The Local Oscillator

The Newsletter of Crawford Broadcasting Company Corporate Engineering

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Generators

Love them or hate them, generators are a part of many/most of our broadcast facilities these days. Ideally, when the utility power goes down for some reason, the generator should automatically start and then come on line once the voltage and frequency are what they should be. I say "ideally" because it doesn't always happen that way.

We generally view generators as backup equipment, much like we view an auxiliary transmitter, and that has not historically been an unreasonable viewpoint. But as Bob Dylan sang in his 1964 classic, "The Times They Are A-Changin'." Aging power grids and ever-increasing demand coupled with environmental controls, not to mention frequent "public safety" shutdowns all are conspiring to make utility power less rather than more reliable as time goes on. In some locations – KBRT's Oak Flat transmitter site is a prime example – we view generators as primary, not secondary equipment. The reality there is that were it not for a pair of really good generators, KBRT would be off the air a good bit of the time.

The 1946-vintage Caterpillar generator at the KLZ transmitter site.

We're finding that the trend is in that same direction in other locations, although for different reasons. KBRT's problem is wildfire weather and the aforementioned public safety shutdowns, which began in the wake of the deadly Camp Fire that occurred in PG&E territory in northern California and eventually bankrupted that huge utility. In other locations, the outages tend to be more because of grid aging. So much of the grid is supported on wooden structures – wood poles with wood crossarms, all held together with galvanized hardware. Those don't last forever. They are subject to frequent damage from storms, high winds, falling trees or tree limbs and traffic accidents.

Another reason for more frequent utility outages is overload. Demand on the power grid outpaces generation capacity, especially during cold or hot spells, and utilities spread the pain around using "rolling blackouts." Whatever you think of this, it's really not a bad way to go. Better to have smaller areas without power for a few hours here and there rather than complete, long-term regional outages.

And while on the subject of generation capacity, I can't help but comment that if the demand is close to and occasionally beyond utility generation capacity, where do those politicians and bureaucrats that are trying to force "zero emission" electric vehicles on us think the power to charge their batteries will come from? What do they think will happen when millions of households plug in their EVs? But I digress.

The thing is, just like an auxiliary transmitter, a generator has got to run when you need it or it's worthless, just a big paperweight. We regularly exercise our generators to make sure they will start and run when we need them to, and that's a good practice. However, regular exercise in no way guarantees on-demand performance.

It's happened to all of us at some point. We get in the car, turn the key and… nada. It started and ran just fine on the prior trip. Why won't it turn over now? Lead-acid batteries work great until they don't, and that's got to be the #1 issue with generators – battery failure. We keep our batteries topped off with a float charger, but at some point, one of the cell grids will fail and the internal resistance will go high – or open altogether. The best defense against this is to regularly replace batteries. If yours is a 36-month battery, replace it after 36 months, even if it cranks the generator just fine. It could be just one crank away from outright failure.

Exercising can actually be harmful in some cases if it is done without a load. A phenomenon known as "wet stacking" occurs when a diesel engine is run at high RPM without a load. Unburned fuel is passed through the engine to the turbocharger and exhaust system, where it builds up. It can cause the engine to run poorly when first started with a load, and sometimes this will (rightly) keep the automatic transfer switch from connecting the generator to the load. The accumulated fuel can also combust in the exhaust system, which can be spectacular (something about orange flames coming out of an exhaust pipe!).

The way to prevent wet stacking is to always run the engine with a load, ensuring that the engine reaches a temperature where all the fuel is burned and none is passed unburned through to the exhaust system. Some generators, particularly ours in California where public safety shutdowns and rolling blackouts make them primary rather than backup, run with full load often enough that wet stacking is not an issue. But elsewhere, particularly in colder climates, it can be. So always exercise your generator into a load, right? Maybe not.

Transferring back and forth from utility power to generator power causes an interruption in the AC power and often produces significant spikes on the AC line. Modern switching power supplies and delicate computer equipment doesn't care much for this kind of thing, and you can cause damage. At the very least, some of your critical infrastructure may reboot in the process, taking your radio station(s) down for several minutes.

Properly sized UPS units powering critical equipment can and should alleviate this, but not always. UPSes are themselves a source of problems, and just like generators, they work great until they don't. The most likely time to find out that they don't is when they take a load, such as when switching to or from generator/utility power. That's a whole other topic that I won't jump into here. Suffice it to say that I classify UPSes in the "necessary evil" category.

One other thing I'll say about generators. Very few of them are meant to be run for an extended length of time. They are intended for occasional standby use, not for hundreds of hours on end. And yet there are times when we require this of them.

After the Catalina fire back in 2007, the Edison grid was down – literally – from May to late August. We ran our Multiquip 70 kW diesel generator all day every day throughout that period. Bill Agresta was continually driving back and forth to the fuel depot down the hill in Avalon, filling up an array of 5-gallon yellow cans and keeping the gen fueled. Every evening after sign-off, Bill would check and top off the oil as necessary and keep an eye on the coolant and everything else. That generator never let us down and kept KBRT operating all that time. We still have (and use) that generator, although it has a later model partner now at the new mainland site.

The point is, if a generator is used for an extended period of time, you've got to pay attention to the oil and coolant level and condition. A shut down and oil/filter change may be indicated. Ditto for the fuel filter(s) and water separator. And if your gen is used for a really long run, like a week or more, it is wise to get a full service done on it as soon as possible. This will (hopefully) reveal and correct any issues such as developing leaks or worn belts.

One final note… we have one generator in this company that has a manufacture date of 1946. It is a Caterpillar, and it came with the KLZ transmitter site when we bought the station in 1992. The station was a CONELRAD station back in the day and it had some aviation navigation application as well. That ancient generator was a key part of the station's operation and it was likely used frequently in the 1960s and 1970s.

It had a 32-volt DC system that we converted to 36 volts when batteries became impossible to get. We have had to fix a few things here and there over the years, but we keep it maintained and it still starts and runs like a top – okay, more like a locomotive, but you get the point.

Take good care of your generators and they will take good care of you.

The New York Minutes
By
Brian Cunningham, CBRE
Chief Engineer, CBC – Western New York

Brian is on vaction this month. His column will return next month.

The Motown Update
by
Mike Kernen, CSRE
Chief Engineer, CBC–Detroit

Best Assets

A business is made up of its assets, whether they are human, financial, or physical. Assets are resources that allow a company to continue to produce products and profits.

Most companies are pretty good at keeping track of the first two, but miserably bad at the last one. I've been where a company's physical assets were not recorded, and I have worked where only large and expensive assets were recorded – those generally just for tax purposes. This is of course their choice, but it begs the question, what do you show your insurance company should a disaster strike? How do you rebuild? It also leaves you without any accounting of what you have; what it is, what is it doing, where is it, its age, and its specific make, model, and serial number.

Kubota tractor on its trailer and secured with the Erickson wheel chock tie-downs.

Now is not exactly inventory time at Crawford Broadcasting Company, so it's easily forgotten. But, as we move through the year, I try to stay on top of the inventory. Purchases displace other assets and items move from place to place to best meet changing needs. Every time something arrives, moves or leaves, I think, "Does this need to be recorded in inventory?" Our master asset list is maintained elsewhere, but I keep a copy that I reference often and refresh annually.

As broadcast engineers, we routinely deal with physical assets. Being able to recall meaningful information about the company's property is valuable, especially when attempting to keep up with device lifecycles. It could be critical too should the claims adjuster need to pay for its recovery someday.

Pin it Down

The new Kubota tractor is fantastic. I think. After it took so long to get it to a point where I could actually use it, I towed it to the WRDT 560AM transmitter site to finally get some work done, but after only about 30 minutes of use, a draw pin fell out of the three-point hitch, bringing everything to a stop. I had to rig up a temporary way to raise the brush hog up enough to even get it on the trailer. Yes, I've now bought some spares!

Also new for the Kubota is a wheel tiedown system made by Erickson that combines a wheel chock with a short length of "E Track." The chocks are positioned to the front and rear of each wheel and an E Track compatible ratchet strap runs over the top of each wheel. It greatly simplifies loading and unloading the tractor from the trailer.

Air Supply!

While the rest of the country is nice and cool and the weather is about perfect for y'all (or maybe not), we here in SE Michigan have been either soaking wet or hotter than a two-dollar pistol! Of course, that means we need our ever-so-reliable air conditioning systems more than ever.

Frozen air handler at the WCHB site.

On our studio building we have ten (you read correctly) rooftop HVAC units, none of which ever have problems – in my dreams! A short rundown of issues we have found this spring: A dual stage unit with a single stage thermostat, a transmitter room rooftop with a seized economizer drive so it was dragging in mostly hot outside air, A transmitter building HVAC that has a shorted compressor (fix is 60% cost of new), a continually icing evaporator at another transmitter building (found that the evaporators are both sized incorrectly to the outdoor unit they are paired with).

Other Supplies!

Everyone knows that supply chain issues are widespread and of course inconvenient and impactful. Here are few notables where I've experienced considerable delays: Nautel transmitter power supplies (2+ mos.), Dell 1RU computers (2-6 mos.), Ubiquiti switches (4 mos.), desktop UPSs, Kubota tractor (7 mos.), any brush hog, Carrier RTU HVAC unit (quoting "sometime in 2023" for orders), Bard HVAC unit (6 mos. and counting).

Stay cool my friends.

News from the South
by
Todd Dixon, CBRE
Chief Engineer, CBC–Alabama

Well, its official. Elvis has left the building. Fortunately for Jack and me, he'll still be available for photo shoots and autographs out in the parking lot, as Stephen is transitioning to an advisory/special IT projects role within the company and will still call the Birmingham area his home.

One of the things that I can say for certain is that I have been blessed to have been under Stephen Poole's tutelage and a part of Crawford Broadcasting Company for over 20 years now. He has allowed me to grow organically into this position. He has taught, scolded, encouraged, protected and appreciated me over these years, and I can assure you, it has been as unique of an experience as his very writing that all of you have been reading on these pages since he first came to work at the company.

I hope to continue to serve the company well as the chief engineer in Birmingham and keep using what has been poured into me as I grow into the position.

I'm sure that everyone who read my introductory column last month about the WDJC-FM Nexgen database separation woes have been waiting with bated breath to know how that drama turned out. As of this writing, it has only happened one other time since last month. At the risk of what we call in the south, "Putting the mouth on it," I won't say too much more about it other than to say that if you don't hear any more about it from me, I consider the current time span to be at least manageable versus once every three to four days, which was causing me to contemplate how valuable being chief engineer really was to me.

One thing I have come to realize is that there is a lot of information to process, learn and synthesize when you are a broadcast engineer, especially when computers are involved. I know I won't be the only one that has said to himself, "That is something I never thought I would have needed to know."

Being able to pull in as much data as you

can in order to make the best decisions regarding what is happening in your facility is key and that is why I have come to rely on Simple Network Management Protocol (SNMP for short). I used a free one called PRTG for a while here, and I'm planning on investing more time setting up a dashboard that will give Jack and me a substantial look at our resources as a whole and in their parts.

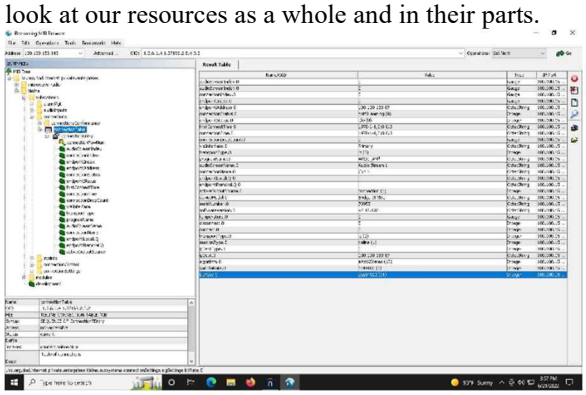

Figure 1 - MIB browser showing the Tieline codec and its OIDs.

One of the limiting factors about PRTG is that the free version limits you to 100 sensors. To be honest, it is why I hadn't pushed the boundaries of SNMP very much, because I didn't feel like I had the sensor space to play around with – until this month!

We get a program from Detroit overnight via Tieline called *Nightvisions*. The program has been a mainstay in Detroit for nearly 50 years and was expanded to include Birmingham's WXJC and California's KCBC last September. Needless to say, it's been important to make sure that this is done right.

For the better part of eight months, we had an issue or two that we could chalk up to personnel, but no more than you might expect from a public-internet delivered remote broadcast.

Lately, we've been experiencing more frequent issues regarding the broadcast. We were already recording the broadcast post-delay to verify it. We had included a Wheatnet silence sense closure to switch to the previous night's DRR recording in the event we missed audio from the Tieline for any reason. Finally, we even set up a second DRR recording to simply record the Tieline audio so that we could compare recordings! We investigated the logs in the Tieline only to see no drops occurring. I went into our ClearOS firewall and gave the connection from the static IP in Detroit QoS priority (even though the broadcast can't be fighting much for bandwidth—it occurs in the middle of the night!).

What were we to do? I wondered about extending the use of SNMP to the nightly connection we get from Detroit. See Figure 1.

SNMP MIB (Management Information Base) files have a number of individual (OID, Object Identifier) pieces of information you can pull using their unique numeric identifiers. If you pull that information into PRTG, it considers that a "sensor." I stumbled onto this as I was perusing the Tieline MIB files. Those files also have OID's associated with what are called "tables." Which, as you can see from Figure 1, are an entire group of OID's and PRTG treats a table as a single sensor!!

Getting the information into PRTG was as simple as inputting the OID into the sensor they call SNMPCustomTable (instead of the normal SNMPCustom). From there, I could have added up to 10 of those pieces of information into a single, solitary sensor. You can see from Figure 2 (from the PRTG app on my phone) that I was monitoring the Local Link Quality, the Remote Link Quality and Connection Drop count, but I could have added any of the others as well.

Mike Kernen in Detroit has scheduled the nightly connection to last for 3.5 hours, and I get a PRTG notification saying the connection is active at 10:45 p.m. each night of the broadcast and one at 2:15 a.m. telling me the disconnection occurred. By the way, seeing all of this information has encouraged us to try a different Tieline codec on our end than the one we were using.

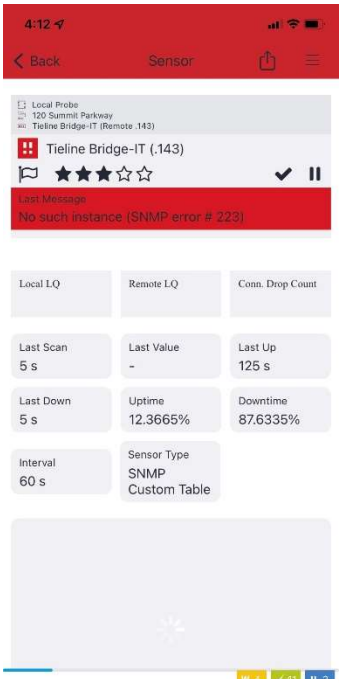

Figure 2 - The PRTG app display on my phone.

I plan on implementing these tables as sensors in our STL links as well with both our Worldcast and Tieline codecs.

Before I close out for the month, I wanted to tell each of you how much I have appreciated the help and encouragement that I have received from you along the way in this job. It really is a privilege to work here, even with the challenges that we have

had to meet and overcome in the past few years.

For now, I'll be trying out a few southern expressions until I find one that I'll end these columns with, this month's is *Bless Your Heart!*

Tales From Cousin IT
Stephen Poole, CBRE, AMD
CBC Corporate IT Specialist

By the time you read this, I will officially be semi-partially-retired, primarily working on IT stuff for the company. I'll still pitch in and help Todd here at our Alabama stations, especially if there's an emergency, but I'm going to trim back a bit.

I once told Mr. Crawford that he would only get me out of this company by dragging me through the door. I still feel that way. I'm very grateful that I can continue to do so, even if it's for fewer hours. This is the best company I've ever had the privilege to work for, and it has been a blessing.

So: What's An "IT", Anyway?

Technically, "IT" stands for Information Technology. That's probably not the precise term for what I'll be doing, but I also probably won't get too worked up about it. Information Services, System Management -- the Geeks(tm) have many different handles (and acronyms) for each specific little specialty. What I'll be doing, in addition to helping Todd during the transition, is continuing to do some programming for the company.

We've already got the Purchase Order Request (POR) system online; I've been chatting with Cris about improvements and add features for that, as well as some other projects that we probably ought to move to paperless in the future, such as vacation forms and employee mileage reimbursement.

Lord willing, I'm also going to set up a shop here at the house. Todd is already ahead of me in the 3D printing department, but I want to concentrate on making my own PC boards for some projects that I've been pondering. The future is wide open, I'm still with the best company in broadcasting, and God Is Good.

Not a whole lot to say this time; I'll doubtless be rambling at length more in the future. (I may even mention the weather, believe it or not.) Until next time, keep praying for this nation!

The Chicago Chronicles
by
Rick Sewell, CSRE, CBNT, AMD
Engineering Manager, CBC–Chicago

In last month's article I discussed my continuing efforts to get the most out of our full Wheatnet infrastructure and the installation of the LXE control surfaces from two years ago. This past month I have been looking at a better method for the board operators to resolve issues that come up from time to time.

We have macros in Nexgen that control the audio server (ASERV) blade's utility mixer (UMX) for each station. This is used to direct audio sources onto the STL bus and subsequently on the air.

The mode we use most for the stations is to have the LXE control surface on the air. Sometimes we are in satellite mode, and at other times we do put the Nexgen audio server directly on air.

We also find that occasionally, while we are in the LXE mode, an audio server stream can get turned on mysteriously on the mixer, and due to the timing of the audio being slightly off, this can cause a "flanging" sound until we get an engineer to fix it. We usually do this by remotely logging into a Nexgen computer and running a macro to correct the problem.

Since we had a lot of issues with allowing the board operators having access to macros in Nexgen, we took that capability away from most of them. But this put the burden back on engineering to fix the issues and the operators had to call an engineer for the fix.

I thought if I gave the board operators buttons on the LXE surface to actually launch the only macros they really needed, that would solve a lot of problems and it would give them some flexibility. Plus, I would like to give them an indicator of the mode the station was in so they could see if everything was correct.

So, I programmed two buttons on the LXE surface, one to put the LXE on the air and the other to put the Nexgen audio server directly on the air.

The LXE button would probably be used most to correct any issues, but I have worked at other facilities where well trained staff would use the ASERV Direct button to essentially turn the control room into a production room, and they would never have to worry about putting something on the air unintended. Right now we don't have anyone that would probably use this feature, but it will be available to those who might.

The buttons are tied into soft LIOs in the ASERV blade that are subsequently in sync with Nexgen inputs. The Nexgen inputs are used to run the Nexgen macros that put the station into the various modes by turning the sources on and off in the ASERV blade UMX. There are other functions in NexGen that macros may change as well.

I then programmed two other buttons on the LXE to light up and give indication as to what mode the station is in so the operator can instantly know what the situation is. These two buttons are just below the other two buttons that I programmed.

One other function that I decided to put into the equation was to create salvos in the Wheatnet software that would reconnect the "normal" or typical sources that each of the faders used on the LXE control surface. As part of the SLIO that causes the LXE macro to run, the salvo that resets all the channels to the default sources also launches at the same time. So, the LXE button becomes an almost total reset button, fixing a multitude of problems that might come up.

Rocky Mountain Ramblings
The Denver Report
by
Amanda Hopp, CBRE
Chief Engineer, CBC - Denver

Will The Busyness Ever End?

Summer is finally here. Before we know it, it'll be crunch time for getting KLDC moved to its new location. We have the rack at the new site, along with the UPS. We've already wired up the rack for power and have pulled the other cable we will need. Parts are piling up at the KLZ site where we will disassemble, clean and then rebuild the various ATU cabinets for the new site.

Omnia.9 Issues

We have made more trips to the old KLDC transmitter site in the last couple months than we have in probably the last five years combined. It's just not a site we need to go to often.

Around the middle of June, I began getting silent alarms from the AM modulation monitor. I would check and there would be levels, but they would be low. One show with low audio – not unheard of, right? But the alarm would never clear.

I went to the Omnia.9 via the NfRemote app so I could see what the levels looked like there and found I couldn't even get access to the KLDC Omnia.

Once on site, I saw the unit was unresponsive. A power cycle corrected the issue, and everything came back with levels normal. We've had this happen before and it's just not a big deal. Something happened at the site to make the Omnia unhappy and in the past, once fixed it it's really fixed. This time, however, proved to be different.

On the 19th, I received a phone call from a board operator letting me know that the audio for the station was coming and going. It would go silent for a second or two and when it would come back, it almost sounded like the audio was skipping a bit. It was very sporadic, sometimes going for hours with no issues.

I looked into it and listened for a good 15 minutes without hearing anything. I switched the audio input sources to the backup Barix. That seemed to fix the issue. I listened for over a half hour with no problems. Later on, I received another text that the issue returned and was worse.

One thing I noticed through all my troubleshooting was that I could not gain stable access to the Omnia.9 with NfRemote. My goal was to switch audio sources thinking there was an issue with the main link we just weren't seeing. No matter what I did, when I was able to get on the Omnia remotely, it didn't respond. This pretty much pointed to the Omnia as being the culprit. I called my dad and let him know.

My husband was leaving soon to go to his parents' house for a family Father's Day celebration. I ended up not going and instead dragged my dad with me to the site. Keep in mind, this site is not in a good area, and I am not allowed to go by myself, so I needed him there, plus those Omnias are big and heavy, and trying to get it in or out of the rack is tough with just one person.

We did a power cycle of the unit with no change. We quickly made the decision to put the Omnia.5EX in. It came up and is working great for us.

We benched the Omnia.9 at the studios, ran audio to it and could not get the problem to return. The only thing we found, besides it being a bit dusty was a stick of RAM was not inserted properly. After cleaning it up and reseating all the connectors and RAM, we ran it for a couple days on the bench and took it back to the site. While working to adjust the modulation, I began hearing it drop out. The unit is currently back on our workbench.

While we still don't know the exact issue, it dawned on us that the site was mowed very recently. We were last out there on the 13th and the growth was awful. When we arrived on that Sunday it was all mowed down. We are wondering if maybe the mowers didn't damage a piece of strap or something, creating RF interference inside the building.

Another symptom that we thought might be related was that Autopilot kept momentarily losing connection to the ARCPlus remote control at the site.

A thorough inspection of the site and strap showed no issues, so we turned our investigation to the indoors, connecting the Omnia.9 to AC power and the AES output of the Bridge-IT XTRA codec. The Omnia showed good audio… for a couple of minutes, then it went silent. And then it came back for a couple of minutes… and then went silent. A look at the codec showed connect… disconnect… connect… disconnect. Hmmm…

The new water heater at the KLZ transmitter site.

So to eliminate the ethernet switch, we plugged the Motorola Canopy link directly into the codec and found that the codec connection and STL audio remained solid. A clue!

With that information, we picked up a new gigabit switch and installed it. Problem solved. Clearly there was something wrong with the old switch, which was who knows how old. They don't last forever I guess.

So the Omnia.9 is fine and always was. What we observed was the codec disconnecting and the Omnia.9 waiting the prescribed amount of time before switching over to the backup analog feed from the Barix codec. When the main codec would reconnect and the AES signal would return, the Omnia would switch back… until the main codec would again lose its connection. That was happening on about a one minute cycle.

We'll let the support folks at Telos know what we found. That was a strange one!

Hot Water

One big thing we have needed to do for years is replace the water heater at the KLZ transmitter site. You may be asking why we need hot water at a transmitter site. The answer is because I want it. Okay, not really. KLZ is where we store a lot of things. Our truck, tractor, mower, weed eater, and there is a big generator out there as well. We need the hot water for cleaning, both power washing the equipment and washing our greasy hands after working on it. We run a hose to our power washer and the hot water cuts through the grime far better than cold water.

The water heater would leak any time the hot water was used. It was weird… it was not leaking from the plumbing but from inside the jacket around the tank. It finally got to the point where it was leaking all the time.

My dad and I planned a work day and spent the day at KLZ. I had placed an online pickup order with Home Depot for a water heater that would work. We went to the site, figured out some other items that we would need and picked up the order along with those parts.

It was a day of frustration. We made the dumb assumption that it would be easy to replace this old, probably 20+ year old, water heater. Boy, were we wrong! Keep in mind, I didn't do a whole lot but stand around and offer help when needed, but for the most part I just stood to the side.

The area to work in was small, and let's face it, I know nothing about plumbing. My dad would finish, we would turn the water on and immediately have a leak. It was in the existing threaded connections, not the new soldered joints.

After hours of working, soldering and just trying to get it to work, we found the last leak was because of an old pressure regulator on the system. We aren't entirely sure why the regulator was there, but after striking out, driving all over the area trying to find connections that would fit it, we took it off, my dad soldered the line on, and voila! It's working great.

No leaks, no apparent issues with water pressure, and plenty of good, hot water. It is truly a thing of beauty. As someone who hates washing my hands with cold water, I am especially happy to have a place where I can have some nice hot water.

Outside Work

I know I need to make trips to the sites and spend at least a day at each one just to clean. There is extensive work at the tower bases that needs to be done. General cleanup and organizing in the transmitter buildings needs to happen. It's a lot of work and trying to find time to get it done has proven difficult.

Thankfully the growth at the sites isn't horrible. Tower bases could use a good mowing and some outside field areas could use some too, but for the most part, it's not bad at all. We are expected to begin getting the monsoonal flow here very soon and that may cause things to grow up quickly.I hope to be able to plan a day or two each week in July to spend at the sites and get things cleaned up. Only time will tell though.

That about covers it for this edition. I pray you all stay safe and well, and enjoy your Independence Day!

KBRT • Costa Mesa - Los Angeles, CA
740 kHz/100.7 MHz, 50 kW-D/0.2 kW-N, DA-1
KNSN • San Diego, CA
1240 kHz/103.3 MHz, 550W-U
KCBC • Manteca - San Francisco, CA
770 kHz/94.7 MHz, 50 kW-D/4.3 kW-N, DA-2
KLZ • Denver, CO
560 kHz/100.3 MHz, 5 kW-U, DA-1
KLDC • Brighton - Denver, CO
1220 kHz, 660 W-D/11 W-N, ND
KLTT • Commerce City - Denver, CO
670 kHz/95.1 MHz, 50 kW-D/1.4 kW-N, DA-2
KLVZ • Denver, CO
810 kHz/94.3 MHz/95.3 MHz, 2.2 kW-D/430 W-N, DA-2
WDCX • Rochester, NY
990 kHz/107.1 MHz, 5 kW-D/2.5 kW-N, DA-2
WDCX-FM • Buffalo, NY
99.5 MHz, 110 kW/195m AAT
WDCZ • Buffalo, NY
950 kHz/94.1 MHz, 5 kW-U, DA-1
WDJC-FM • Birmingham, AL
93.7 MHz, 100 kW/307m AAT
WCHB • Royal Oak - Detroit, MI
1340 kHz/96.7 MHz, 1 kW-U, DA-D
WRDT • Monroe - Detroit, MI
560 kHz/107.1 MHz, 500 W-D/14 W-N, DA-D
WMUZ-FM • Detroit, MI
103.5 MHz, 50 kW/150m AAT
WMUZ • Taylor - Detroit, MI
1200 kHz, 50 kW-D/15 kW-N, DA-2
WPWX • Hammond - Chicago, IL
92.3 MHz, 50 kW/150m AAT
WSRB • Lansing - Chicago, IL
106.3 MHz, 4.1 kW/120m AAT
WYRB • Genoa - Rockford, IL
106.3 MHz, 3.8 kW/126m AAT
WYCA • Crete - Chicago, IL
102.3 MHz, 1.05 kW/150m AAT
WYDE • Birmingham, AL
1260 kHz/95.3 MHz, 5 kW-D/41W-N, ND
WYDE-FM • Cordova-Birmingham, AL
92.5 MHz, 2.2 kW/167m AAT
WXJC • Birmingham, AL
850 kHz/96.9 MHz, 50 kW-D/1 kW-N, DA-2
WXJC-FM • Cullman - Birmingham, AL
101.1 MHz, 100 kW/410m AAT

Crawford

Corporate Engineering

2821 S. Parker Road • Suite 1205

Aurora, CO 80014