pointing between the cell company, civil engineering firm, utility provider and utility construction folks.

On the other hand, we regularly find unrepaired damage from authorized utility construction. The damage to the ground system was either ignored or misunderstood and has often been causing loss of coverage and general instability for years.

Site Maintenance Damage: Although you should never allow an AM site to become overgrown, you also must not allow maintenance activities to cause damage. Mowing when the site is wet enough for the tractor to leave ruts or get stuck is even worse than letting the grass grow for another week or two. I have also repaired numerous radials and cables that have been damaged by overzealous weed eater operators.

Wrapping It All Up: With careful construction, due diligence in RF maintenance, a little grounds up-keep and yes, more than a little good luck, you may never need to know what is below ground level at your AM site. *But,* you must always be aware that half of your AM antenna is hidden down there and watch over it jealously lest you be visited by a wayward tweaker (and I don't mean Greenie) or backhoe.

Kevin C. Kidd, CSRE/AMD is the proprietor of AM Ground Systems Company and KK Broadcast Engineering. More information can be obtained by calling 866-22RADIO (866-227-2346) or visiting www.amgroundsystems.com.

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Studio Site

A Boom Year for Your Studio?

by George Zahn

The Forgotten Studio Accessory

It's one of the necessary evils in our studios. Whether we have a single announcer microphone or an interview table, the microphone stand or boom is always there. The trade-off is simple. A simple desk stand takes up table space and, unless you place a small boom on the stand, it quite often can occupy the location of copy or other preparation materials. The only possible nice trade-off is that most basic desk stands do have at least rubber feet that help reduce a portion of the vibrational noise. A well-weighted desk stand might be able to hold a very short boom (similar to that used for low height musical instrument recording) to get the microphone closer to the host

The other standard option to this point was the scissor-style mic boom, a jointed arm that attaches to the studio table and has a center point of articulation with springs that help keep the boom in position. Oh, how I wish I had a ratings point for every metallic, ringing sproinggggg sound heard from bumping the boom or an emphatic guest pounding on a table.

Taking a Stand

Back to the small desk stand for a moment: The only possible nice trade-off is that most basic desk stands do have at least rubber feet that help reduce a portion of the vibrational noise. A well-weighted short desk stand might be able to hold a very short boom (similar to this used for low height musical instrument recording) to get the microphone closer to the host while leaving their immediate table space more accessible.

So I'm asking in this article, possible solutions and photos of what your station or studio may be using as a solution to the unintentional spring reverb effect of the scissor boom. I hope you'll share them with me and I'll be happy to revisit this issue in a future article.

I know our station still uses old style table mounts and scissor booms. They can block eye contact with guests, and if you want good photos in the studio for social or print media, they look "official" but can also be a real obstruction.

Some stations that need space on the table top for paperwork might use something as simple as a floor stand with a basic boom. The stand itself can create some issues if you have hosts with fidgety feet tapping on a tri-leg stand. Keep in mind that the cardioid mics many are using in radio studios are much more prone to any kind of handling or vibrational noise. This is largely due to the design that allows the microphone to become unidirectional.

A nice round-bottom mic stand is less under-foot, but may not handle any boom length without the possibility of tipping over. The heavier the base, the better the ability to hold a boom, but there are still limitations.

Things Are Looking Up

I did a quick search and there are some do-it-yourself plans and some pre-made models to allow us to mount microphones to the ceiling. Depending on the weight-bearing capability or the structural construct, mounting a boom to the ceiling of your studio might well be an option. Be careful of drop ceilings, which may have a very limited weight threshold. On the surface, it seems like an idea worth exploring.

The idea of mounting microphones from the ceiling is not new. "In the 1930s, the old WLW-AM studios on Arlington Street in Cincinnati had ceiling mounted microphones that were kept in balance by pulleys so that you could move the microphone into just about any position and it stayed perfectly," says radio historian and program host Mike Martini from Cincinnati-based Media Heritage, Inc., "The ceilings were fairly high, and only the engineers could touch the microphones in the Crosley plant, so they often had to use ladders when making some adjustments."

We may not have the cavernous studios of the WLW radio behemoth of yesteryear, and we may wish we could get every one of our announcers to quit moving microphones around so we can get a more consistent mic placement and sound, but there has to be better ways to do this. Actually, some historic photos from 1930s and 40s broadcasters do show everything, from wall-mounted to ceiling-mounted mic booms. It seems that some of the DIY plans that call for the basic desk mount on a solid ceiling structure and properly securing the boom to that mounting, could be very interesting as a solution. Obviously a wall mounted system that juts out horizontally from the wall has to be properly placed to allow for movement around the studio. The wall mount might be better for the on-air talent mic, with the mount attached to the wall instead of the more vibrational surface of a desk or table.

The cabling of scissor-style stands is very interesting. Some engineers like to run cable through the hollow opening in the scissor stand, soldering the connector after feeding it through. That looks great and precludes the need for any type of zip ties or Velcro cable wraps to secure the cable to the stand – it looks best. Some newer mic stands, especially those designed for USB microphone connections, have USB connectors at both the mic end and desk end of the mic boom.

Most stations simply haven't considered other mic boom options. Some are even using home-made mic booms that were made from the support section of an old scissor spring boom draft table lamp, with some creative modifications at the point where the lamp would attach. That structure would be replaced by the microphone clip or mount. A note if you wish to try this: the springs on such a draft table lamp might not be suggested for a heavier microphone.

Booming Business

For the techs who must have everything, I ran across a novel take on a mic stand. A company named Miktek has a multi-functional microphone and mic stand, the ProCast SST which has a scissor stand. In its heavily weighted base, it has a small mixer, and it's geared to hook via USB to computers as its primary use. This unit is designed mainly for podcasters, but nonetheless may be a fairly low-cost way to turn any quiet extra office into a secondary interview room. The ProCast allows for connection of a second microphone (It comes with one permanently mounted mic on the stand). The mixer has an extra line or microphone input and two headphone outputs for monitoring, plus a USB and an analog output for connecting to a computer or any recorder with a Line In. *(more information at: www.miktekaudio.com)*

On this interesting unit, the electret, cardioid condenser shock mounted mic is on scissor boom. In the weighted base is a 2-line fader input (the internal mic plus another mic or line input, or two external inputs) with a master fader. The monitor section allows mixing of the base audio output, but also an input from an outside source such as a computer. There are two mini headphone jacks for monitoring. The unit is mono but it's a clever take on what would normally be a basic mic stand. There is some very basic metering, and the unit also has individual mute switches for each input which could be used as "cough" buttons.

While this is a novel and creative take on a mic boom, with a list price of $499 (some websites have it as low as about $300), I could find no frequency response specs on the built-in microphone, nor on the overall signal-to-noise ratio or quality of the pre-amps or the input and output circuitry. One other caveat is that since the primary mic is "built-in," matching mic quality for interviews might be a bit more challenging. Ideally, it would be nice of the company offered a "companion" mic identical to the attached microphone. Some may use this as a quick "pack and go" mic and mixer.

Vox POP!

Next to the vibrational crud that some mic booms pick up, another microphone issue is popping "P" sounds. Some people have a prolific propensity for profoundly popping P's – yeesh, I want to put a windscreen on my keyboard just typing that line! Most microphones do have some sort of built-in pop filter. This is a small foam screen inside the microphone capsule itself, gently nestled between the microphone's mesh grill and the actual transducer element.

The pop filter will help deflect some of the plosives, but most microphones need help beyond that line of defense. External windscreens help to further diffuse the plosives that concuss the mic's element, creating a low frequency distortion. Are all windscreens created equal? It's hard to say, but some custom made screens may have slightly more dense foam.

A good example is the Sennheiser MD 421. The windscreen made specifically by Sennheiser is a more pricey option than an off-the-shelf windscreen that you can buy at a local or online music supply. Having worked with both the generic and the Sennheiser custom screens, I can tell you that at least in this one example, the Sennheiser model does disperse plosives far better than the cheaper option. This may or may not apply for other microphones which have custom manufacturer-suggested screens.

Some stations may have followed the lead of music recording studios, using a nylon screen which can be adjusted to move an announcer a bit farther from the mic (while still letting the announcer be close to something). The nylon helps to diffuse the blast of air from the plosive, and for those few announcers who may have too much bass on a cardioid mic from the proximity effect of working to close to the mic, the screen can back the announcer off of the microphone. Let me know if your station has tried this type of music studio windscreen in your studio and if you've had any luck with it.

As mentioned in a past article, there's always a way to fix a popped "P" in the mix later. If you have a graphic EQ for the studio or as a plug-in, in digital editing, popped P's can be excised in at least two ways. You can easily see the plosive if looking at the wave form on a DAW, and you can usually just highlight the plosive and delete it while still leaving enough of the "P" sound to be intelligible. To EQ, highlight only the area of the plosive and pull out frequencies from roughly 30 Hz to 125 Hz. If you accidentally highlight more than the "P" portion of the audio, this EQ setting will thin the voice way too much, so use it judiciously.

I'm looking forward to hearing and seeing some better boom ideas than most of us are using. Please feel free to share!

*George Zahn is a Peabody Award winning radio producer and Station Manager for WMKV-FM at Maple Knoll Communities in Springdale, Ohio. He is a regular contributor to **Radio Guide** and welcomes your feedback. Share your stories with others by sending ideas and comments to: gzahn@mkcommunities.org*

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Engineering Perspective

Training a Replacement

by Dave Dunsmoor

How do you go about training your replacement(s) – and what do you teach them? What do you not tell them?

Not If, But When

The old adage says anyone will be missed for about as long as it takes a bucket of water to fill the void when you pull your hand out. In other words, everyone is replaceable.

It does not matter how valuable you are, how much you know, how much you do, or how much of the station's essential data you keep "in your head" (instead of in the books). To repeat: *everyone* is replaceable. The real questions are: how smoothly will your replacement be able to pick up where you left off? Do you care? Does it matter?

In many ways, of course, the answer may depend upon the terms of your departure. If you are ready to "burn bridges," go ahead and just leave, with everything still in your head.

However, if you are on an upward progression career path, carefully training a replacement – maybe even finding one – accomplishes more than just doing a favor for the old employer in making a decent, smooth transition in the operation of the engineering department. It also gives your new supervisor a positive impression about you, showing him you will not leave them in a bind when it is time for you to move up again. This can have an immediate positive effect on your salary. (Now we are getting somewhere!)

Sizing Up Potential Replacements

What you teach a replacement depends on what they already know, as well as how much time you have before it is time to turn in your keys.

Does the person have a fairly decent grasp of all things electronic/mechanical or merely basic conceptual knowledge? Even someone with a good background of "book smarts" can be terribly inept in actually putting all that theory to use, or they may just appear to be completely lost. Understanding them well might change what is actually needed to be taught.

One time, while training a new guy, I instructed him to troubleshoot a medium-sized UPS. He came back a few minutes later and announced that he had found the problem: "the battery is dead." *Grrrrrr*, I thought to myself: "I know the battery is dead, that's why it doesn't produce an output."

But instead of jumping on him about the obvious, I asked if he had checked the battery charging circuit. "Yes, and if the battery is dead, it will not try to charge the battery" was his more in-depth second answer. OK, now I saw that I did not have to teach him electronic theory so much as communication skills. I had asked one question, and he had provided me with one answer to the one question. Nothing more, nothing less.

I learned something that day.

Making It All Clear

You are likely to run into any of a wide variety of skill levels in the people who have been selected to do your job. To get the most value out of your time spent teaching them what is necessary, in order to be able to take over when you do leave, you might want to prepare some months (years) prior to the event. What I am talking about here is documentation.

I do not mean that you need to have a formal library of binders on every subject (although that would be great). However, something more substantial than a desk full of post-it notes is necessary. If you are adept at generating documents on the PC, this can be as simple as doing all your note-keeping or logs in Windows Notepad or Wordpad. A handwritten notebook also will suffice – if it is legible.

Start At the Core

Where do you start? Perhaps by looking around the engineering equipment room. If you were going to give an in-depth tour to a visitor (perhaps one of your peers), could you answer questions regarding the specifics of the operation of each rack, of each piece of equipment in each rack, of the interconnects between the racks and how they fit into the overall operation of the plant?

If you were going to do this over the phone – from a hospital room for example – could you describe exactly which pair of wires connects the transmitter plate control to the remote control unit? You could find it if you were there, but could an engineer from across town find it also? Could he find – or even read – your notes? Which IP is associated with which router, server, etc. Where does Telco enter the building, what circuits go where?

Here is an idea: do the overall big picture first. A "oneline" drawing is useful here. A oneline drawing resembles a block diagram and lays out which equipment is in place, and where it fits in the overall scheme of things. One line connects the blocks together to form a quick visual of how everything is laid out.

Once this is done, then you can add the details – racks, equipment, connections, pins, cable numbers and so on. This is where you will want to add notes (and drawings if necessary) about specific variances in wiring, setup, and so on. This is the kind of thing that will be invaluable to a new engineer as he goes about the job of keeping things running smoothly after you are long gone. By the way, "new" does not just mean newbie – a veteran engineer replacement will appreciate not having to "hand-over-hand" the wiring closet during troubleshooting.

How, Where, Who?

Have you made an inventory of your spares? Where do you typically get replacement parts; which companies do you have accounts with; what are their phone numbers; who are your contacts? Anything and everything that has to do with the completion of your job during the course of the year ought to be in a notebook (or a series of them).

You should also make maps of the roads to the transmitters, STL hops, etc. Do you have a spare set of keys – and are they labeled? What are the entry codes for the security alarms and the various pieces of gear? It will not help someone else get back on the air if the audio processor is "locked" and the password is not available.

Know who to call in an emergency – the Police or Sheriff's number (besides 911) should be available, as well as fire/rescue numbers. (A side note, this should be a reminder to have the Public Safety folks out to show them the facilities, what is inside, and who to contact if they get a call about the site?) They like to know what issues they are likely to encounter when called, for example when dealing with high voltage or especially if you ever need to call them to get an injured worker off a tower.

Similarly, document the key data with all your computers. True, almost everyone can reload Windows these days, but where are the audio/video/chipset drivers, what are the configurations? Where are the applications, the passwords, the licenses, and so on?

Benefit Now

Yes, I know – you have only so much time. However, if you start with one item, one small project, and do another every day or so, it will get done.

By the way, consider this: you are not just doing this for the new guy, but for yourself as well. The faster you can lay your hands on vital information in an emergency, the sooner you are back on-line, the sooner you are back on the air, the more valuable you are to your current employer, and the more professional you are.

And then, when the new guy shows up, you can easily, quickly, and with great comfort show him where everything is, and where to find the needed information.

Tips, Tricks, Traps

After you have gone over all of the general stuff, and where to find the needed information, a good next step would be to delve into some of the more subtle aspects of your installation. This area is potentially the most troublesome, but perhaps the most overlooked.

There are so many things that can go wrong in the middle of the night (or in the middle of drive time) that you cannot cover all possibilities. But do keep a log of some of the more repetitive, or urgent ones. The log will be helpful to you as you tracking down problems – and to the guy who follows in your stead.

Perhaps there are some quirks in tuning the transmitters, the ATU, some seasonal variances that you adjust for, some difficult neighbors to deal with, some planned improvements that have not happened quite yet, some wiring practice errors or intermittent equipment problems you have not had time to solve. Having these documented will save time for whoever has to deal with such issues.

Who's Who

Another list might consist of the local engineers (or even folks not in the business) who are knowledgeable and willing to help in an emergency or for a special project. During a three-station move several years ago, one of the local "electronics guys" was quite willing and able to do some of the time consuming, tedious work while I and the other engineers were doing the "engineering." It was very helpful and very much appreciated – especially when on a short timeline.

These are the things you will want to pass on. What you want to keep to yourself are the office politics, the rumors, the things that can be hurtful. Do not be afraid to mention some things that will make life easier (office manager is a stickler about bringing in receipts), but if she likes to drink too much after hours, best to keep that to yourself. It is not job related. And it can boomerang.

A friend was on a job interview, and the HR department approved his application and soon passed him on to the department head. The supervisor spent about five minutes describing the job requirements. Then the conversation moved over to how bad it was to work there, how tough it was to get parts, and so on. My friend thanked him for his time – and left, never to return.

The point here is: make your engineering department easy for someone else to walk into cold and it will make it much easier for you to walk into every day.

After many years as an FAA technician in Minot, ND, Dave Dunsmoor has retired and plans to restore aircraft and do some contract engineering. Contact Dave at: mrfixit@min.midco.net

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Streaming Guide

Metadata Strategies for the Modern Streaming Player

The rise of HTML5 and push-based technology among the factors evolving the streaming radio experience.

Andrew Jones, Director of Sales Engineering & Elijah Atkinson, Technology Developer – StreamGuys

Broadcast radio has always been best when focused on the listener experience. Terrestrial radio has thrived globally through its free and mobile model, reaching audiences in virtually any location with a mix of news, talk and musical entertainment. And the proliferation of digital radio platforms worldwide is making more choices and better quality a reality.

The streaming model continues to evolve as a listener-friendly platform. Audiences can access more streams on more platforms, and enjoy a richer media experience through metadata-driven enhancements. Rather than watch a straight-line player with a station ID and a timer, on-line and mobile-device listeners enjoy information from basic song and artist information to purchase links, social media activity and even video.

Understanding the dynamics of the media player, and how to efficiently integrate metadata into live streams, are undoubtedly two components that will help broadcasters elevate the streaming radio experience and remain competitive.

Audience Expectations

To build an efficient metadata integration strategy, it's wise to understand the audience expectations and broadcaster needs for today's streaming media player.

On-line audiences are far more sophisticated than five years ago. Services like Pandora and Spotify have changed expectations of the user experience. Naturally, radio broadcasters win when it comes to high-quality audio, leveraging truly professional tools on the production and processing side.

However, the player today needs to integrate valuable information around the audio experience:

- Program name, song title, album and artist, alongside album art as a basic visual element
- For music stations: "Buy Now" links and "Lyric lookup" to drive purchasing and further engage listeners
- Social media integration (Facebook, Twitter) to interact with stations and other listeners
- Expanded programming and artist information, such as a history of previously played songs or episodes and more performer details.

Above all, these experiences must be made available on multiple devices and platforms. This wasn't always easy, but player and metadata technology is evolving. Broadcasters can today efficiently deliver many of the top features audiences receive from the Pandoras and Spotifys of the world.

Building a Framework

Adobe Flash Player has long been the leading choice to drive player audio and real-time metadata integration in the broadcast space – and for good reason. Flash reliably supports real time, in-stream metadata that triggers other player events. This is especially important when it comes to switching ad banners on the player or triggering in-stream ads. Essentially, Flash can read metadata in the stream and react accordingly.

However, Flash has plenty of shortcomings when it comes to the user experience. Foremost, Flash is not supported on every platform. For example, iOS does not support it all, making Flash streams on iPhones and iPads absent. Flash streams are also not supported on most other mobile devices – a big hole given the millions of Android users wordwide. Mobile device manufacturers have put this restriction in place due to the exceptionally high resource usage of Flash.

Security exploits are another downside to Flash, driving software developers and mobile device suppliers to abandon ship. Flash works on a plug-in based architecture that interfaces with the web browser. That plug-in permits a specific set of actions that enables the content to play within the Flash wrapper. The architecture's side effect creates a scenario where bugs and vulnerabilities occasionally have a drastic security impact.

Adobe does an excellent job of patching these bugs, but the plug-in architecture requires the consumer to continuously – and often manually – update Flash plug-ins. The number of exploits and vulnerabilities in the format has soured much of the software development community.

The struggle is that Flash continues to provide excellent functionality for the broadcaster, but shortchanges the consumer. For the broadcaster, Flash plug-ins can read in-stream metadata in real-time from the audio stream itself. This ensures that the metadata is updated in the player from the same network connection that the audio stream uses. It eliminates the need for a duplicate connection for metadata, eliminating latency and synchronization issues. Changes to the artist/title and other data within the stream are instant.

However, if the consumer cannot play the content – or worse, continuously struggles with software updates and security patches – the arguments to retain Flash-based media players quickly thin.

This struggle has paved the way for HTML5-based media players, now a desired alternative to Flash players.

Next-Gen Approach

HTML5 is the latest evolution of the standard that defines HTML, and is designed for use by all open web developers. Audio and video elements are easily embedded, while supporting the manipulation of dynamic multimedia content. This open-standards approach lends itself well to software developers and consumers, as it has broad support across all mobile and desktop devices. For consumers, HTML5's lack of an external plug-in enables native, secure playback of audio streams within any web browser.

The flexibility of HTML5 is also a win for the broadcaster as more listeners can tune in with less struggle. However, one key shortcoming creates a new challenge: The fact that HTML5 provides no native support for in-stream metadata.

This is a problem not only for consumer-oriented data (song/artist, social media, etc.) but also stream monetization. To trigger ads and switch banners, the stream needs to have metadata inside; and the player must be able to read metadata as it changes.

Content delivery networks like StreamGuys employ several techniques today to create a solution that gives broadcasters and consumers the best of both worlds with HTML5: Homegrown innovations that automatically feed metadata to HTML5 players to achieve all the ad and data triggering of Flash; and support for as many browsers and devices as possible.

Scraping, Polling and Pushing

The workarounds for solving the HTML5 in-stream metadata are few, with some more effective than others. Some players attempt to solve the problem through a duplicate connection to the stream. This architecture provides one connection to the stream for decoding the audio, and a separate connection to the stream to acquire the metadata.

While technically an effective technique, it is complicated and inefficient. The process uses Javascript, client-side audio decoding to discard the audio and retain the metadata, which is a heavy burden on client-side resources. The duplicate connections also double bandwidth usage.

Metadata scraping represents a more efficient approach. This is a server-side utility that establishes a single connection with the live audio stream solely for the purpose of collecting stream metadata. Compared to the player-side duplicate connection strategy, metadata scraping significantly reduces bandwidth usage to minimize network load. The terminology represents the process of "scraping" the metadata out of the stream, establishing one connection that all players use as the metadata source.

There are two ways client applications can get metadata from the server-side scraping utility:

- Polling, the scraper utility outputs metadata to a web-based file that all streaming players can continuously reload
- Pushing, the scraper utility uses web sockets to support real-time delivery of low-latency metadata

Polling is the more prevalent of the two today. In this technique, the player is "short polling" a server-side source, automation system output or an Icecast server's status page every few seconds to retrieve metadata for display within the player. This technique is easy to implement, and thus widely supported.

Short polling is not without its limitations. Every player issues HTTP GET requests for metadata every few seconds. Frequent requests have the positive effect of improving latency for dynamic, on-time metadata changes, but the process can quickly escalate network traffic and resource usage. In high volume situations, this approach can crash the web service that powers the embedded player.

The emergence of push-based metadata represents a significant leap forward. Like short polling, the scraper utility maintains a persistent connection to the stream and extracts the metadata when it changes.

The difference is that the metadata is then pushed through an active web socket connection to the player. Once the player is loaded, a single request is made to the metadata server and a full duplex socket connection is established. As metadata changes occur, they are pushed out in real-time from the server to the player through the active connection. This eliminates the process of each player short polling the server and generating frequent, unnecessary traffic for infrequently changing data. The result is a highly efficient scraping approach with low network overhead, as dynamically changing data is pushed directly from the server to the client in real time over a persistent connection.

The emergence of push-based metadata directly correlates with the evolution of web sockets, as led by visionary organizations like Socket.io. Now supported in every web browser, socket connections ensure users can automatically push and pull data between the server side and the web browser. Prior to the existence of web sockets, the only way to move data between the two was via HTTP Get and/or Post requests. These methods produced high network overhead, as a full HTTP protocol packet was built for each metadata request.

The emergence of sockets and push-based metadata also eliminates the need to poll the server every few seconds. This has a significant benefit for the broadcaster on the monetization side. For example, the persistent connection enables a tightly coordinated, synchronized banner ad display alongside an in-stream ad insertion – a much trickier endeavor in a short polling scenario. It has the added benefit of pushing these same metadata changes to third-party platforms, such as TuneIn, with the appropriate API integration. StreamGuys is currently transitioning its SGplayer service from short polling to a push-based methodology based on these recent technology advancements.

Regardless of the method chosen, the fact remains that metadata management and integration is a necessary requirement today to both evolve the broadcaster's on-line business model; and to attract, retain and grow radio audiences and advertisers. It is an ideal time to talk to your CDN to learn more about the options and possibilities for delivering a richer, more dynamic streaming experience that will additional better monetize your efforts. *– Radio Guide –*

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FCC Focus

Can Tragic Events be Prevented?
– & –
Revised LPFM Rules Consideration

by Peter Gutmann

As this is being written (in early September), the industry continues to reel over the horrendous murder by one Vester Flanagan of two TV news reporters while conducting a live interview on WDBJ, Roanoke. As the shock subsides, our thoughts invariably turn to the vexing question of how – or even if – such tragic events can be prevented and what the law requires – or permits – stations to do. Unfortunately, in situations like this where the act was seemingly unforeseeable, irrational and unprovoked, there are no satisfactory answers or "bright-line" standards.

Clearly, if there is reason to suspect an employee of tending toward violent behavior, then there is a duty to take appropriate action. But how can that be determined?

In one sense, the obligation would seem to begin with careful screening of applicants. Yet there are strict legal limits to the extent of appropriate investigations. For example, in most states application forms cannot require disclosure of criminal arrests or indictments but only convictions. Out of respect for individual privacy, the EEOC is pushing to bar the use of background checks. Interviews need to steer clear – even indirectly – of any areas that might run afoul of legally protected categories. And references often are useless, as many companies limit inquiry responses to confirmation of dates and titles of past employment and strongly discourage the revelation of any useful or subjective information about performance, personality, attitude, etc. – and with good reason, since the denial of a job on the basis of a former supervisor or colleague's negative evaluation could lead to a lawsuit for defamation.

Once an applicant is hired, what about questionable behavior that might prompt an obligation for management to act? According to news reports, after "heated confrontations" with other station employees WDBJ provided Flanagan with counselling. When his angry behavior continued and he threatened the news director upon being fired, the station called the police and hired private guards for several days. After that, he continued to live nearby and worked at a number of other jobs, apparently peacefully. Only then, over two years later, having had no further contact with the station, and without any other troubling intervening incidents, Flanagan murdered the reporters at a remote location. It seems hard to imagine what more could have been done to protect station employees – especially off-premises – without illegally invading Flanagan's privacy.

The Department of Labor has published guidelines (directly applicable to federal workplaces) but they seem focused mainly on reacting to actual incidents (bullying, sabotage) or clear danger signs (dysfunctional attitudes) and provide little guidance as to how the WDBJ murders might have been prevented. Even requiring staff to remain within heavily-fortified offices would have been futile were they to venture out to research a story or even travel home.

As with prior shootings of innocent victims, this episode reopened the debate over gun control. Flanagan had purchased the murder weapon in Virginia from a licensed dealer legally, since he had no record of convictions and had not been adjudged mentally ill. But even proposals to tighten the screening of firearm buyers have a huge built-in loophole for those seemingly harmless at the time of sale but who years later become dangerously unstable. Given the sheer profusion of firearms in America, it seems impossible to keep them out of the hands of the insane, much less folks susceptible to occasional fits of rage or whose mental state deteriorates over time.

My partner John Garziglia raises an intriguing question – how can a broadcaster's obligation to provide a secure working environment be reconciled with the FCC's obligation to provide unfettered public access to local public files that must be located at a station's main studio? Indeed, the Commission recently fined a college station for relocating its public file from its main studio in a building with restricted entry to a nearby campus building accessible to the general public. Stations have been heavily sanctioned for impeding such access by requiring more. Unless a would-be public file seeker is obviously dangerous, stations may not request any information beyond name and address. Perhaps the answer lies in requiring public files to be posted on-line and eliminating the need for a physical copy, as has already been done for TV.

(John also notes that, as any visitor knows, the FCC requires passage through tight security in order to enter its own headquarters. It seems hypocritical to require stations to allow public access to broadcast facilities while denying similar access to the FCC, a public agency.)

Another difficult consideration is the extent to which media coverage of crime encourages imitative destructive behavior. On the one hand, there's not much any of us can do about the general societal trend toward ever-increasing acceptance of anti-social speech and conduct. Yet observers point to the vast numbers of credible studies linking violence to media depictions and the accessibility of such depictions in movies and cable programming. On the other hand, we need to understand the causes behind seemingly senseless acts, and that requires facts and analysis. Indeed, the New York Times, the "grey lady" of newspapers with impeccable journalistic integrity and standards, devoted four stories and nearly two solid pages to the aftermath of the WDBJ shooting. While its purpose was to seek meaning and constructive solutions, one of the articles highlighted the dilemma of whether such extensive coverage of a sick act (including some TV and on-line media that displayed the murderer's video) was genuinely newsworthy or sensationalized pandering to our basest compulsions. It has been said that a major component of the public interest lies in giving the public what it's interested in. So unless our lurid fascination subsides can the media really be blamed for its coverage of crime?

While it's human nature to seek meaning in the worst tragedies, perhaps there is no "lesson" at all to be learned from this one – but only to sadly admit that random violence, along with everything else, is a sad but unavoidable part of life.

Revised LPFM Rules Consideration

Turning to the more prosaic, also as this is being written the FCC is considering public comments on a petition for rulemaking seeking to substantially reform the Low Power FM service. Beyond their immediate impact upon LPFM licensees, the proposed revisions hold potential import for full-power stations as well.

The petition was filed by the "Low Power FM Advocacy Group," comprising over 100 licensed LPFM stations. While diffuse and repetitive, the basic contention is that restrictive rules, secondary status and an inability to operate commercially are depriving LPFM stations of their ability to provide needed public service.

Taken as a whole, the petition proposes a fundamental change in the basic nature of the LPFM service. It includes all of the following modifications to the current LPFM rules:

- Any business having annual revenues of less than $1,000,000 would be eligible to hold an LPFM license (rather than only established local non-profit organizations).
- Mutually-exclusive LPFM applicants would no longer be subject to auction (although the petition does not suggest substitute selection criteria).
- Licensees could own two LPFM stations (rather than just one, as currently allowed).
- License assignments would no longer be barred within a three-year holding period nor would consideration be limited to reimbursement of expenses.
- Unbuilt permits could be assigned but only for the fair market value of equipment and facilities.
- LPFM translators could be fed by any means, rather than only by direct off-the-air reception of the primary station.
- LPFM translator antennas could lie within 40 miles of the LPFM antenna (80 miles in top-50 markets), increased from the current 10/20 mile restriction.
- LPFM booster stations could use up to 200% of the LPFM primary station's authorized power.
- Time brokerage and other operating agreements would be allowed with any TV or LPFM station (and a full-power FM, but limited to 42 hours per week) upon a showing of (undefined) "licensee-assessed community need."
- AM stations could time-broker LPFM stations.
- Churches and non-profit entities could conduct fund solicitations using currently-barred language that constitutes commercials (comparative language and calls to action).
- LPFM technical rules would be conformed to the FM translator rules.
- Transmitters could be used that are merely verified as compliant with FCC requirements (rather than requiring FCC certification).
- LPFM call signs would no longer require an "-LP" suffix unless required to distinguish it from the same basic four-letter call sign assigned to a station in another service.
- LPFM fines for FCC rule violations would be substantially reduced.

Much of the petition seems riddled with specious facts, pretzel logic and unwarranted assumptions (my favorite – its blithe assertion that: "Truly, no one is listening" to AM anymore). Yet the general thrust of enabling LPFM to fulfill its intended function as a locally-oriented, viable, self-sustaining supplement to commercial broadcasting comes through loud and clear. By weakening distinctions with commercial radio it undoubtedly will stoke the same fears that prompted the established radio industry to oppose the creation of LPFM in the first place.

Indeed, the National Association of Broadcasters already has filed comments strongly opposing the petition, asserting that the proposals would undermine the reason for the creation of LPFM by subverting genuine local service by committed local groups and substituting pressure for mass appeal and profit. (The NAB's position implicitly recognizes that LPFM provides a safety valve against contentions that some commercial stations provide minimal local service.)

It remains to be seen whether the FCC will heed the petitioners' urgent call for relief or whether, by seeking comment, it is just trying to mollify them. As with most things, time will tell.

Peter Gutmann is a partner in the Washington, DC office of the law firm of Womble Carlyle Sandridge & Rice, LLP. He specializes in broadcast regulation and transactions. His email address is: pgutmann@wcsr.com

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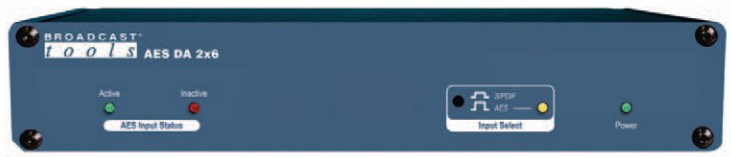

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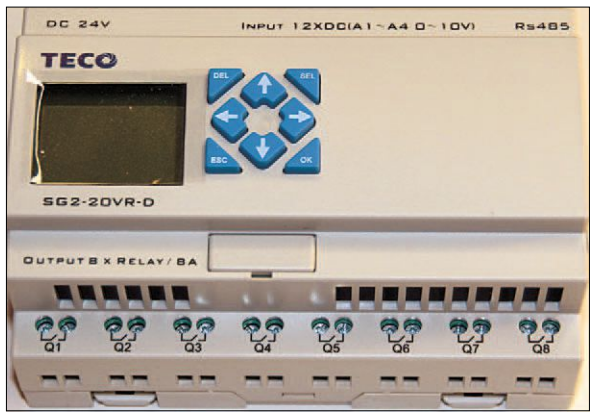
Practical Engineering

Programmable Logic Controller

by Mike Hendrickson

A few years ago we were cleaning out a file cabinet at MPR and discovered some interesting components. In the cabinet we found a programmable logic controller (PLC) – in this case specifically, it was a Teco SG2-20HR-D. This spiked my interest in the idea of PLCs.



A couple of months latter my wife and I were making a vacation road trip to Florida and on our return to the Twin Cities she was planning on visiting a quilting convention at Paducah, KY. While she was looking at quilts, fabrics, supplies and other quilting goodies, I retreated to a local public library and spent the day researching PLCs on the web.

The first thing I found was that the Teco device could be programmed by one of two programming languages: ladder logic programming or functional block diagram programming (FBD). The ladder logic language is typically used in electrical applications in factories. The FBD uses a primitive CAD type of drawing to create the program using NAND, NOR, OR, and NOR type logic blocks.

As I read about the device and played with the programming language, I realized that this simple, inexpensive device had a lot of potential. One of the concerns we have had at Minnesota Public Radio is the RF switching between transmitters. There are some off-the-shelf controllers for the RF switches, but none of them really met the requirements of MPR. These requirements included more than just turning the transmitters off. We wanted a "smart" controller to prevent problems. The controller also had to properly switch transmitters between different modes of operation, since we operate many HD transmitter plants.

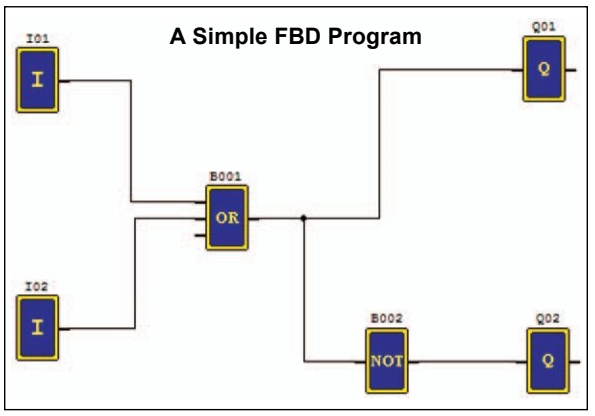
MPR had written macros that we used in our remote control systems, but this has one big problem – if the remote control is not functioning, any device that the remote control is controlling via a macro will not function. In the event the remote control is not present, the transmitter switching must be done using the manual control knob on the RF switch. Over the past few years at MPR there have been several cases of an RF switch needing to be rebuilt because of an "oops"and the switch burning out. There had to be a better way. Enter the PLC!

Many years ago I built an RF switch controller using TTL chips and timers. The unit functioned quite nicely and I still had the schematic. As I looked at the FBD language I realized that all I had to do to make a controller was to duplicate the schematic and add a power supply.

The FBD language permitted me to draw the schematic on the screen. I could then place the program in simulator mode. Simulator mode permitted me to do various "what ifs" to make sure the controller functioned as desired and functioned safely.

The Teco PLCs come in a variety of configurations. They are available in 12 VDC, 24 VDC or 85 to 240 VAC models. There are also expansion modules available for the PLCs to add additional capabilities. We have been using the Teco SG2-20HR-D and the SG2-8ER-D. This is a PLC that has 8 DC inputs, 4 analog inputs, and 8 relay outputs. The expansion module adds an additional 4 inputs and 4 relay outputs.

As an example, the diagram below is very simple FBD program for the controller. In this program there are two inputs, I01 and I02, an OR gate, an inverter or NOT gate, and two outputs. When the PLC is running, if there is a no input voltage, output relay Q02 will be closed and output relay Q01 will be open. When there is an input voltage on either input, Q01 will be closed and Q02 will be open. This simple program does not begin to take advantage of all of the possible functional blocks available.



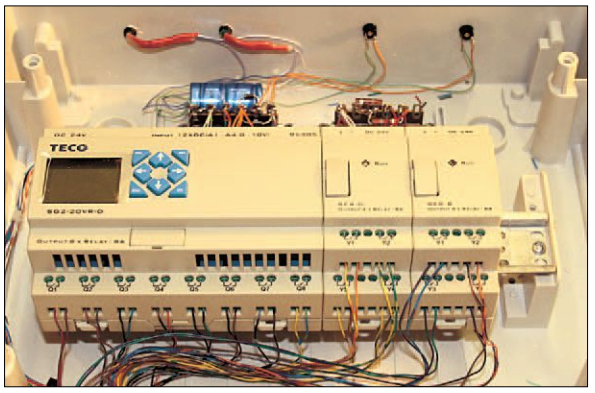
The programming language has a library of blocks that you can pick out and place on the screen. The blocks are connected together with "wire." Timers are given their parameters for on and off delays. After the programming is completed the program can be run in simulation mode without the PLC. The PLC is programmed by the computer using a special cable connected to either the serial or USB port on the computer. After the PLC is programmed, the computer can be left connected to the PLC with the FBD program running in monitor mode for troubleshooting if necessary.

The PLC has a non-volatile memory. As an experiment I disconnected the power from a PLC for several weeks. When I applied power, it resumed running the program.

We built our first prototype controller for use at our Bemidji, Minnesota transmitter site near Blackduck, MN. In this case, it was not a case of switching between two transmitters, but switching the combined output of two stations between a main antenna and an auxiliary antenna. This site had two analog transmitters along with two HD transmitters.

As is to be expected, we uncovered several initial problems with the controller installation. The first problem is that the controller inputs do not have internal pull up resistors. The controller is expecting an external voltage source to indicate a high condition. The problem is that when you interface the controller to a modern transmitter with open collector outputs, the active output is a low. We needed to add a pull up resistor to these inputs to get them to interface with the transmitters.

Another problem we ran into was that the controller was going to be paralleled with the remote control status logic input showing the status of the transmitters. The controller was expecting a swing of logic voltage from below about 5 Volts to above about 14 Volts. The remote control expected a switch from about 2 Volts to about 4 Volts. The two different devices could not be paralleled with each other. The fix turned out to be simple. Since this is a programmable controller, we added transmitter status outputs that fed the remote control instead of the remote control being fed from the transmitter directly.



As part of the design for the RF controller we came up with the following requirements:

1. The controller had to be an industrial type controller.
2. The controller had to be easily programmed.
3. The controller had to have dry contact relay outputs.
4. There had to be a dust proof housing available.
5. The controller had to be a universal design that could be used in any of the MPR transmitter sites.

The controller had to be programmed to do the following logic sequences upon command:

1. If the command is to switch to the transmitter not on the air, permit the controller to make the switch, otherwise ignore the command.
2. Turn off both transmitters.
3. Monitor the transmitter status and do nothing more until the status verifies the transmitters are off.
4. Delay for 1 second.
5. Command the switch to change positions.
6. When the RF switch interlock switch opens, open the transmitter interlocks.
7. When the RF switch has moved to the new position and closes the RF switch interlocks, close the interlock on the transmitter connected to the antenna.
8. Check the dummy load interlock and either close or open the interlock on the transmitter connected to the dummy load.
9. Delay for 1 second.
10. Turn on the transmitter connected to the antenna. (Note: We do not permit the controller to turn on the transmitter connected to the dummy load.)
11. Supply status outputs to the remote control for the switch position.

Recently we found another need for the PLC, but not in a transmitter plant. The studios of MPR have an underground parking garage. The garage door is controlled by a set of timer relays, photocells, and RFID card readers. If we are really generous, we would call it a "kluge." This kluge can be replaced by a single PLC receiving inputs from the sensors and supply an output to control the door opening and closing.

There have been other suggestions for uses of PLCs. If you are thinking of a group of discreet relays, timers, and other components, I suggest you consider using a PLC.

One source for PLCs is www.factorymation.com – another source is www.bb-electronics.com. Both companies have the PLCs in stock.

As a final note, the material cost to build a RF Switch Controller using a PLC is under $400. The programming language is available over the web for no charge. The programming cable is about $35.

Hendrickson is the Chief Engineer of American Public Media Group. He has been involved in Broadcast Engineering since 1969. Over this time period he has been involved with all aspects of broadcast engineering from the technical to the budgeting.

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- DTMF-16 and DS-8 DTMF tone decoders.

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Rules & Regs

Mr. Callahan Goes to Washington

by Steve Callahan

In August, I found myself on an Amtrak train bound for Washington, DC. I admit that I am no Jimmy Stewart, but this trip to the nation's capital was important to me and to all other AM station owners.

Several weeks before, I had been contacted by the National Association of Broadcasters in regard to coming to Washington to meet with some of the FCC Commissioners. The topic of our discussion would be the AM Improvement Act and, specifically, the translator window for AM stations that had been removed from the proposed act. I would be one of five local AM broadcast licensees who would visit as many Commissioners as we could and explain to them how an AM-only translator window would give us a fighting chance to continue to serve our listeners.

Upon arriving in Washington, we five met in a restaurant just around the block from our hotel. We were scheduled to meet with three Commissioners and one Commissioner's legal advisor the next morning. We were from several states and were all experienced broadcasters who were very interested in the opportunity to file for an FM translator in what we hoped would be an upcoming AM-only translator filing window. Unfortunately, the chairman of the FCC had removed the AM-only filing window proposal from a list of improvements which could be afforded AM stations. It was also unfortunate that the chairman was unavailable to meet with us.

I quickly learned that the reason the five of us had been approached by the NAB was that we have Dave Doherty, of Skywaves, Inc. as our consultant. At dinner we discussed how we all had been interested in acquiring an FM translator for our AM stations, but that in several of our markets there were none available for sale and if there was one for sale, the price was exorbitant. Seems we all had something else in common. We all wanted to continue to serve our listeners and serve them even better with a translator signal.

We had heard rumors that the FCC might offer a compromise to the AM-only translator window and as we discussed the ramifications of that possible compromise, it was clear that it would not aid the local AM broadcaster, but would hinder the ability to the local station owners to acquire an existing translator.

Not surprisingly, all of our stories were very similar. We all operate community-oriented AM stations that address the needs of our cities of license. We were all concerned that the AM listening was changing and that our listeners were also changing. All of us shared a passion for local, community broadcasting. We were all "the little guy" and had been serving our listeners and our communities for decades the best we could with our AM stations. The five of us got our marching orders for the next day.

We started off at 8:30a.m. the next morning at the FCC. After passing through security, we went up to the Commissioner's eighth floor, reminiscent of the 8th floor at the FCC's previous home on M Street. All of us were surprised at how modest the 8th floor of the FCC was. Our first meeting was with Commissioner Michael O'Rielly, who was extremely hospitable and welcomed us warmly. We thanked the Commissioner for the opportunity to meet with him and each of us in turn introduced ourselves and explained that it seems like the AM-only translator window was supported by everyone but the chairman himself. We also told Commissioner O'Rielly that there was a very good possibility that an FM translator could help prolong the life of many AM stations and that without that station, communities would lose their one and only radio voice. One of us explained that his station just had an on-air fundraiser for the local hospital and had helped raise $64,000. He was concerned that without a translator, the station might have to sign off permanently, and then who would, or could, continue his station's public service accomplishments? Commissioner O'Rielly asked several very interesting questions and left us with the impression that he was in favor of the AM Improvement Act with the inclusion of an AM-only translator filing window.

It was time for an early lunch at the NAB offices, so we all boarded the obligatory black Suburban for the trip across town. During lunch, we replayed the first meeting of the day in our minds and we were all satisfied that we had done our best. After a quick tour of the NAB and its Broadcaster's Hall of Fame, we were in motion back to the FCC.

Our next visit was to the office of Commissioner Rosenworcel, who was on vacation, but Johanna Thomas, her legal advisor was available to talk with us. We explained that AM stations have an uphill battle with the ever-increasing noise floor from fluorescent lights, computers, monitors and other unintentional noise generators. The five of us explained that our low power levels at night were especially prone to such terrestrial noise and that an FM translator would be especially helpful at night when we had to run at low power levels to avoid interference to distant AM stations of the same frequency. Unfortunately, such low power levels in no way provided adequate coverage to our audience, but even a low powered translator, which would be paired with a specific AM station and could not be separated from it, would help us reach listeners after sunset.

Later, Commissioner Mignon Clyburn welcomed us into her office and was most gracious and attentive as we shared our concerns with her. All five of us explained that we were small, local broadcasters who wanted to do more to serve the increasing ethnic segments of our listening area. In my case, I offered that I would like to help eliminate the need for 11 pirate FM stations in Brockton, Massachusetts by providing time at night for Haitian programming. Unfortunately, my night power of four Watts does not reach Brockton as well as our day signal does, and we would have a much better chance with an FM translator. We asked Commissioner Clyburn to renew the support that she had for the AM translator window when she was acting chairman.

Meeting FCC Commissioner Mignon Clyburn

We were next met by Commissioner Ajit Pai and his staff. He was very interested in our individual stories and our need for an AM-only translator window. He expressed his unreserved concern and support for AM radio. Commissioner Pai related several stories of his visits to AM stations during his travels and how he's seen first hand how local stations serve their communities. He speculated that the chairman might be concerned that an AM-only translator window might be perceived as favoring only AM stations.

We all explained that, until very recently, AM stations, except in Alaska, were unable to apply for, or even provide programming to FM translators. Recent translator filing windows excluded AM stations who now should be allowed the same opportunity.

Obviously, not every AM station in the country will be able to find an open translator frequency in the city of license. However, all five of us assured the FCC Commissioners that if any of us were granted a translator construction permit, we would immediately build that translator and use it in conjunction with our AM station. The AM Improvement Act is long overdue to be acted upon. My trip to the FCC left me with the impression that the Commissioners we visited truly appreciated our input "from outside the Beltway" and we are all anxious to see if the time and effort we spent will eventually be successful for all AM radio stations.

Steve Callahan, CBRE, AMD, is the owner of WVBF, Middleboro, Mass. Email at: wvbf1530@yahoo.com

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Chief Engineer

Some Studio "Add-Ons"

by Scott Schmeling

First, a quick note in reference to last issue's article regarding the problems I was having with an STL shot. I got an e-mail from Jay Underdown in O'Fallon, MO. Jay said, *"A signal level that is causing your problem may be caused by your receive dish being too high! If your antenna is in or near the second Fresnel zone, the signal will cancel and cause reduced or no signal."*

Jay attached a chart that showed the Fresnel zones. He said he's also a fan of the GaAs FET preamps from Advanced Receiver research.

To be totally honest, until we ran into a problem several years ago, the rule of thumb I had learned was, "50 feet up at the studio and a couple hundred up at the transmitter and it will be fine." While that does work most of the time, I decided long ago to get a path analysis, just to be sure. But all I've ever looked at is ground clearance. I'm going to start paying more attention to the rest of the data. Thanks, Jay.

A couple months ago I finished a small studio project. We were moving one of our "satellite" studios. The programming for the station is all handled out of our main studio location in Mankato, but we have maintained a studio at the original location. Charlie, our local sales rep, goes on the air every morning with Dwayne, back in Mankato, and talks about what's going on in town, and ends with a quick trivia game.

In the planning stages, we decided none of the old equipment would be moved over. We purchased a new (smaller) Dynamax console and a Tieline Field Unit to be used in place of a conventional STL. When Charlie is not on the air with Dwayne, the studio is used for recording client ads and interviews, as well as dubbing audio that Charlie has recorded outside the studio.

Construction went very smoothly – everything was very straight-forward. There was *almost* nothing "fancy" about it. I did, however, make a couple "refinements."

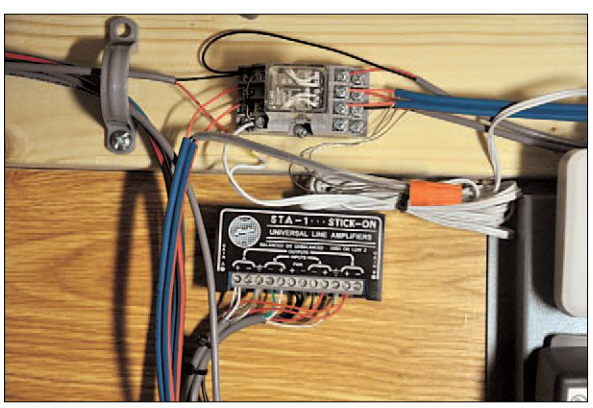
The console outputs are active balanced (two IC's) and the meter is calibrated for +4 out. We opted to use the on-board computer sound card rather than an expensive "professional" model. In theory, you can feed the unbalanced input of the on-board card with *either* the plus or minus and shield from the console out. But even when I do that, the input level setting has to be turned down to almost nothing in order to not get severe clipping in the recorded audio.

I've started adding a Radio Design Labs (rdl.com) STA-1 to the studios I build. The STA-1 is a Dual Balanced/Unbalanced Line Amplifier with an advertised gain of -12 to +20 db. The console Audition +4 dB outputs feed the STA-1 balanced inputs and the STA-1 unbalanced outputs can be adjusted for a proper input level on the computer.

I use either of two techniques for setting the input levels. First I connect a tone generator to a console input and adjust for a 0 dB on the meter. Then I open Control Panel/Sound/Recording and adjust the input level setting to somewhere in the middle. We use Adobe Audition as our standard audio recording software. Next I either start a recording in Adobe Audition or start a digital audio level meter program I've found to be very handy.

You can find the Digital Audio Level Meter by Paul Marshall at www.darkwooddesigns.co.uk/pc2/meters.html. In addition to three different meter types, there is also some good information regarding computer audio. I found this program when we were setting up new computers for streaming. I wanted to verify my audio input levels before starting the streaming software. The program worked like a charm and I've used it a number of times since.

With either Adobe Audition or the Digital Audio Level Meter running, I adjust the outputs of the STA-1 for the desired level indication. By the way, this also works for other unbalanced consumer devices.



(Continued on Page 22)

Trump Card

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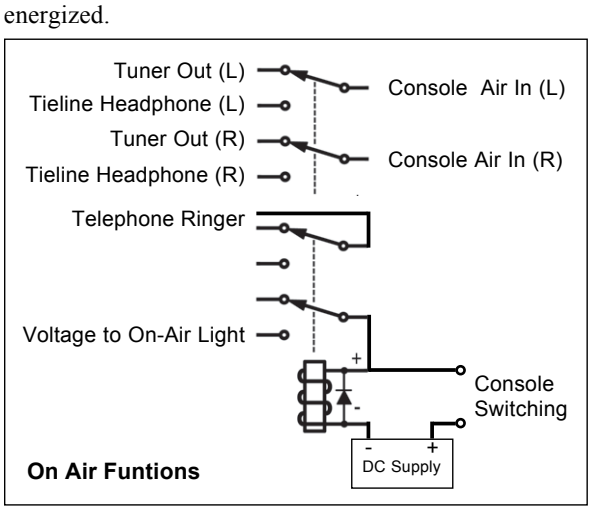
Some Studio "Add-On's"

– Continued from Page 20 –

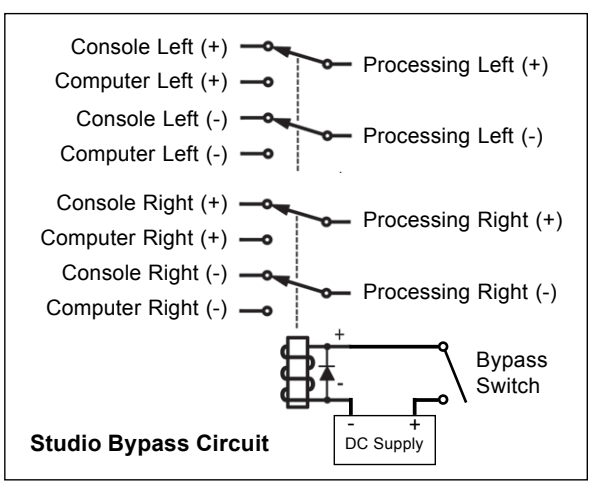
Another refinement is the addition of a 4PDT relay activated by the "Warning Light" output of the console. The console provides an opto-isolated output for user supplied On-Air lights. This output is used to drive a low-voltage DC relay. Whenever the microphone input is selected and the mixer channel turned on, the relay is energized.



This relay performs three functions. First, it can provide 120 VAC to an On-Air light (or a DC voltage for a relay located closer to the light itself – my preference). Another set of contacts will open the line to the speaker/ringer of the studio telephone – muting the phone when the mic is on. The last pair of contacts is used to switch the audio source to the console's "AIR" input.

I had mentioned earlier that in this studio we are using a Tieline codec to send audio to the studio. The codec is a bi-directional device – it sends *and* receives audio. The biggest issue with using a codec, whether as an STL or for a remote, is the audio delay. This makes it nearly impossible to monitor off-air. The Tieline headphone circuit allows mixing the send and receive audio such that you will hear yourself as you speak, as well as the mix-minus audio the main studio is sending back to you.

The remaining pair of relay contacts is used to switch the AIR input between the output of a receiver (when the mic is off) and the Tieline Headphone output (when the mic is on). Balance is set on the Tieline so the send audio and the receive audio are at roughly the same level and that the level very closely matches the audio from the receiver.



This way, when Charlie has his mic on, he hears his mic (no delay) and the mix-minus audio being fed back down from Mankato. He can converse with Dwayne as if they were in the studio together.

While we're talking relays, here is another application you may be interested in. This is for stations that run a computer automation system. I've found there are times when it would be very handy to be able to take the console off-line. Like when you have to do some repairs or maintenance on a console module. For stereo stations, another 4PDT relay does the trick. Wire the relay wipers to your audio processor inputs. You can decide whether you want the console or the computer outputs on the normally open or normally closed contacts. My preference is to put the studio on the normally closed contacts so the relay has to be energized to put the computer sound card directly into processing. That way, *if* you have a relay failure, at least the console will be on. The relay can be controlled with a toggle switch. If you want to be fancy, you could add an LED indicator to show the console is Off-Line. I will admit, here, that I don't actually have this circuit in place – *yet*. But it's going to happen this winter!

That's going to wrap things up for this edition. In our part of the country, cold weather is around the corner. This is a great time to double-check your transmitter sites and get them ready. Take weeds or any other vegetation growth down and seal up any openings where "critters" can make their way in. These are jobs that are much more pleasant doing when the weather is still moderate. That's it for now. As always, I welcome any comments from you. And remember ... keep it between 90 and 105!

Scott Schmeling is the Chief Engineer for Minnesota Valley Broadcasting. You may email him at: scottschmeling@radiomankato.com

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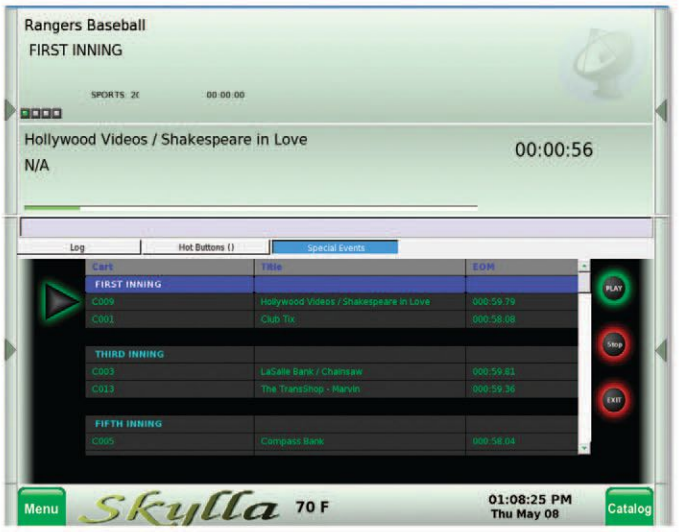

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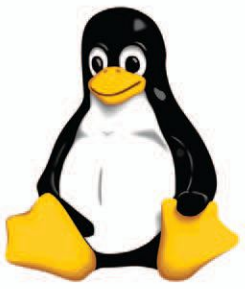

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AES67 INSIDE

5 things you need to know about this audio standard.

AES67 is everywhere. It's in every major audio network, including our WheatNet-IP, which means that you'll be able to transport audio between all these systems and other devices and peripheral gear that are connected to them. This IP audio transport standard was ratified in 2013 by the AES X-192 task force, of which Wheatstone was a member.

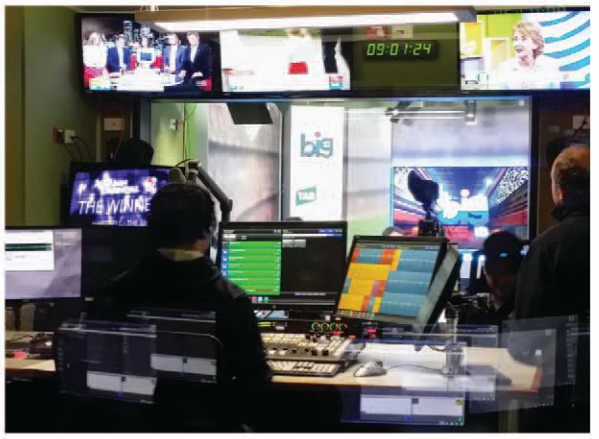
But, AES67 is by no means a complete interoperability standard. It doesn't provide for discovery and control, both of which are needed for any kind of interfunctionality to take place. These standards are in the works, but in the meantime, turning devices on and off, controlling peripheral gear from the console, signaling when a source is ready for air play, and controlling the playout system with a fader – these are all functions of WheatNet-IP and similar audio networks. In the case of WheatNet-IP, for example, a single Ethernet cable carries the real-time audio stream as well as network and device control messages and other metadata. AES67 covers the audio streams only.

With all this in mind, here are straightforward answers to the more common questions our engineers receive on AES67.

For the entire story... INN27.wheatstone.com

New Studio?

Heaven Forbid You Forget the Elevator.



It's easy to lose track of the many details of a new studio project. Let us take a moment to remember Edificio Intempo, the 47-floor skyscraper built in Spain that was said to be missing one important detail. Elevators.

The good thing about being in the audio network and console business is that we get to tour more than our share of broadcast studios from around the world. Our Director of Sales Jay Tyler has been in no less than 3,000 broadcast studios in his 20+ years at Wheatstone, and he has seen it all.

Here are a few things Jay, along with Studio Technology's Vince Fiola, who builds broadcast studio furniture, has noticed lately.

For the entire story... INN27.wheatstone.com

Network Edge: Engineers Vote BEST of SHOW at IBC!

At IBC, judges are comprised of engineers and industry experts who spend a great deal of time poring over every considered product before they choose a winner. So, it's great news when they select your gear! This year, we are proud to have won ***the NewBay Media Best of Show Award from Radio World International*** for our ***Network EDGE***, which lets you use IP wireless radios to establish STLs (and more)!

For the entire story... INN27.wheatstone.com

Pictured left to right: Wheatstone's Kelly Parker, Raffaella Calabrese (Publisher, Radio World International), Marguerite Clark (Editor in Chief, Radio World International) and Wheatstone's Jay Tyler

AM Redux

Beyond FM translators

AM gets a bad rap. Fortunately, recent changes to FCC regulations are helping some AM operators turn things around with the use of FM translators.

We're firm believers in translators to extend coverage, which explains why we've just come out with the FM-25 audio processor for this purpose (we also make a step-up version, the FM-55). But we're also firm believers in AM radio and began to wonder why so little in the way of new technology is available to adequately process the AM signal. So for our engineers Jeff Keith, Steve Dove and Mike Erickson, it was back to the drawing board – and Mike's large collection of AM radios....

For the entire story... INN27.wheatstone.com

Dan Slentz Sayz 'Thanks'

LPFM advocate predicts new 100W will rank in ratings.

We received an email from Dan Slentz, an engineering consultant who has become a tireless advocate and industry friend to LPFM. He recently flipped the on-air switch to new WDPE low-power, non-commercial, educational FM radio station licensed to Dover - New Philadelphia, Ohio. He's got stuff to say about the AIR-4 console and other gear he's installed at the station.

For the entire story... INN27.wheatstone.com

Tech Management

Simple Leadership Principles that Work

by Rolin Lintag

Most of the times, it is the simple things that work. Leadership in the work place, for example, need not be complicated. People are complicated but leadership is not. I may be over simplifying things but once you hear me out, you'll see that it not only makes sense but it is also intuitive. Yes, nothing is new under the sun. However, you can finish all the leadership courses that you'll pay thousands of dollars for but if you fail in what I describe here, you seriously limit your effectiveness.

Over the years, I have tested the proposition that leadership in the work place is very similar to parenting. Well, at least in two basic parenting principles:

1. Practice what you preach.
2. Lead by good examples.

We tend to compartmentalize our family life principles from the work place, and for a good reason. I'm not going to fault anyone for that. But both areas depend on relationships built upon mutual respect. And respect is best earned, not bought nor coerced. There may be different kinds of respect in our mixed up culture nowadays but I know of only one type of respect – one that moves people to voluntarily follow a leader.

It is human nature that we follow those we respect. So how do our two parenting principles affect respect?

I find myself explaining something axiomatic to even come up with an article for. So I'll just give you true to life examples to drive home the concept. For me, stories explain better than any doctorate level dissertations can in this case, so here it goes.

I once worked for a Director of Engineering who emphasized to me (as a new hire) why I should write on the site log whatever I have done at the remote site. I get it and got it clearly, so I filled the log religiously. I knew that whatever I had worked on at the site was worth writing down so that the next engineer visiting the site knew what was done. Well, the Chief Engineer visited the site when I was on a week-long vacation and guess what? He did *not* fill out the site log. "Do what I told you to do and not what I do," is one directive that we all know too well will not work with teenagers. How do you think adults will react to that? Will you follow someone who says one thing but does the opposite?

Next story. One of my pet peeves is looking for misplaced tools. I don't enjoy wasting my time looking for the tweaking tool around the room or looking for that Torx screwdriver that you seldom use – but when you do need it, it better be where it should be. Now, there are many kinds of engineers in the station and there are those who consistently return the tools to their designated drawers, while there are those who are too focused on the job that they somehow assume tools will magically end up where they should be the next time. I've worked with both types of engineers and I perform the magic needed for the latter type of engineers. To my surprise, my attention was called by the supervisor when a senior engineer complained about me putting away the tools. Really ... being evaluated negatively for doing what should be done at the end of the work day? I try to set an example for others as a Chief Engineer. Who among us would like to be reprimanded for doing something right?

Two negative examples are more than enough here. So let's look at the power of the positive.

One of our engineers reports back the Discrepancy, Action Taken and Recommendation every time there is an issue that he resolved. I don't have to ask for it since he is doing it as a matter of practice. I won't let him escape with doing something right, so I made his behavior an example for others to emulate.

I wrote up an email, copying the GM and my other corporate bosses, of what it means to our organization for others to emulate an engineer like him. I am not doing it to flatter the guy. I am deliberately encouraging the value of good communication within the Engineering department. Information, like how a problem was resolved, needs to be shared with other engineers. I am sure you can relate with this particular example. I say it many times, and I'll say it here again, that "Broadcasting is in the business of communications but many problems in the station are due to lack of communication among engineers."

For those engineers who communicate – may their tribe increase! Therefore, good behavior needs to be encouraged. Good examples need to be followed.

(Continued on Page 28)

ARRAKIS SYSTEMS INC.

NEW...

ARC-10BP-Blue

ARC-15BP-Blue

Bluetooth inside

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Arrakis leads the way again !!! The #1 selling ARC-10BP & ARC-15BP advanced Radio consoles have gone 'Blue'... Bluetooth enabled that is! This means that the last channel on the console can be paired to any Bluetooth enabled audio device such as your Cell phone, MP3 player, MP3 recorder-editor, and more. Just pair your cell phone to the console and answer your incoming calls with the 'Call' button and drop them with the 'Drop' button, just like a standard phone hybrid. The Caller receives the console bus mix ('minus' the caller audio) so there is no feedback. OR... you can pair any Bluetooth enabled audio device such as an ipad, Tablet device, or MP3 player and stream full bandwidth, high quality stereo (A2DP) audio to the last channel on the console. If a paired Cell phone call comes in, then the stereo stream is dropped and the call can be answered. Arrakis does all of this while still allowing an external phone hybrid to be connected to the same channel at the same time. Your imagination is the only limit !!!

ARC-10BP-Blue $2,795 ARC-15BP-Blue $3,795

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Simple Leadership Principles that Work

– Continued from Page 26 –

There are a few words that can choke us as we say them. There are times we feel like dying within us when we have to admit fault. "I am sorry," is a phrase that can be equated with suicide of the ego. If those words are not in your vocabulary, you may want to check again your life principles and evaluate how it is working for you so far. One company president I knew of admitted that he had a moral lapse and that he was no longer fit to lead the organization. Nobody caught him of what he confessed to, and for other organizations, it may not have been a big deal.

Anyway, there are many company presidents we have heard of who are public successes but private failures in their families. So why not sweep it under the rug and move on? Well, not for this company president. His integrity drove him to say those choking words, "I am sorry." He stepped down, disappeared from the limelight and went through restoration. I later on found out that he again rose through the ranks and was given another shot at leading another organization. To me, he is a big man.

One of my favorite movies is "We Were Soldiers." I liked it, not just for the action, but for the principles embedded in the leadership style of the lead character. "I will be the first to step into the field of battle and the last to step out." are words that assure his men as they go through the valley of death. It is the tough situations that bring out the best leadership within us. I have heard it many times from veteran engineers that they learned to become Chief through the school of hard knocks, and they say it with a chuckle, thinking that a college grad like me will not put my stock on experience. I assured them that I know of no better way for the Earth to produce diamonds but through high pressure and high temperature. Anything less than that breaks like glass under pressure. Sounds corny and cliche, but that is how it is.

I have high respect for engineers who are secure enough in their value that they are not scared to share information. Mentoring and coaching are traits that every supervisor should have as a requirement, not just an option. If the supervisor is a good mentor, he is setting a good example for others to pass on what they know to new engineers. I have worked with engineers who are apt to teach their trade and will not use their knowledge as a bargaining chip for job security. Contrary to what others think, an engineer who teaches others increase his value to the organization. They can be given more responsibility in other areas. Just ask your Regional Managers or Corporate VP in Engineering how they went up the ladder. One common characteristic they have is that they are good mentors.

Mentoring is not just show and tell. It is also modeling the right behavior for others to follow. One owner of a radio station I know of will not be a Prima Donna when it comes to cleanliness in the station. He dons his work clothes, picks up the broom and sometimes the mop, and get the job done himself. Not always, but once is all it takes to make the message clear to all of us. I'm sure he will clean again if he has to – but I'm pretty sure we won't let him do that himself again.

Most of us who have been in this industry for some time have mentors that have influenced us in our careers. One mentor who left an indelible mark in my profession is Lew Entz. He is no longer around for me to show my appreciation and I cannot thank him enough. But I can immortalize his good examples through the following words. Lew never got tired of explaining to me how a directional MW antenna works with regards to power division and phasing, working evenings with me on the two-tower array. I will not be as good as him but I did learn some – not because the topic was easy but because the teacher was good. He took the time to write to share his thoughts but never got published. He taught his engineers the trade but never sought the recognition for himself. He definitely practiced what he preached and led us by his good examples.

I'd like to leave you with a question regarding your mentors. Did they set good examples for you to follow and practiced what they preached?

If your answer to that is yes, then do likewise.

Rolin Lintag is Asst. Chief Engineer for KRON 4 in San Francisco, CA. You can reach him through rlintag@kron4.com

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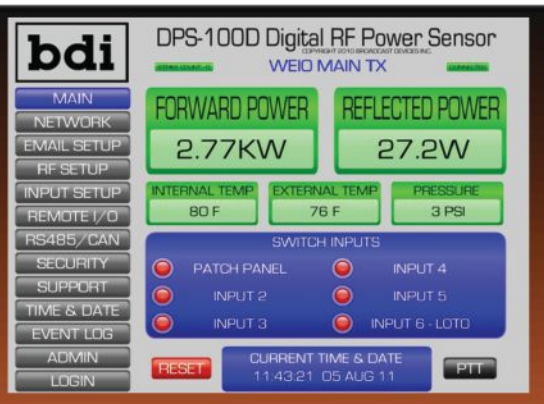

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Transmitter Site

Logical Troubleshooting Techniques - Part 2

by Tommy Gray CPBE CBNE

"Hey! The transmitter just went off the air ... again!"

I started my last article with these words but this time I added the little word "again" to the mix. These words are the ones that drive us up the wall. We thought we had the transmitter fixed only to have it go off again. Early in my career, I worked at a small UHF TV station, about an hour's drive from my home. This was before the days of pagers and cell phones. The station had been flooded at least twice, due to its close proximity to a river than ran through the city, and also due to the fact that it was built in a very low place. There was a levee nearby but it was not of sufficient height to handle large amounts of quickly rising water, and when the floods topped it, they came rushing right into the station.

The water marks in the transmitter room were about three feet up the wall – and the inside of the transmitter cabinets too! Needless to say, the facility was filled with intermittent problems. I cannot tell you how many times I would pull an all-nighter doing PM, only to drive the hour home and see my wife standing at the door motioning me to go back – the station was off the air! Getting there, I would simply have to exercise a sticking contactor or something simple. It was enough to drive a sane person completely crazy.

Eventually the station sold, the new owners purchased a new transmitter and everything was fine, but the cheapskates who were absentee owners of the station when I was there, would not spend a dime to help the situation. I finally got a little peace of mind by purchasing a battery powered radio that had TV bands so I could listen to the station when I went to lunch or left for the day. If I heard it go off, I could turn around and go back, saving myself a lot of unnecessary driving. If you find yourself in a similar situation, I feel for you. Thankfully, for the most part, things are a lot better these days with regard to transmitter reliability.

Logical Troubleshooting Starts With Good Recordkeeping

My first stint as Chief Engineer was aided largely in part to a great CE who retired and left just before me. He was an immaculate record keeper. He had a file cabinet that contained a folder for every piece of equipment we owned. Inside each folder were comprehensive maintenance records of everything he had ever done to the item. He had documented the symptoms, and the exact part that had failed. All I had to do, in a lot of cases, was to go to the file cabinet, pull out the record, and find the failed part again.

I have tried to teach every new engineer I have ever worked with to document everything. You may not remember what you fixed at 3:00 in the morning five years ago, but if it is in your maintenance records you don't have to remember – just look it up. My young engineer friend I am now mentoring is learning well, and documenting everything. He takes weekly meter readings on everything in the transmitter buildings of the four stations he maintains. He recently called me for a chat and I asked how his transmitters were running. His first comment was, "They are running exactly like they are supposed to and my readings have not changed." Lesson learned. When something *does* change, and he cannot figure out why, he can go back to his readings and "extract a trail of impending failure" and just about know right where to look. This can also help to prevent a failure before it happens.

Logical Troubleshooting Sometimes Involves "Fixing Other Peoples' Mistakes"

I recently helped a fellow engineer who was having problems with blown fuses in a large FM transmitter control circuit power supply. The thing would run great for a couple of days, then for no reason blow a fuse. He had checked everything and could not see anything wrong. After a few days it got to the point it would not stay on for more than a few seconds without blowing. (That makes it a little easier than trying to find something that only happens every few days!) He could turn off the plate breaker, turn the transmitter on and everything was fine. When he loaded the AC with the transmitter power it would run a while and blow.

I finally figured out that the current draw in the control circuit was changing under load, causing the fuse to blow, but was right on the edge of failing and not failing. I had him pull out the fuses and check the values against the schematic. As it turns out, the output fuse was

(Continued on Page 32)

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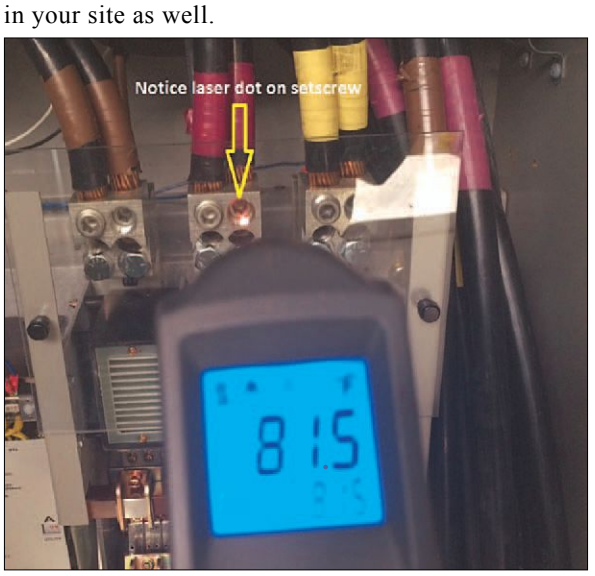
Logical Troubleshooting Techniques - Part 2

– Continued from Page 30 –

supposed to be 3 Amps but was only 2. Here is the kicker. This transmitter's control circuits had not been touched since it was purchased, so the wrong fuse came from the factory! Yes, even factories make mistakes sometimes. He put in the correct fuse and the problem has not surfaced since. Now the funny thing is that it has been five years since it was first installed and it has never had this problem before. As components aged and currents and voltages drifted around, it finally reached a point where the fuse would trip. Hopefully the correct fuse will, once again, keep it running for a very long time.

Logical Troubleshooting is Aided by Good Preventive Maintenance

Sometimes you can avert a problem altogether by performing proper preventive maintenance. Periodically checking screws, wire terminals, coax connections, etc., for loose connections, can help you head off a failure. We recently had a generator transfer switch fail at a site we own. The site is very well maintained, and as clean as a hospital operating room. However no one had been opening up the transfer switch and after several years, on two of the three phases, the wire mounting lugs where the wires attached had loosened up and the wires burned, taking the station totally down for a couple of hours while repairs were made. Now you could not see that the lugs were getting loose, but good PM, including using a laser thermometer, would have disclosed a hot connection alerting the tech that there was an issue before it burned out. In the picture below you can see where I am measuring the temperature of the wiring connections in a transfer switch. All the phases should read close to each other if the load is balanced. One very hot connection is a red flag that something is not right. This technique will work for a lot of other gear in your site as well.



As you can see, the temperature is just a little above the ambient temperature (75 deg.) which is a good thing. Repeat the process for all lugs and wires. If you see one wire or lug that is a lot hotter than the others, then you have a problem! You should immediately plan some off air time to check your connections, etc. I would recommend an annual inspection that includes tightening up all your wiring connections. Kill the building power at the disconnect switch and using a flashlight (and a helper), go in and tighten up every wire in all your AC panels. This will prevent costly downtime.

Logical Troubleshooting Involves Using Your Head

The first thing you should do, when faced with a crisis at the transmitter, is to keep a cool head. There is an old saying that sums it up: "Cooler Heads Prevail." If you are frantic, or in a panic, you will likely start doing illogical or even dangerous things, possibly wasting a lot of time, or even get hurt! Take a few moments to "*THINK.*" What is wrong ... what happened? Try to walk through what is supposed to be happening, and then see what is not. If you have someone with you, tell them to be quiet and give you a minute to think. I have even asked everyone to leave the room so I could have time to think and evaluate the situation. It has always proven helpful.

Use your sense of smell for unfamiliar odors (burned wires and resistors, etc.). Use your ears for unusual or missing sounds (clicking relays that are not supposed to be clicking, fan motors not running at the correct speed, etc.). Use your eyes. One simple technique I use sometimes when searching for the source of an over load is to open the transmitter, defeat the interlock, and standing a safe distance away from the transmitter, have an assistant turn off the lights in the building, and then turn the transmitter on again, to allow you to see the source of an arc, etc. Works great! In the dark you can clearly see even a tiny arc.

Hope these tip help you. More to come later!

Tommy is the Senior Director of Broadcast Engineering and Technology at KSBJ Educational Foundation, Humble (Houston), Texas.

Tips From the Field

Backup Protection for CryptoLocker & StreamS IOdigi2 AES-EBU Box

by Tom Bosscher

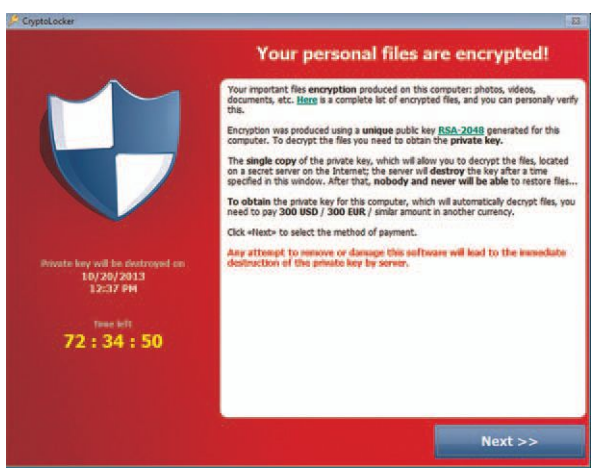
The Plumber's Toilet Overflowed

We've heard all the warnings. We issue the warnings – anti-virus this and firewall that. But yet, some of us just don't listen. With some 60+ computers in the building that I take care of, I have not had a single case of the dreaded "CryptoLocker virus." About six months ago, my 91 year old dad caught it – the hard drive was hosed. The laptop was an old warn out old Vista machine. Since he only surfs the web, I simply bought him a used laptop.

But sometimes, some of us just don't listen. My desktop computer at work – that I use for everything – did I have it protected? No. I'm the IT guy, I know what I am doing. What's the saying, "Pay me now, or pay me later?"

I was downloading a driver from a website I thought was good – from a link that I thought would download the driver. Thirty seconds later, I heard chatter from my storage hard drive. The chatter was every single picture, PDF and document being encrypted. And then ... "The Screen." Just like the horror picture at the drive in movie theatre, the "Screen" was staring at me. *"Your files have been encrypted for your protection."* In milliseconds, I knew what had happened. I made a mistake. One that I lectured others not to make. And here it was. On *my* computer.

Well, I crashed the PC, killing the power supply. I pulled my nice "S" drive, all 500 gigs of it and put it in a USB carrier attached to a utility computer, which I disabled from the network. Every PDF, every document, every cute picture of my nine grandchildren, were, encrypted – toast.



The CryptoLocker Screen

About a year ago, on the Christian Radio Technical forum, CRTech, I was informed of a program called "AOEMI", a backup program; it takes one gigantic snapshot of a CPU's main drive, and stores it as one giant file. You can then reverse the process and make a new drive look just like the one it took a picture of. I tested the program. I made a backup of the bench utility computer. That process took about 40 minutes. I then took a new hard drive, and used the program to build a new "C" drive. This also took about 40 minutes. I then plugged this new drive into my utility computer and booted it up. The computer never knew the difference. So I was now convinced this program was useful. More information at: www.backup-utility.com

I started to make backup copies of the "C" drive on all the critical computers in the station – about 40 of them. At one point, about six months before, I made a copy of my very own desk computer, just for fun. Six months later, that "for fun" time turned into a serious moment. I took that six month old image and transferred it to a new hard drive. 45 minutes later, I had my computer back. Well, yes I was missing anything I had added in the last six months, but that wasn't too difficult to find that information on the data backups.

I then sat back and realized that I had just been taught a lesson. Life gives us tools to do good things. But we need to *use* the tools. So what do we do after this? I installed a network drive, that every CPU is mapped to. The AOEMI program can perform the backup routine based upon a calendar and time that you choose. We have most machines set to make an updated image copy every two weeks. Now the immediate concern is that some of the Crypto-Locker programs will go out and look at all mapped drives and scramble them for breakfast also. The network storage drive I use has two network ports.

(Continued on Page 36)

Tips From the Field

– Continued from Page 34 –

Attached to the second NIC is a simple independent network that consist of an identically size NAS, a very small computer with SecondCopy on it. Every few days, the first drive is backed up to the second drive, which cannot be seen on the main network. All of the computers backed up have three differently dated images on the second drive. So even if the primary drive gets attacked, we have safe copies. This takes a little work, but the ease of mind that it gives you is priceless.

At a contract station I take care of, I manually run the AOEMI program once a month on their nine CPU's, with the images copied to a mapped drive sitting off the engineering computer. When they are done, I unplug the external drive that the images were copied to. An unplugged hard drive cannot be modified, encrypted or hacked.

Take a little time to analyze what you need to put in place to back up the images of your C drives. Computers, hard drives and equipment are easy to replace. The data? Not so much.

The Box Looks Pretty – But It Gets Better

Sometimes, someone has a sense of bringing a product to market when it is needed, and no one else has seen the signs. And this time, Greg Ogonowski and his company Indexcom, have come out with the cutest little box that solves a fundamental problem with many of our studios.

There are many audio cards out in the market to choose from. But with many of the new digital consoles and centralized/networked audio delivery systems, we need a box to give and receive digital audio – and digital only. In our facility, we have around ten digital editing systems, mostly using Adobe Audition. I've used the various PC card audio interfaces, and I've looked many times at the prosumer market that gave us so many USB interfaces. One of the major problems with these units is that they only operate off the +5 VDC supply of the USB port. This limits the voltage swing and, while the boxes may be fine for your consumer -10 dBv input levels, they cannot get anywhere near to the +20 dBm needed for adequate head room and signal-to-noise ratio that is needed in the broadcast environment. Many of these USB boxes give us analog audio in and out, and maybe AES-EBU out, but none gave me the choice of just AES-EBU audio in *and* out. Well Greg and his company have.

Indexcom calls it the StreamS IOdigi2, or the Model 2202. Only about 2" x 3" x 5", and sporting only three connectors, this box will be installed in most of our digital editing stations, especially as I change out to new computers. There is no need to open up a computer. Use a small CPU, with a small form factor (SFF) and plug the USB connector from this silver box into the computer and you are good to go. So far, I have not had to install any drivers. Plug the box into an XP, a Windows 7 or a Windows 10 CPU, wait thirty seconds, and re-route your audio. In our operation, we are using a legacy Logitek digital audio system, using three engines and five audio control surfaces, and we have access to a lot of analog and digital I/O spigots. Two AES-EBU cables to the closest engine and we have pristine audio. And the news gets better in the fact that a 0 dBfs signal uses the same digital waveform as a -85 dBfs signal does, its just that the bits are in a different location. No problems with adequate headroom or signal to noise issues.This box handles 16 bit and 24 bit stereo operation at several sample rates. It plays very well with all of the Adobe products we tried.

StreamS IOdigi2, Model 2202

There are specifications to be had, and you can find those at https://www.indexcom.com/products/iodigi/ I don't need to review specifications for myself if Greg is behind the design. What I do get to do is to upgrade all of my audio editing interfaces to full digital, for a very reasonable price ($390) and with the greatest of ease. The even better news is that if I have a CPU fail, I do not have to swap out an internal audio card. Replacing a defective computer in a production room should take minutes, pausing only to swap out six or so cables. I look forward to saving time. This is a good looking box that does even better in solving a problem in future proofing our studios.

Tom Bosscher is the Chief Engineer at Cornerstone University Radio. Email him at: tom@bosscher.org

From the Ground Up

Building a Syndication Network in Three Weeks

by Chris Tarr

So, the GM comes into my office ...

"I've got great news! We've hired the big Sports Talk guy from across the street! We've decided we're going to syndicate his show to stations across the state. So, we need you to put together the stuff to distribute the show. You've got three weeks until launch ... that should be plenty of time, right?"

After I pulled my jaw off of the floor, I went to work. I sat down with the station program director to determine the formatics of the show, and get an idea of what we were feeding, and to whom.

So the basics were this: A daily four hour sports talk show, fed to large and small stations across the state. It would be a relatively easy show to operate – no "national" spots or local ID's, just a closure to trigger local breaks and some sort of ability to record the show and upload the segments to an FTP server for stations wanting to "delay" the program.

OK, now we have a basic set of parameters. The first decision was what to use as a delivery method. Satellite was out of the question at the time, due to cost and time constraints. ISDN was a possibility, however that doesn't scale well. So it really boiled down to IP delivery. Again, that opened yet another can of worms.

We had plenty of reliable bandwidth in the building, so that wasn't an issue. The bottom line was that we needed to have an encoder that would accept many incoming streams, provide I/O for relay closures, and be inexpensive enough that a small market station could afford to buy a decoder.

Using those design parameters, we settled on the Barix 500. It can be configured as an "STL" allowing for unidirectional audio to many connected decoders, as well as providing four discrete relay closures. With that decision made, it was time to sort out the mechanics of making the show go.

I decided that the easiest way to configure it (at the time) was to essentially make our station an "affiliate," hardware wise. At the same time a relay closure was fed to the affiliates, one would be sent to our automation system, signaling a break. My reasoning for this was two-fold: I wanted the operation to be super easy for the operator, and I wanted to have my automation system handle the audio routing through the matrix switcher.

Since we fed audio to both live stations, via the Barix, and to an audio logger for editing and upload, I felt that we should create a mix-minus to both devices that sent just the "show" audio and not our local commercials. That would prevent other stations from running our spots, and would make for easy editing of the recorded segments since there would be long gaps in the audio.

After laying it all out, I realized that all the operator needed was one button to run the show. That button would send the closure to the Barix box (and off to the affiliates) as well as trigger the automation to make the audio changes and play the local commercials. I thought that was pretty slick!

So I went and found the coolest, most majestic button I could find. I ended up buying a large red button, complete with flip cover to prevent accidental pushing. I mounted it in a nice large box. The instructions were simple: *"To make something happen on the show, press the button!"*

With all of that out of the way, it was time to start testing. Fortunately, a very good friend of mine is an Engineer at one of the affiliates, and also was running a show via Barix, making him a great resource. He connected his side up. He was hearing audio, and sure enough – he saw a closure when I pushed the big red button. We were in business!

With a couple of days to spare, I thought we were home free! I had knocked it out of the park – until day one.

It's the big day. I saw the affiliates connected to the Barix. I hit the button a few times before the show, and I saw the relay light go on. Everything looked great. The show began, and everything was working according to plan. I heard the local break fire, and I saw the matrix router change ... it was all working!

About an hour in, I got a call from an affiliate. They weren't getting all of the closures. I called the others – same story. I looked back at my automation logs and saw all of the closures being received. It was a mystery to me.

We limped along through the rest of the show, and got day one in the books. I called up one of our affiliates to test. I gave the button a nice, deliberate push, and he saw the

(Continued on Page 40)

Building a Syndication Network in Three Weeks

– Continued from Page 38 –

closure. The operator gave it a tap ... nothing. After doing this a few times, it occured to me: the Barix needed to see that closure for at least 500 ms in order for it to "register." So, I explained to the operator that he needed to push the button and do a "one count" before releasing. That worked for about two days.

Now I realized that I had to again make it easy. So the solution was to install a timer relay ahead of the Barix encoders. Now, any little tap on the button caused that relay to latch and hold for one second. From then on, we never had another issue with relays.

All of that setup (as Rube Goldberg as it was) worked well for quite a long time. Then, we made the conversion to Axia and, at the same time, upgraded our automation to Wide Orbit. This gave us the perfect opportunity to revisit how things were configured, and hopefully simplify things.

One of the neat features of Axia and Wide Orbit is that they can talk to each other via Axia's "Pathfinder" software. Pathfinder is exceptionally powerful – it can change audio routing, trigger GPIO events and things of that sort. Wide Orbit can trigger Axia changes and vice versa via Pathfinder – it was time to retire the big red button.

Working with the Wide Orbit installers and Matt, my in house Axia guru, we were able to really distill how to make the technical part of the show run simply and seamlessly.

The first thing we did was create a profile for the show, on the Axia surface, that the operator selects when he gets into the studio. This sets up the mix-minus to the encoders and the show logger. It also activates one of the buttons on the surface's "button bar."

For the relays, Wide Orbit and Pathfinder came to the rescue. The first element in each commercial break is a Wide Orbit workflow that tells Pathfinder to close the GPO pin to each encoder for 1 second. At the same time it changes the color of the button on the Axia surface in the studio from red to green, signaling to the operator that the relay had closed. That same button acts as a backup, in the event that Pathfinder has a problem – the button talks directly with the GPO pin, firing the break. Because the mix-minus was already created in Axia, that is the only thing that now needs to happen! When it's time to go to a break, the operator fires the break using the automation's start button and the rest just happens!

Now, over the years we have run into a few issues. First off, there is very little intelligence built into the Barix boxes. Therefore, unless you have an excellent connection on the decoder side, there will be occasional artifacts. Some affiliates have very few (and haven't minded the occasional "burble") while others have had significant problems with dropouts. Most of the time investigation shows that it's either a networking issue internal to the affiliate, or a peering point somewhere in-between that is saturated. I've worked with our affiliates over the years and I've been able to help them resolve the problems 99% of the time. As for our end, my network is 100% gigabit, and we have a symmetrical fiber connection into the building as well as a business class cable connection as a backup. While there have been one or two close calls, there hasn't been a case of the stream not being available that I can remember.

The other issue is Pathfinder. Obviously we rely heavily on the Pathfinder software to be up and running. The software itself is extremely robust, however we did have it running on an old, slow machine which caused some issues. The upside is that Pathfinder can (and should) be configured to run in a main/backup configuration, and Wide Orbit can be configured to seamlessly switch between the two in the event of a problem.

I won't say that this solution is the perfect replacement for satellite delivery – it's not, and if I had my choice (and a huge budget to match) that would be the preferred method. However, over time, this method has proven to be highly reliable, and we've been running the show for several years with no major issues. It certainly can be a great way to syndicate a show with a low "barrier to entry."

If anything, it proves that when an Engineer is given a huge task to complete in a short amount of time, the result is often something very creative!

Christopher Tarr holds the CSRE, CBNE, and DRB certifications from the Society of Broadcast Engineers, and is the Director of Engineering for Entercom's Wisconsin stations. He can be reached at chris@tarr.cc

Small Market Guide

Continental 816R Transmitter Power Control Problems

by Roger Paskvan

It was a quiet Sunday in small marketville. The phone rang and my PD informed me that one of our FM stations was off the air. The Continental 816R beast had died again.

Well, the 250A breaker on the wall was down, indicating this was no simple problem. I returned power and quickly realized that we were facing a SCR power control problem. Applying power to the transmitter brought an immediate trip of the transmitter main or the wall power breaker. Bringing the power control down to under 5%, I was able to get a clamp-on ammeter on the SCR power leads and read the currents. One amp, one amp, and nine (9) amps indicated we had an SCR problem or a short on one phase of the power supply.

Further testing led to a short in the High Voltage (HV) rectifier stack. (12 Ohms instead of the usual 100K Ohms) Normally an ohmmeter will not check high voltage diodes but 816R HV stacks always seem to short when they go bad, and any ohmmeter can find it. Luckily I had a new spare in our parts arsenal and the HV diode stack was replaced.

Applying power in small increments, the breaker didn't blow but the phase primary current was still not balanced, indicating a further SCR or control card problem. Substituting the SCR control cards indicated that all the cards worked but the card in the one channel acted funny. Ramping up the power gave the standard groaning sounds but louder than normal. Back to the card cage and trouble-shooting the SCR control cards. (See figure 1)

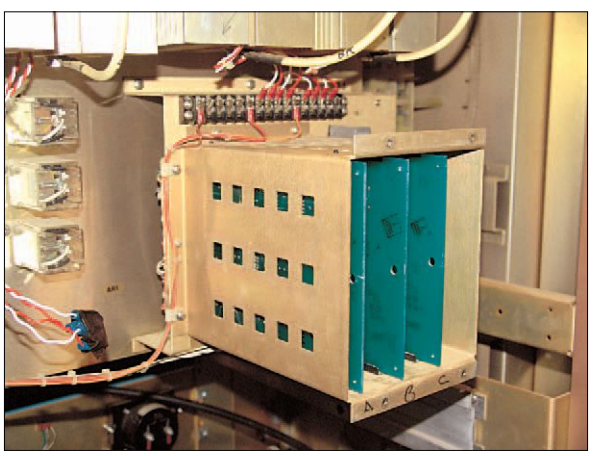


Figure 1: SCR Gate Control Card Cage

Now the reason for this article is to call attention to a little known set of transformers that are cleverly hidden behind the card cage, out of sight. They do not appear in the overall schematic (only as three squares with wire numbers on the drawing). These three transformers provide the AC phase voltages to operate the gating cards. There are three transformers, one per phase, that are connected across the 208 three-phase supply. Their secondaries provide 18 VAC to each gating card through the edge connectors behind the card. To check these transformers, you have to call the Continental people to get the card cage pin numbers, which are actually the primary/secondary connections to these transformers. Normal operation will indicate 208 V on pins 1&6, 1&11, and 6&11, a three-phase input. The secondary outputs will have 18 VAC on card cage pins 6&7, 18&20, and 26&27. One of our transformers was lower than 18 VAC and was replaced. (Keep this info handy, it's hard to find.)

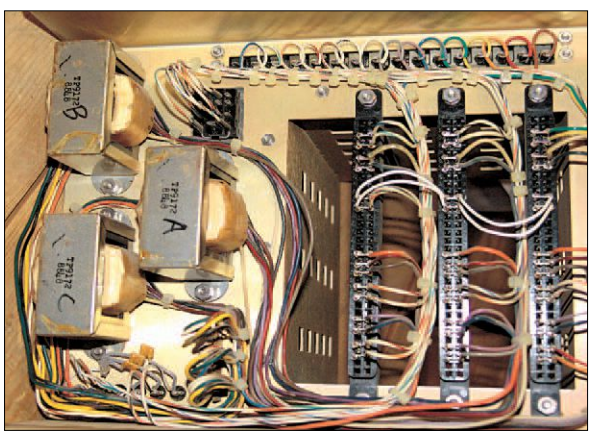


Figure 2: Rear of Card Cage Showing Control Xfmrs

To get at these transformers, you have to remove the entire card cage and all the terminal connections. After you flip the cage over, the three transformers become visible. (See figure 2) The replacement is $160, but they are custom made so the factory is your only source. Another lesson learned in small market radio.

Roger Paskvan is a Professor of Mass Communications at Bemidji State University, Bemidji, MN. You may contact him at: rpaskvan@bemidjistate.edu

Survival Guide

A Healthy Work Schedule

by Rich Wood

Defining Enough

The concept of "enough" entails more than just how much time you spend on the job. It also means whether or not being at work is voluntary or forced by too much responsibility, or too few people, to cover the cluster's needs.

The nominal U.S. workweek is 40 hours, the national tradition since the Fair Labor Standards Act (FLSA) regulations were adopted in 1938. Nevertheless, many engineers work 70, 80, or even 90 hours a week.

Part of the problem is that employers often consider engineers to be management and "exempt" from overtime. In 2003 the government revised the definitions of "exempt" to include "management" people who have no more authority than the receptionist. (Formerly "management" meant the ability to hire and fire and to make decisions that carried the backing of the company.)

Insult is added to injury when you come in late after a long night risking your life with high voltages, to be met with a derisive "nice of you to make it in!" That from fellow staffers who are required to work a rigid schedule and resent your "freedom" to come and go as you please. Though an engineer who is out of sight is usually at the transmitter, the perception is that you just slept late.

Enlightening Management

Usually there is no recourse available other than working or walking. Not being an attorney, I cannot give advice on where the law stands regarding your personal situation – both for pay and the number of hours you may be regularly required to work.

At the same time, my impression has always been that a salaried (exempt) employee was expected to be available and willing to work more than 40 hours when something special required more time – but not 80 hours as a *regular weekly requirement.*

The solution is to enlighten management (and staff, to minimize resentment) so they understand you might have been at three of the eight stations overnight. Developing a relationship of trust is critical. When a breaker trips and you spend the night at the transmitter, management should understand and let you sleep late.

Enlightenment

Many managers in major markets develop a self-serving enlightenment. Every minute off the air costs a fortune in lost revenue and the engineering "cost center" suddenly becomes the station's salvation.

My experience has been that most managers understand the "always on call" nature of engineering. Those who do not understand rarely get the cream of the crop, instead getting consulting engineers and ballooning engineering budgets. Worse, important, yet expensive maintenance gets ignored.

Unfortunately, such enlightenment is on a case-by-case basis, even within a company. I know of engineers fired for refusing the risk in some life threatening situation – such as during a natural disaster still in progress.

Stop and Take a Break

Some engineers arrive early because they can get work done before the phones begin to ring. These tend to eat lunch at their desk or simply work through lunch. My doctor tells me that is not very healthy. You need a periodic breather, even if you arrived late because of that transmitter site visit at 3:00 a.m.

Some managers have even been known to buy the occasional pizza and beer for the engineer – even bringing it to the work site personally. That kind of mutual respect cures a multitude of ills. Small and medium market engineers deserve no less. The financial stakes may be lower, but are no less critical to a station's success.

Another necessary break is for education. A heavy workload limits the ability of an engineer to keep up with the latest developments in technology – instead spending excessive time keeping old gear going at a far higher cost than something new. Getting to demonstrations, seminars, and other educational opportunities is important. Management should make it easy for this to happen.

And do not forget regular refresher courses in safety. You need time for that. Bred by familiarity, veterans often overlook safety; younger engineers have yet to learn what an RF burn feels like. Again, management's understanding of what you do – enlightened self-interest – will result in fewer insurance claims and fewer hospital visits.

Management That Understands

Of course, none of this will happen without the engineer making it clear when his workload has reached "enough."

My most recent station experience was ideal. The owner had a personal interest in engineering and a very close relationship with the Director of Engineering. There was never even the suggestion of dereliction of duty.

Engineers are not slaves. But they should not make themselves slaves either. Set up a reasonable work schedule, take proper breaks, and help management see your value. Your job satisfaction and survival will be greatly enhanced. *– Radio Guide*

Service Guide

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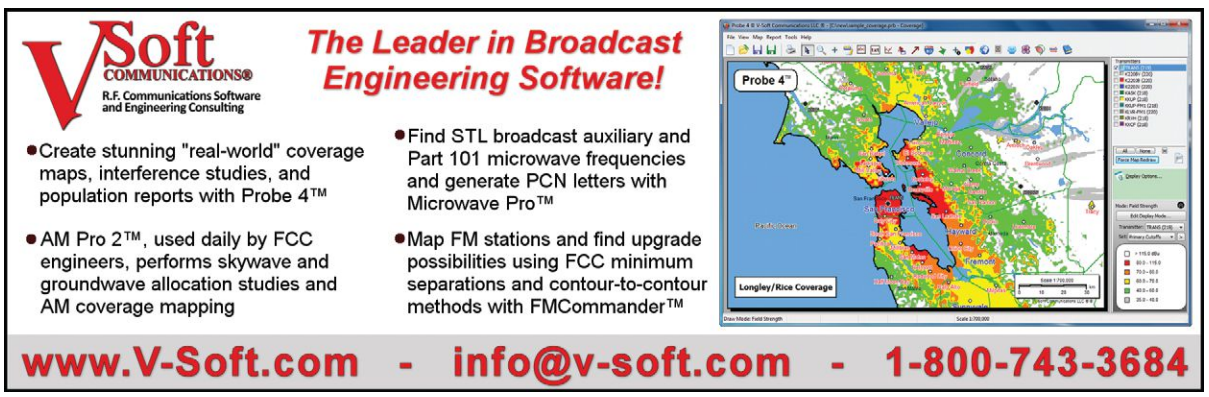

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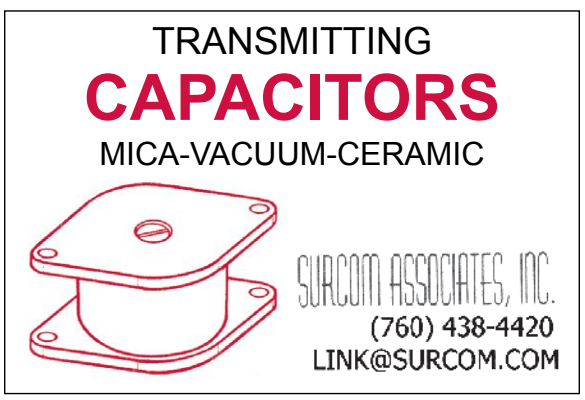

Service Guide

Radio Equipment Products and Services

Final Stage

RADIO ROUNDUP

The Radio Guide Event Register

Email your dates and info to: ***radio@rconnect.com***

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October 13-15, 2015
Madison, Wisconsin
www.wi-broadcasters.org

2015 IEEE Broadcast Symposium
October 13-16, 2015
Orlando, Florida
http://bts.ieee.org/conferences-and-events.html

2016 CES Conference
January 6-9, 2016
Convention Center – Las Vegas, Nevada
www.cesweb.org

2016 NRB Convention
February 23-26, 2016
Nashville, Tennessee
www.nrbconvention.org

NAB 2016 Spring Convention
Convention Center – Las Vegas, Nevada
April 16-21, 2016
www.nabshow.com

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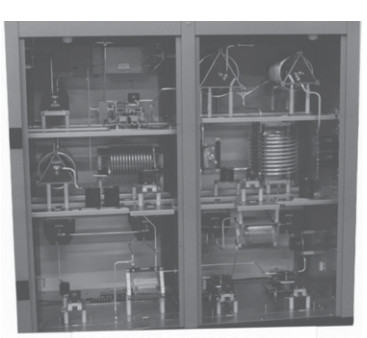

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THE AUDIOARTS D-76 DIGITAL CONSOLE

The Audioarts D-76 console has all the practical style and rugged functionality of the beloved D-75 standalone console, a staple in radio studios for the past 15 years, but with modern necessities such as an RJ connector system for all your I/O.

The D-76 is a tabletop, modular console available in a 12-channel or 20-channel frame, and includes StudioHub+ RJ45 connectivity.

Sporting a sleek new profile, the D-76 comes standard with ample mic preamps, plenty of stereo busses, and a comprehensive monitor section that provides separate feeds to control room/headphone and studio monitor outputs — plus headphone jack and built-in cue speaker.

It has four stereo busses, dual-domain outputs, sample rate conversion on all digital inputs, and interchangeable input module daughter cards for easy analog-to-digital conversion in the field. Its modern design features backlit controls and meter bridge with full-scale, bargraph digital peak plus VU metering and automatic timer and clock.

Individual plug-in modules make installation and service a breeze. The D-76 can be ordered with an optional SUPERPHONE module, which supports two callers. It can also be ordered with the optional IP-76 plug-in module for interfacing to the WheatNet-IP Intelligent Network.

This new console has everything you have come to expect of an Audioarts console — like ease of use and rock solid reliability (including a KILLER power supply, built by Audioarts).

It is laid out in a sleek new design that is both affordable and practical for modern radio stations of all sizes.

Contact Audioarts Engineering for more info on the D-76 Digital Audio Console.

- Modular hot-swap plug-in design
- Optional IP-76 module provides connectivity and additional I/O through WheatNet-IP network
- Optional SUPERPHONE module with dual caller support
- StudioHub+ RJ45 connectivity
- Inputs can be analog or digital, depending on daughter card installed
- Any combination of analog and digital line inputs
- Input channel A/B source select
- External rackmount power supply
- Universal opto-isolated mic and line control ports on all input modules
- Sample rate conversion on all digital inputs
- Optional dual failsafe power supply
- Digital clock (can be slaved to ESE time code)
- Cue function and auto-dropout
- Connectorized faders and monitor pots
- Connectorized channel ON/OFF switches
- CR and Studio Monitor outputs with separate four-buss source selection plus independent external 1 & 2
- Both Program and Switched VU meter pairs
- Four microphone preamps standard, with option for four additional
- Digital timer with autostart and manual control
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