# The Local E Oscillator

The Newsletter of Crawford Broadcasting Company Corporate Engineering

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#### Summer!

It seemed like it would never get here, and then suddenly and with little warning, summer is upon us! I, for one, am very happy for the warmer weather and to look out my window and see green instead of white.

Now we look to begin all those outdoor and warm-weather projects that we couldn't do previously. Most of what we have on the slate are maintenance items, making things ready for yet another winter, which will be here before we know it.

In Denver, I have a tower to build. Not a big tower, just 200 feet, but a tower nonetheless. Last month we got the green light from the county on the modification of our use permit to add a seventh tower at the KLZ site for KLDC, and now I am working on preparation of the building permit application.

Step one is a geotechnical investigation. We did a geotechnical back in 2004, but the latest revision of the TIA standard (TIA-222-H) includes a laundry list of items that we didn't even look at previously. These include:

- Soil density for each soil layer.
- Internal angle of friction for each soil layer.
- Cohesion for each soil layer.
- For expansive soil conditions, the active zone of influence and recommendations for design.
- Elevation of free water encountered and the ground water depth below grade to be considered for design.
- Frost depth to be considered for design.
- Soil electric resistivity, pH values and corrosive nature of the soil.

TIA-222-H has a whole section, Annex G, that deals with geotechnical investigations for tower structures, and we are obligated to use it. In fact, our structural engineers insist on it, as they should.

So... we should very shortly have a truck out at the site making borings and taking samples for this soil study, and when the report is complete, we'll get it off to the structural engineers to use in the foundation and anchor design.

The tower design is already done, so we should have complete engineering in hand shortly after and then we can get the building permit application filed. There's not much to it, so hopefully we will get a quick approval, but you never know. The last time I did this, which was nine years ago, that county building department made me purchase a copy of the standard (then TIA-222-G) and provide it to them so their plan checker could make sure we played by the rules. I doubt he even looked at it.

#### NX50 Issue

We had an interesting issue with the KBRT main 50 kW transmitter, a 2012-model Nautel NX50. That transmitter has been a solid performer, with just occasional module (usually modulator) failures, probably lightning caused, in its just over eight years of full-time operation.

The transmitter had a module failure back in April, and our transmitter engineer Mike Duffy put the spare module in. Unfortunately (really unfortunately), the B+ fuse on the backplane was blown and also had to be replaced, and that particular fuse is located in a difficult to access place where it's very easy to drop the fuse into the works of the power supply – a location from which it is very difficult to find and retrieve dropped items. Mike got the old fuse out but did not get the new fuse in. He experienced firsthand dropping, searching for and retrieving the old fuse and opted to return later with a means of preventing a repeat with the new fuse.

It was during that period between removal of the blown fuse and installation of the new one that something very strange happened. The transmitter

died. And I mean died. No lights, no fans, no AUI screen... nothing. Dead as a doornail. Todd Stickler put the aux transmitter on and called Mike, who made an emergency trip to the site to see what was what.



#### KBRT's new generator.

He found two fuses that go from the secondary of the power transformer to the line and neutral buses feeding both 15-volt switching supplies, both 48-volt switching supplies and the single 12-volt power supply. Before replacing those fuses, he conducted a thorough investigation and found that indeed there was a dead short from line to neutral on those buses. We initially thought we had a bad supply, but it was easy to confirm that wasn't the case.

That left just one item to look at, a relay (a solenoid-operated contactor, really) on which the coil is fed directly from that AC bus. Mike manually actuated the contactor a few times and the short immediately cleared. He found two small screws on the transmitter floor right next to the contractor, screws that had evidently fallen from somewhere above, likely the result of vibration or seismic activity. Could one of those have been lodged across the solenoid coil terminals? Mike doesn't think so, but clearly something was causing the short, and the construction of the coil (wound on a plastic form) is not such that it could be easily shorted by anything in the mechanism.

Mike replaced the fuses, and the transmitter came back on just fine, and we've had no further issues. He did get the new B+ fuse installed, and all modules are back on line as well.

Incidentally, that contactor switches in a large bleeder resistor across the B+ bus when AC power is removed from the transmitter, and that's all it does. When AC power is applied, the contactor opens, and the resistor is out of the circuit.

So... it's a mystery. What produced that short? We may never know. But that little episode was a good reminder that out there in earthquake country, we need to pay attention to anything that could fall into a transmitter or any piece of equipment. It wouldn't take much of a shake to dislodge a loose screw, wire or piece of hardware and send it into the works where really ugly things can happen.

#### **New Generator**

Also at the KBRT transmitter site, we got a new generator last month, a Diesel 70 kW Multiquip DCA-70. This is a portable, trailer-mounted generator with integral fuel tank, identical except for its age and a few updates to the DCA-70 we brought over with us from the island when we moved to the mainland Oak Flat site in 2013.



The older generator has been absolutely

### A new fence enclosure was built for the old generator.

solid and has never let us down. It ran continuously from May through August 2007 on the island, keeping KBRT on the air after the fire while the Edison grid was in ashes. We have used it frequently at the Oak Flat site, once for an extended period while Edison dealt with an underground splice failure and burnout.

Of late, the last couple of years, it has been used a lot, as since the 2018 Camp Fire in northern California, Edison has been quick to shut down the power grid during fire weather. It was determined that deadly fire (85 dead) was caused by a power line, and the damages put PG&E into bankruptcy. Who can blame Edison for being over-cautious? But that makes our generator a primary source of power at times, and considering all its hard use, we felt it would be wise to replace it.

The old unit has been very well maintained, and we are keeping it at the site inside a new fence enclosure, ready to plug in and fire up in the event that the new generator ever has a problem. It will also let us do oil changes and other maintenance on the new unit in the midst of a long run if necessary.

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

Hello to all from Western New York! This time of year in the Northeast, weather conditions are usually pretty pleasant with loads of sunshine and

temperatures in the mid- to upper-60s. Just days into the month of May, we broke several records, the first was snowfall amounts, and a week later, we broke an alltime record temperature of 91 degrees! I am hoping that this is not an indication that we are in for a hot, dry summer. Cool I can take, but extreme heat tends to wear me out quickly!

Back in February, I had a tree cutting company

come out to the WDCX-FM transmitter site to give us an estimate on cutting down several trees that have grown into the commercial power lines feeding our transmitter buildings. With the amount of windstorms we have experienced in past years, it only made good sense to be proactive and have these trees cut down before we experienced a power outage due to downed lines because of these trees. The estimate was nearly \$16.000, way too much to justify the expense.

Thinking outside the box, I phoned our utility company and spoke with their facilities manager about them cutting the trees down, or at least topping them below the power lines. We met at the transmitter site in April, and he agreed that it would be a good idea to have the work done, and they would cover the cost!

The first week of May, a crew from Asplundh showed up and began topping the trees. I asked if they would be able to cut the trees down to ground level instead of just topping them, citing the reasoning that they will just grow back up in a few years, so we would have to do this all over again. They agreed, so they began clearing out all of the trees approximately 30 feet into the woods, and beginning at street level, they cut nearly 90 feet back towards our building, saving us thousands of dollars! I gladly gave each worker a WDCX coffee mug and



T-shirt for their efforts and bought them lunch for doing such a good job!

Back some time ago, we were experiencing

a strange anomaly with the audio on WDCX(AM) in Rochester. It began as light white noise way down below normal audio level but got increasing louder as time went on.

I checked both the analog and digital outputs of the Omnia processor, and both sounded fine, so the issue had to have been generated in either the Nautel AM-IBOC exciter or the Exporter Plus. I boxed

both up and shipped them off to Nautel for repair.

After not hearing from them for many weeks, I phoned to check on the repair status, and found that they had not even looked at the units yet! They somehow got overlooked, and they agreed to get on the repair right away.

Several days later, the Nautel service Department called to report that they could not find any issues with either unit. I asked that they keep both units in testing, with hopes that the issue would resurface. They did eventually find an issue, made the repairs and sent the units back.

On Tuesday the 24<sup>th</sup> of May, I reinstalled the Exporter Plus and AM-IBOC exciter only to find that the white noise is still there! We performed numerous tests and discovered that something in the analog audio section is generating the noise. On air, the digital signal is clean & clear, and I also checked the mask with our spectrum analyzer and found no issues with the sidebands and no spectral regrowth.

I will be interested in what the Nautel service department finds as the cause of this. It certainly has been one of those "head scratching" events!

That about wraps up another month here in the great northeast, and until we meet again here in the pages of *The Local Oscillator*, stay safe, social distance, and happy engineering!

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

#### Changes at 560

Unfortunately, winter holds up everything

that needs done outside, saving it for spring which makes it seem like a gigantic pile of to-do's to just stare down until the weather breaks. My list had such things as getting a transmitter building painted and fixing the rotted siding on another.

As winter passed, that list grew to include some failed security cameras, tower light monitor repairs, and removal of the generator at our 560 kHz site in Monroe, Michigan. The tower light monitors

deliver their status via a simple non-

conductive system using a light beam from the "hot" AM towers using a plastic fiber optic cable running over to the tuning houses. The difficulty was that the LED emitter had dimmed just to the point of the receiver's detection threshold, making it very intermittent. Swapping the emitter diode fixed the problem, but it was less than obvious at first since the human eye knows no such threshold – I could see the light and it appeared to be working as it should.

Fixing the generator was not so simple. While its four-cylinder Ford diesel hadn't run in over two decades, it did start and ran well after I installed a battery. What it didn't do was generate ANY electricity. Since its fuel tank was leaking, there were signs of furry little trespassers, and because it was quite old with any number of other problems lying in wait, we decided it wasn't worth digging into. I was able to find a happy new owner for the old Onan and have its rodent gnawed shed demolished, undoubtedly displacing some warmblooded squatters in the process.

The transmitter building has wood lap sided gables, which were badly rotted, leaving the attic an inviting space for birds and field mice. It's now resided with a fiber cement product that will outlast the building. Paint and caulk will complete this improvement within the next couple of weeks.

#### **Remote VT Personnel**

Recently, remote voice tracking technology has allowed adding a great new talent to two Crawford radio stations – one in Detroit and one in Birmingham. Doing this has afforded an amazing



Detroit-based talent to be heard in a far-away market, filling otherwise open evening airtime with very compelling content.

> The talent works from her home, so we configured a computer with NexGen, a USB mic, a SoundBlaster, and a pair of powered speakers for her home studio. Adding to that, we have voicemail boxes in both markets automatically emailing WAV files of listener messages, allowing her to respond to them in both markets, engaging and interacting with her listeners. She has already attracted an exclusive sponsor

#### **Security On**

Security is a continuous thing. I make it a point to always be on the lookout for any weaknesses that need addressed. Locks, cameras, NVRs, antivirus, fencing, signage, backups, alarms, etc. You can never tell if you have everything covered, but basic common sense can tell you when you don't.

for her Detroit show.

Recently, Amanda Hopp was helping me get some more computers set up with TeamViewer (which is awesome) and let me know that she'd spotted a machine running an improper version of ESET. I set about auditing every computer we have, which showed me that we needed and were licensed for a version different than what we were running – a better version that has protections against ransomware. Amanda's common sense security mindset noticed something I couldn't have. She told me, and I responded. Thanks Amanda!

One of our transmitter sites lacks fencing at the perimeter. Our towers and tuning houses are enclosed with appropriate signage, but the remainder of the land is open; anyone can walk onto it or drive a vehicle nearly anywhere on the land, including right up to the transmitter building.

Recently, I've installed signs proclaiming the property as "Private" and saying "No Trespassing" at obvious points of entry. We are also increasing our NVR and camera presence there to help in deter entry and provide evidence should it be needed. Properly marked, the land becomes obviously off limits and protects the company should any harm come to our property or to an uninvited person.



I've noted by way of the Burk event log many attempts to access our ARC Plus systems. The system logs the IP address of the remote system (likely a bot) while it declines their access. One can easily trace back these addresses to a locality. I've seen break in attempts from Russia, Turkey, North Carolina, and The Netherlands, to name just a few. It's a chilling sight, because these nefarious doers have already made it past the firewall and are being kept at bay by only the unit's password. I'm at the beginning stages of evaluating every access hole we have and determining the best ways to close as many as possible without hamstringing our users and our support capabilities. TeamViewer, access control lists, and strong passwords are going to have to become the norm, like them or not.

#### **Phony Baloney**

As I reported last month, our 50 kW 10tower array for 1200AM has a super reliable carriergrade Trango Networks point-to-point microwave system giving us more network STL connectivity than we could wish for. AT&T has informed us that they are sunsetting their last-mile copper services in the area without offering any alternative. In our search for a reliable and tenable replacement, we've spitballed every conceivable alternate up to and including providing our own underground and demarc at the roadside, complete with its own solar array and 5.8GHz point-to-point microwave. Unfortunately, the PTP system made it over the meadow but not through the woods. The trees, shrubs, and grasses proved too much for the radio's weak spread-spectrum signal by about a third of a mile. Even as I inched my truck down the path toward the road, I could see the dish's signal level drop off sharply. Once it was lost, I had to back up about half the way to the transmitter building to reacquire.

Connection to an ISP is the challenge. The transmitter building sits nearly a half mile back from the main road, at the end of a wooded two-track. Any cable provider faces a significant buildout with at least 2,200 feet of trenching, directional boring, or pole setting. Charter has done a survey and Comcast is expected to do theirs very soon, but ironically the most likely candidate for this may just be the one with by far the lengthiest connection – ViaSat. At this point, setting up a dish and pointing it toward space seems almost infinitely simpler, and with next to zero up-front costs, is about one third of what we're paying per month now.

#### News from the South by Stephen Poole, CBRE, AMD Chief Engineer, CBC–Alabama

In the "Before I Forget" department: you may already know this, but inflation has also caused copper and aluminum prices to rise dramatically. Ergo, we all need to check our cameras and other security, because I suspect the thieves will be making

a reappearance shortly. Yay. Ah, Alabama. The first

couple of weeks of May, we had flooding rains, storms, high winds – you know, the usual. As I write this, we're looking at a couple of weeks of hot, dry weather. It's a beautiful thing.

Each time we have a storm, of course, we have to check all of the transmitter sites to ensure that we're not missing a roof, or a generator is running and the remote notification failed, anything like that. Now that it's dry and hot, we try to get

caught up on everything – and the AC in my truck is working fabulously, thank the Lord.

#### 101.1 Spectrum

As mentioned last time, we're installing Spectrum high speed internet at all of our sites except for 92.5, WYDE-FM, which is in the middle of nowhere. WDJC-FM is still being arranged, and we're building a demarc and trenching power for the access at 850 WXJC. 1260 WYDE and 101.1 WXJC-FM both have good, high speed access.

The latter didn't start out that way. Todd, Jack and I made several trips to Cullman to meet the Spectrum technicians before we finally had a reliable link. One of the techs was a certified curmudgeon who complained the entire time about how Spectrum was asking them to work overtime in that area. They also jumped on him about each call-back, if the service didn't work. When you add in the non-stop storms that we had in early May, well, this poor guy stayed busy.

The access was installed and seemed to work, but we couldn't access via our assigned static IP. In fact, the access shortly stopped working. A tech was dispatched; he checked the signal level and said that we were getting way too much, so he installed an attenuator. Then, the router died. A tech



came out and swapped the router. This lasted for a day or two; then the new router died. A tech brought another router, and discovered that our modem had died as well. (Around here, Spectrum puts in two devices, a separate modem and a separate router.) He had one in the truck, so he put them both in place and

all was well.

At this point, we seemed to have (semi-)reliable access, so Todd dispatched himself up there to try to get some port forwarding done. The microwave link has been repaired from the relay point near Warrior, AL to 101.1 in Cullman, but the first hop, from WDJC-FM on Red Mountain to Warrior, is still down. (We're expecting a tower crew to address that very shortly.) After arguing with things for quite a while, he got

some ports forwarded to one of my old laptops. It's not ideal, but at least I can go in via SSH and, with port tunneling, I can check the transmitter and other equipment.

Cullman EMC has replaced the rotten pole at the site. This was the one near the building; it had rotted underground, so it was only a matter of time before a strong wind would knock it over. There are no high-tension wires on that pole – the transformers are mounted on a separate pole at the top of the hill – but we still didn't want it to fall down and go boom. Thank you, Cullman EMC.

#### Spectrum at 850 AM

This is a big one, because 101.1 and 850 simulcast most of the time. Our Dragonwave link has been pretty reliable, but with revenue on the line, we figured that this site could use a backup as well. While we had some trouble with Spectrum at 101, as just noted, I have to say that the contractors who work for them in the Birmingham metro seem to be top-notch. They had 1260 done in no time flat (a few hours at most), and the access has been solid and stable.

At 850, they're not going to run the access all the way to our building, over 700 feet from the road. We are going to mount a pole in the concrete pad that served as the floor of the old building, now demolished and removed. On that pole, I have a nice weatherproof NEMA box in which we can install the Spectrum equipment. We will then use a wireless link (uBiquity or the equivalent) to get the signal from that demarc box into the building. Lord willing, I'll have some pictures of this project in the next issue.

We plan to pull power from tower #5, which is only about 220 feet from the NEMA box. To make it neat, safe and legal, the wire needs to be buried. Cris suggested that we rent a trencher for a shallow cut from the old building pad to the tower; I was all for it. Unfortunately, in the Birmingham area, these things have to be rented well in advance, and after a lot of research, I decided it would just take too long. For about the same money, we're going to hire the fellow who does our mowing nowadays. He's going to use a single box blade to (carefully!!) make a shallow cut for the wire.

#### Security

As always, we have to think about this. I've already mentioned the physical aspect – namely, copper thieves possibly (almost certainly) making a return appearance. But the cyber aspects are important as well. You have no doubt heard about the Colonial Pipeline hack; ransomware managed to get into their systems, shutting down the pipeline. We're told that Colonial finally just decided to pay the ransom. Gas prices are still rising here, but at least they've stabilized. The pipeline should be back at full capacity in another week or two.

Other stories have appeared, and more seem to pop up all the time. I read just the other day about one business (a bank?... can't remember) that had to pay many millions of dollars to get their systems back. Unless you've been living under a rock with no Internet access, you already know how this works: the ransomware insinuates itself into your system(s), then encrypts everything on the hard drive. Finally, a screen will pop up demanding the payment of a ransom, at which point the criminals will send you a key code that will allow the drive to be unencrypted.

Some people have been surprised at how many of these larger business apparently don't (or didn't) have recent backups. But it's not that simple: we're by no means as large as some who've been hit, but even for our company, backing up many gigabytes of data isn't a trivial exercise. It requires quite a bit of thought and planning, and the actual transfers can take many hours. Remember, to get a good backup, you'll have to take the computer off line for at least the final transfer. Also, you have to hope that your backup was done before the ransomware burrowed into your computer. Otherwise, you'll just install a corrupted backup that will shortly make the same ransom demand.

How does this ransomware get into your computer? By far at this writing, the most common way is someone downloading an attachment that seems to have come from a trusted source. The thieves have become very clever about this, too. They can send you an email that looks just like it came from your bank or favorite retailer, complete with logos and all the other stuff you'd expect to see. They may even have legitimate link to the company's Website; all they care about is whether you download and execute the attachment. It's a big problem, and given that many (most) of the people who are using computers aren't terribly sophisticated, it's easy to see how a large company could be hit. Think about it: all it takes is one employee, inside that giant network, to compromise and ruin everything.

I've been giving a lot of thought (in my copious spare time) to the future. One way I've tried to limit malware in our mail system is by blocking huge numbers of foreign IP addresses. That's not foolproof (IP addresses can be spoofed), but it just makes sense. Why should we be receiving email from North Korea or Bulgaria? Blocked.

Years ago, a partner and I wrote an extremely effective anti-virus system for MS-DOS. The way we did it, we hummed to ourselves and tried to think like Bad Guys. For my part, I also spent (way too much!) time actually disassembling the DOS kernel, looking for vulnerabilities, then patching them. We never found a virus that was able to get around our package. I can't say that such a virus didn't exist, but the ones I tested (including some of the top and most infamous names at the time) were stopped cold.

Can it be done for Windows? Not unless they change their kernel architecture, which is probably the source of the rumors that Microsoft is seriously thinking about using Linux or BSD under the hood. Look, I'm not bashing Microsoft: to give them credit, they've come a long way from the early days. But there are some things inherent to the way that they do things that cause security vulnerabilities. Especially in the past, with older versions of Windows running on less-capable hardware, they used all sorts of (frankly, unsafe) tricks to speed things up – for example, basically opening all of memory to every program so that copy and paste would be nice and quick(!!). They finally addressed that, but it took many years.

Again, to give them credit, they knew that the average user would be terrified by a warning



Figure 1 - So THAT's where they went!

screen that says, "this program is trying to overwrite the MBR with an encrypted boot loader!" Can you

imagine Aunt Maude's or Uncle Leroy's reaction to something like that? They'd take a hammer to the thing! Back in the Days of DOS, Microsoft had a simple system that would indeed detect and display a warning if someone tried to tamper with system files. But programs that must do that – from FORMAT to FDISK to you name it - needed a way around that big, nasty, scary warning. So ... Microsoft added a simple system call that would disable the protection while their utilities were running. As soon as they finished, they'd turn the protection back on. Naturally, the hackers quickly discovered that system call. Their viruses would turn off Microsoft's protection first thing as the first step in attacking a machine.

#### Finally ...

That's about it for this time. Only one picture, too (Figure 1): proof that I need to look toward the ceiling more often. These pliers have been up at 101.1 in Cullman for quite some time. I've long since bought another pair to replace them.

Until next time, keep praying for this nation!

#### The Chicago Chronicles by Rick Sewell, CSRE, CBNT, AMD **Engineering Manager, CBC-Chicago**

#### Wheatnet Blade Utility Mixers

I have been working in the Wheatnet environment for six years now. One of my favorite

features of the system is the Utility Mixers available in most of the blades. There are two of these handy devices in each blade. They feature eight channels that mix to one or two separate outputs.

For a long time, we have used them to feed the input of our Vox Pro computers so that our on-air talent can record themselves in one channel and phone callers in the other channel. This is one of the most common uses for the Utility Mixers in the blades.

I have started putting these to even further use recently. Last year when we took our entire suite to the

Wheatnet system, we had one station that uses a talk studio for a lot of its programming. Instead of using an analog outboard mixer for the six microphones in the talk studio, we purchased the eight-channel Sideboard from Wheatstone.



The Sideboard is basically a turret with eight faders that marry up with one of the Utility Mixers in a blade. The physical faders actually control the

> virtual faders of the Utility Mixer. In this instance, we use two of the M4 microphone processors to process each of the six mics and then run them through the Utility Mixer of the M4 blades to send an output to just one fader on the LXE control surface. It allows the board operators to have control over each individual mic, plus overall control at the control surface stage with the fader there.

> Another aspect we use with the sideboard is the last fader, number 8, to control the headphone feed to the talk studio. This is due to the fact that we send two feeds to the talk studio.

one a speaker and the other for headphones. We use the studio module on the LXE to send a mix-minus to the speaker. It has a built-in volume control in the module. The headphones did not need a mix minus feed so that the hosts and guests in the room using

headphones can hear themselves.

To give the board operators the ability to adjust overall headphone volume, we run the feed through the "B" side of the Utility Mixer that is controlled by the sideboard. It gives them overall control and each host/guest also has their own pot at the mic station in front of them.

I know that astute engineers will immediately bring up the issue that if the headphone feed actually ends up in the mix on the "A" side of the Utility Mixer, you could have some serious feedback on the air. Not to worry, I programmed the "A" and "B" buttons on the sideboard so this should never happen.



## This utility mixer is controlled by the Sideboard and controls talk studio mic levels.

One of the other aspects of the talk studio experience that we have to consider is that the board operator needs to talk back to the hosts in the talk studio. This is easy for the talk studio speaker since we are using the LXE studio module to feed the speaker. The studio module has a built-in talkback button. However, we have the separate feed for the talk studio headphones to consider. The headphones need a full mix of audio, not the mix-minus we are using with speaker.

First, I programmed a separate button on the LXE control surface to send a momentary interruption to the headphone feed with the operator's mic audio. This is very similar to how most of us are performing EAS interruption with the Wheatnet system.

This was adequate. Still, it meant the operators had two separate buttons for talkback. They had to remember to use a different button depending on whether the current host was using headphones or just relying on the talk studio speaker. I figured there had to be a way to use just one button. I once again came back to my old friend, the Wheatnet blade Utility Mixer. I set up another Utility Mixer. On one channel I set up the audio coming from the LXE studio module. This has all the mix minus audio, but doesn't include the talk studio mics, so that the speaker it feeds doesn't go into feedback or cause the mic audio to sound hollow. This channel will also include the board operator's talk back audio.



#### This utility mixer is used for talk studio talkback.

To give the headphones the talk studio mic audio, I use the second channel and assign it the mix coming from the first Utility Mixer that has all six mics and is controlled by the Sideboard. So now the operator can use the one main talkback button and talk to the hosts whether they're using headphones or the speaker.

This means the headphone feed is a little complicated in the fact that this actually involves three different Utility Mixers! Good documentation is a must for not only my fellow engineers, but for myself, so I remember how this all works during a troubleshooting session.

Another good use for the Wheatnet Utility Mixer is to combine two separate signals into one digital stereo feed. This is similar to feeding the Vox Pro recorders with two discreet channels. In that instance the host mic is on one channel and panned hard to the left and the caller audio is on the second channel which is panned hard to the right.

We have a studio in Rockford that we need to have connected to our Hammond studio. We have a stereo Internet codec. I want to send normal station audio and a feed of the telephone callers as well. Once again, the Utility Mixer comes in handy.

In this instance, we send the LXE Studio module feed panned hard on the left, and the phone feed panned hard on the right. With this method we can feed normal station audio, plus phone callers. Using the Studio Module feed allows the Hammond board operator to Talk Back to the host in Rockford.

The Rockford studio is also an all Wheatnet setup. We use Utility Mixers there to separate the stereo signal that has two separate feeds into mono channels. This way the host can listen to the station audio or interact with callers in Hammond.

We also use the "B" feed of the Utility Mixer to feed the Vox Pro so that the Rockford feed is on the left and caller in Hammond is on the right.

While there are some really great features in the Wheatnet blade system, to me the Utility Mixers are among my favorites. If you have blades and aren't using them yet, open up the page and let your imagination loose.

#### Valley News By Steve Minshall Chief Engineer, KCBC -- Modesto

This month's contribution to *The Local Oscillator* is a bit of a stretch to correlate with broadcast engineering. However, since we all deal

with computers on a daily basis, I think you might find this interesting. Some of my colleagues in the broadcasting and computing

industries have gotten a kick out of what I have done with a computer.

It started several years ago when a radio salesperson told me about his crypto currency mining operation he had going at his house. It seemed intriguing,

but not something I wanted to take on all by myself. After talking it over with my son, who is a very talented amateur IT guy, we decided to give it a try. There are many iterations to the story, but I will present the highlights.

After a bit of study and calculations it looked to us as if crypto currency mining could be a lucrative endeavor. We ordered up all the necessary components including six water cooled 1080 TI graphics cards. It all looked good on paper... our investment would pay for itself in about six months. We had grandiose visions of purchasing more and more computer hardware as we raked in the money. We had visions of racks full of graphics cards and pushing the electrical service of our houses to the limit.

All was going just wonderfully, until about

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the day that we turned it on. Rather suddenly the profitability of crypto mining went to about zero. We were spending as much on electricity as we are making at this point. It was winter and we were dissipating the heat using a truck radiator in my son's house. For the most part he kept his house warm without using his heater. The electricity used was not

completely a waste, but trading natural gas for electrical heat is not a great trade-off. When the weather warmed up, we moved the equipment to his shed so that we could dissipate the heat outdoors. With the profitability near zero, and the hassle of maintaining the system we decided to shut it down.

For a couple of years, we had some expensive computer equipment sitting around doing nothing, but then COVID came along. My son was asked to work from home. He is an electrical draftsman, so he would need to be on the computer at least eight hours each workday. Since he had the crypto currency miner sitting there doing nothing, he decided to rebuild it into a desktop for drafting and installed one of the graphics cards to do some crypto mining in the background.

In the two years that we had the crypto miner shut down, the profitability had come back. His single card was running with the profitability of about two dollars per day, that is two dollars above and beyond the cost of electricity used. This led to a discussion about whether we should rebuild the miner with the six graphics cards. Six cards would give us \$12 per day of profitability, not bad.

We were not sure where to put the miner and where to dissipate the heat. The six cards can dissipate up to about 1,500 watts, and when you consider that it is running 24/7, that is a lot of heat. I told him that we should use the crypto miner to heat my hot tub. I meant it as a joke, but then we started talking seriously about it. The more we discussed it, the more practical it seemed to be.

We came up with a plan. We would put a coil of stainless steel tubing in the hot tub as a heat exchanger. We found a nice coil, 25 feet of 3/8 stainless steel tubing on eBay. It was meant for use as a heat exchanger in some sort of homebrew beer making. I don't drink, and I know nothing about making beer, but this heat exchanger coil looked like it would be a perfect fit for the project.

I bought some nice fittings that worked perfectly for making the penetrations through the side of the hot tub. The heat exchanger coil is run into the house through a block of wood at the bottom of a window via a pair of hoses.

We tried to use all six graphics cards but ran into several problems. First, the miner was drawing about 15 amps on a 15-amp circuit, not so good. Second, it was more heat than we needed, the hot tub temperature got to  $107^{\circ}$  and was still climbing. Third, a problem arose that we had been fighting with previously, the computer was not stable running six cards.

With much experimentation, we found that we could run four cards with perfect stability. Four cards seem to be about the right amount of heat also. Using just the four cards reduces the electrical load to an acceptable level. Four cards seem to be right for this application. Still, what to do with the other two cards?

It became obvious right away that we can't just dump heat into the hot tub without some way to regulate the temperature. The answer was simple enough and easy to implement. Going to eBay for a solution, we found an engine oil cooler with a cooling fan. We bought a nice thermostat that is controllable via Wi-Fi. This thermostat provides AC voltage on one outlet for cooling and on another outlet for heating. The thermostat's outlet for cooling runs to a 12-volt power supply. The 12V power supply is connected to a two-way, three port motor



The miner sits in the corner of the living room and consists of a computer, 4 water cooled graphics cards, power supplies, pump and coolant reservoir.

operated valve. When you apply power to the valve, it moves in one direction. When you remove power from the valve, it discharges a capacitor through the motor and moves the valve back to the original

position. The power supply also connects to a speed controller that drives the fan.



The heat exchanger is a coil of stainless steel tubing submerged in the hot tub.

The thermostat is set for a  $1^{\circ}$  hysteresis. We have the temperature set for  $102^{\circ}$  on the thermostat. When the temperature hits  $103^{\circ}$  it turns on the power supply. The valve then moves to the radiator position, diverting the incoming hot water from the crypto miner through the radiator before going into the hot tub. The radiator cooling fan also comes on at this time. When the temperature goes back to  $102^{\circ}$  the valve goes back to normal and the fan stops running. So far, this system is working absolutely perfectly.

From what I can tell after running the system for a couple of months, for four months of the year it will run at a near equilibrium where the energy put into the hot tub is just slightly above the energy losses, the radiator fan running just a small amount of time during the day. During the four hot months of the year, the radiator and fan will have to dump a considerable amount of heat during the day. During the four cold months the hot tub's internal heater will need to run a little bit to supplement the heat from the crypto miner.

It will be interesting to see what we do when we have 110° temperatures in the summertime. The radiator won't do much good, but I think on those few days we will probably open the hot tub cover and let evaporative cooling do its thing.

Right now, the miner is making \$4 to \$6 per card, per day, in profitability. Since the normally wasted energy of the crypto miner is used to displace energy normally spent on the hot tub heating, the overall profitability is even higher.

That still leaves the two cards that I am not using. My son and his wife started looking through Craigslist and found a free hot tub. My son, his wife, my wife and I went to the house with a bunch of three-foot, half-inch water pipes and four-foot squares of plywood and rolled the hot tub Egyptian style from the backyard to the street where we rolled it onto my tilt-bed dragster trailer, reversing the process at his house. His hot tub is smaller and better insulated than mine, so the two remaining graphics cards should do the trick. His crypto currency miner heated hot tub will be very similar to what I have put together except that he is going to build an external heat exchanger.

My wife and I like to go out to the hot tub in the late evening as a time to relax, look at the sky, and discuss the events of the day. This is something that we've done for years, and it has been great to have some alone time by ourselves on many an evening. It has always been kind of an expensive luxury to keep the thing heated, but now we are actually getting paid to heat the hot tub, and that makes it all the more enjoyable.

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

#### Mowing

What a month May was! To say spring has sprung is an understatement. At my house, we have had close to seven inches of rainfall. While I don't

normally track the totals, we did have at least one day with close to two inches of rain. (This area gets only 14 inches of total precip a year, so that is significant!) It is because of all this rain that the growth at the transmitters has blown up.

As I type this, I am at home, in the evening after a day of attempting to mow at the KLVZ transmitter site. We were

at the site not long ago, a couple weeks at most. There was not much growth there at the time. I wanted to spray since we have Canada thistle, and the county tends to get angry when we don't treat it because the seeds get into the South Platte River and from there into irrigation water which goes to farms... and then farmers have this noxious weed coming up with their crops.

I had Jerry Ford, a good friend who runs horses on the KLTT transmitter site property and who is going to apply the herbicide spray for us, take a look at the growth. He called me telling me we for sure had to mow. Sure enough, many areas are three feet high or more.

My dad and I loaded up and took the tractor out to the site. That evening my husband had the urge to mow. He knew I was a bit stressed because it's a shorter week due to the holiday and me taking time off and Jerry wants to spray over the long weekend. I really have one day to get it done. We went out there that evening and he mowed for a couple hours. And if you are wondering, my husband does have a lot of experience with a Kubota tractor and brush hog due to his previous job.

The plan was for me to show up early the next morning and mow all day so we could take the tractor back to the KLZ site where it will be safe and secure before the holiday weekend. At KLVZ, we have to keep it locked inside a tower base fence, and let's face it, that's not all that secure.

By the end of that evening, Jordon noticed



the back left tire going flat. We figure it was from running over some broken glass since there are bottles and other trash in the area next to the road where he was mowing. The site is among a number

> of gravel quarries along the river and there is constant truck traffic. Those drivers don't hesitate to toss their water and beer bottles and other unspeakable things onto our land as they drive by.

> First thing the following morning, I called a local mobile tire service that specializes in tractor tires and was told they'd be out that morning. It wasn't until early afternoon that they

showed up.

The mechanic got the tire repaired and was going to air it up, but then his compressor would not start. At this site, we have no compressor, so we had to wait for a guy to come out to look at his vehicle in hopes of getting the compressor working. After over an hour wait, the guy showed up and the mechanic was able to use the air compressor on that repair truck to get our tire put back on and aired up. It ended up being a waste of a day, but I was at least able to mow around the guy anchors.

I had plans... plans to show up early the next day and start at daybreak. I did that. Got to the site about 5:30 AM and started the tractor at 5:45 and began mowing. I had a plan and at the rate I was going, I'd get the east half of the 15-acre property done before lunch, and then with Keith's help so that there was no stopping, we'd be able to get the west half done after lunch.

I should have known something else would happen. I had gotten about  $\frac{3}{4}$  of that east side done. I was near tower 2 on fairly flat land with very few prairie dog mounds but some flood debris here and there. I don't know if I hit something – I didn't hear anything – or if the tractor just had cut one too many thistle. An awful noise came out the brush hog, so I turned that off and began inspecting and quickly noticed a ton of fluid coming out of the gear box area. Never a good sign.



## Oil was pouring out of the PTO area of the tractor. Once we pulled the drive shaft off, the extent of the damage was apparent.

My dad came out and on further inspection, found that the brush hog itself looked fine. That's the good news. The bad news is that the oil was coming out around the PTO spline on the back of the tractor. The bearing was gone along with the seal, and the spline was cocked at an angle. Our guess is that the spline shaft broke internally.

After many phone calls, I found a place a few miles north of the KLVZ site that can work on it – the site is in farm country, so thankfully there are tractor shops around. We are praying this repair won't be several thousand dollars, although that's exactly what it looks like.

All our mowing is at a standstill. Sites are growing up fast – the KLZ site has growth that is chest high – and a simple push mower won't cut it. I'm going to have to go to the drawing board and see if I can get a tractor to use. My husband wants to talk to his dad about this as he has a Kubota tractor that he won't be able to use for a while. But I will also be looking into hiring someone possibly to help get things done. I'll be sure to let you know in next month's column.

#### **J1000 Problems**

On Saturday the 15<sup>th</sup> of May, I woke up to KLDC being off air. After looking into it, the J1000 was not responding. I put it on the backup transmitter and headed to the site. I was with my parents because I had just taken my mom to get her second COVID shot. My dad was already pretty sick from his shot the day before, so the trip to KLDC was fairly short. The J1000 would not run at all. We decide to leave it and run on the backup through the rest of the weekend.

On Monday morning, we discussed the issue with Nautel and found that when a power module fails in a certain abnormal mode, it takes the whole transmitter down because of the impedance the failed module presents to the combiner. You have to go through some troubleshooting steps to figure out which module is the failed one. Once you figure that out, you can unplug the bad module and still get 250 watts out of the transmitter, which is better than a sharp stick in the eye.

We isolated and disconnected the bad module, which meant we could use the J1000 in a pinch if the aux should fail.

The transmitter is still under warranty, so Nautel sent us a replacement module, which we put in the transmitter. We are now operating back on the main J1000 transmitter.

#### Upcoming

June will be a month of mowing... I hope! As noted above, the KLZ site is growing up fast and we need to keep the site cut. We have survey stakes all over the property and want to make it easy for anyone who needs access to do work on the KLDC relocation or the road widening project.

I also have some cough buttons to install in three studios, and I'll be reworking the mic wiring in some of those studios.

That about covers it for this edition. I pray you all stay safe and well.

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 KKPZ • Portland, OR 1330 kHz/97.5 MHz, 5 kW-U, DA-1 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 • Cullman - Birmingham, AL 101.1 MHz, 100 kW/410m AAT WXJC • Birmingham, AL 850 kHz/96.9 MHz, 50 kW-D/1 kW-N, DA-2 WXJC-FM • Cordova-Birmingham, AL 92.5 MHz, 2.2 kW/167m AAT



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