

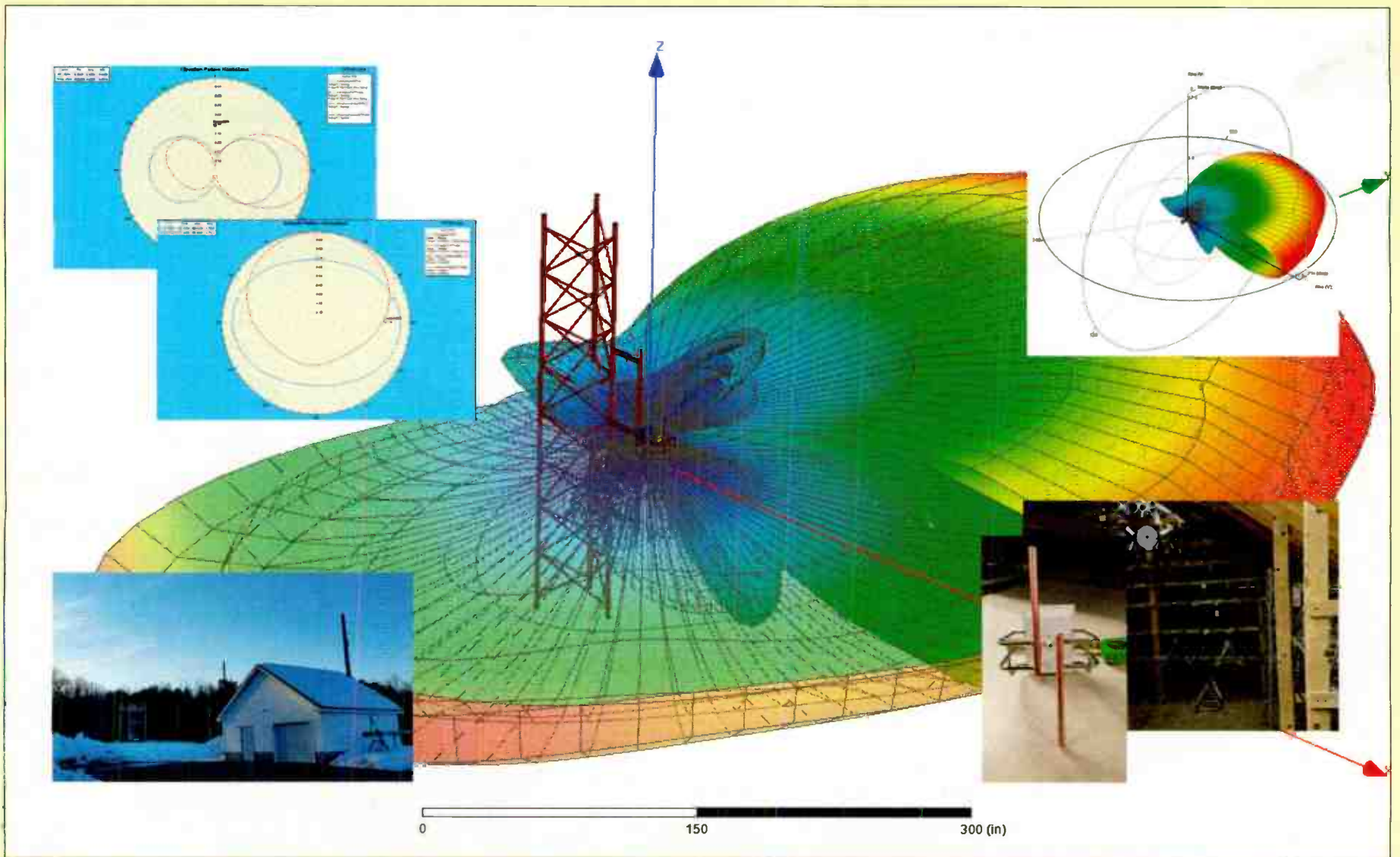
Radio Guide

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July-August 2021 – Vol. 29, No. 4

Shively Pattern Work



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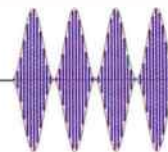
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Critical Content for Radio

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Shively Pattern Work: “The explosion in the number of lower-power “shoehorned-in” stations, with their highly directional pattern requirements, have necessitated the need for more diverse radiator options – ones that can provide more narrow and precise patterns with accuracy and repeatability, while at the same time providing a more affordable solution, overall.”

Chief Engineer – by Scott Schmeling (page 10)

Let's Keep It Clean: “When all of our fuel was pumped into his holding tank, Taylor did an inspection of our empty tank, then reversed the process. The fuel was pumped (and filtered) from the holding tank in his trailer back into our generator's fuel tank.

It is recommended that diesel fuel samples be taken annually if the fuel is stored more than four months. This is a way to monitor the quality of your fuel and to prevent downtime.”

Transmitter Site – by John Marcon (page 40)

Air Cooling Blues – Part 2: “In this second installment, we will look at the effects of inadequate cooling on a solid-state air-cooled transmitter. The tricky part of this story is the fact that the transmitter was OK in the beginning but, as the months went on, some components on the amplifier circuits started failing and no one knew why. There were other problems unrelated to cooling but they were ironed out during the warranty period. The long running issue were the overheating RF transistors and electrolytic capacitors.



The Broadcasters' Desktop Resource

... edited by Barry Mishkind - the Eclectic Engineer

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Cover Story

Shively Pattern Work

Constantly Evolving, Consistently Accurate, Continually Essential

by Jonathan Clark

The old expression, “the only constant is change,” certainly should have been coined for the world of FM pattern work. Whether you’re talking about the available technology, the accepted procedures, or even the most basic reasons for its incredible importance to a station, pattern work constantly evolves. Shively Labs has been at the forefront of this evolution at every iteration, providing creative solutions for current issues, with accuracy second to none.

Regardless of constantly changing parameters, reliably achieving accuracy and predictability has always been Shively’s top priority.

Since FM pattern work first began, the parameters have constantly evolved for everyone involved – the stations, the consultants, the manufacturers, and even the regulatory authorities. The change has been constant, but the need for accuracy has always been paramount. Consultants need to know their designs can be met; stations need accurate indications about where their signal can be received; the authorities need to be assured their rules are being followed; and manufacturer needs to be confident that their products and solutions match all those expectations.



The Pattern Range

Back in the 70’s & 80’s, most stations were facing omnidirectional pattern requirements (while at the same time, dreaming of targeted, optimized signals they felt would serve them better). Nowadays, stations are more often faced with extremely complex patterns, surgically designed by hard-working, creative consultants to fit into a very specific space. But even though the requirements and desires may have rotated 180-degrees over the past fifty years, the need for knowing exactly what the antenna system can deliver is as important as ever.

With each step forward in technology (full-size



Scale Model Towers

testing ... to scale models ... to HFSS computer-modeling) the flexibility, range, and scope of pattern work has increased. The sheer number of iterations that can be tried on any specific project has increased exponentially, while at the same time, “dead-ends” and wasted time during the design phase has been significantly reduced. This benefits

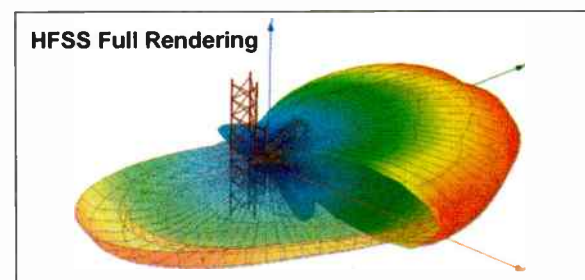
everyone, as more effort can be directed to finding the best solutions, and the evolutionary nature of the changes allow a higher level of verification as well – a solution found in HFSS can be proven on the test range, or vice-versa.

Stations need to be heard, but they also need to be legal – and to be able to afford the solution.

As pattern requirements for licensing have gotten more and more rigorous and precise, the need for tools to examine not only more iterations, but also formerly untried solutions or configurations must be considered. Decades ago, Shively led the efforts to certify super-detailed scale-modeling as an alternative to full-size testing, as that “new” technology allowed a huge increase in the number of potential solutions that could be examined in the same amount of time that a full-sized study would require – as well as being far freer from the interferences that have always plagued full-size test ranges. Fast-forward to today, and HFSS now is having a similar effect on scale-model testing – allowing even more iterations per study, more details about the radiator, parasitic elements, the tower and appurtenances, other coax running through the antenna’s aperture, or anything else that can affect the RF path.

HFSS Computer-Generated Modeling

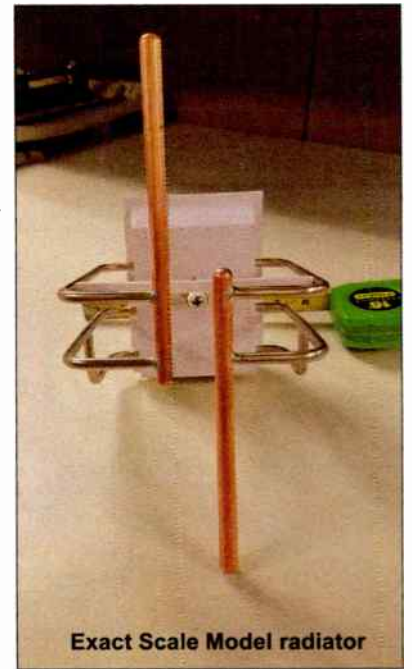
Furthermore, this software-driven aspect allows even more automation of the process – an “Optimetrics” module within HFSS allows Shively technicians to carefully establish constraints and parameters of the antenna mounting, and parasitic element design, then run the iterations overnight or at other times the factory would be shut down, further expanding the amount of analysis that can be completed in the allotted time frame. At the same time, HFSS can also simultaneously provide additional data on other essential radiation characteristics, such as upward and downward radiation components, allowing Shively to present much more comprehensive info in an easy-to-visualize 3D format than was possible even a decade ago.



HFSS Full Rendering

Software isn’t the only change impacting the world of patterns. New requirements to allow the squeezing of stations into crowded markets, or adding a booster, also drive R&D work into new antenna radiator designs and configurations. It wasn’t that long ago that, regardless of power or location, a station’s antenna options for a directional requirement were very limited, and often, very expensive. The explosion in the number of lower-power “shoehorned-in” stations, with their highly directional pattern requirements, have necessitated the need for more diverse radiator options – ones that can provide more narrow and precise patterns with accuracy and repeatability, while at the same time providing a more affordable solution, overall. The number

of Shively radiators that can be utilized for these new requirements has increased significantly over the last several years, alone. Yes, the high power Shively Model 6810 workhorse still carries much of the load, but Shively now has a large variety of models, in different side-mount, panel, and log-periodic styles, including those that can be deployed in cost-effective solutions that can get the station on the air, without emptying the bank account.



Exact Scale Model radiator

This continued emphasis on process refinement, the interweaving of new applications with time-proven techniques, and new product R&D, all combine to provide the tools Shively’s engineering staff need to ensure a station’s signals are getting to the right place.

But, techniques and products are still just the tools; it’s always the craftsmen that wield them that really make the difference.

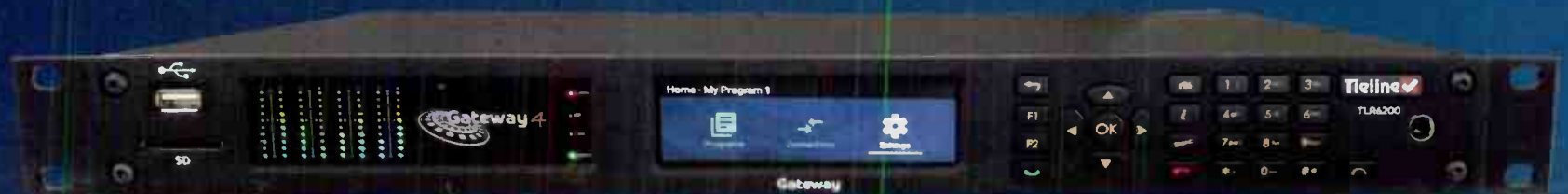
Beyond all the new hardware, testing environments, and procedures, Shively has remained a leading supplier to the world FM industry for nearly 60 years due to the people behind the tech. Over that time, Shively has enjoyed tremendous loyalty from their customers, but also from their own engineering staff. These killed engineers and technicians, many of whom have been focused for decades on understanding the products and the rules, selflessly share their knowledge and experience with new technicians entering the ranks, allowing continuity through any changes, internal, or external. Many who have retired still give huge amounts of their time and knowledge back to the next generation of technicians, to both keep the process consistent, and evolving at the same time. Math, physics, and RF engineering skills are all required, of course, but also a knack for assembly, creativity, and the ability to learn from the history without being confined to it are essential for success, and harder to find. And always at the core, the passion to listen and understand the ever-changing needs and desires of the broadcasters and their consultants is crucial to everyone’s success.

Stations face a similar situation in their own engineering departments, so it is always gratifying to see call letters, or names, or both, return time and time again, confident their unique solutions will be found, accurately, and consistently, regardless of the time that has passed since the last project.

For decades, faced with FM patterns that are omnidirectional, or sometimes seemingly “unachievable” in nature, Shively has pioneered industry-leading techniques and products to solve real-world broadcasting problems. Drawing upon years of experience with full-size, precise-scale, and now three-dimensional HFSS computer-generated modeling, Shively has the techniques, products, and most importantly, the experience and personnel to provide unmatched FM pattern solutions that are accurate, affordable, and trusted by stations, consultants, and regulatory agencies around the world. – Radio Guide

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Studio Site

Good Feedback

Reactions to Radio Gear and Revisiting Connections

by George Zahn

Last issue, I was talking about a few fun gadgets that might help broadcasters improve sound and the ability to navigate as we come out of the pandemic. Later, I'll pass along some feedback I received and experienced with one of the microphones and also another mic that might just be a favorite of a colleague for USB applications.

First, the situation that's been discussed in this column multiple times over the last year. I looked back a year and was asking if the Covid pandemic would create a long-term alteration for radio. Given new spikes and the Delta variant, we may not be out of the Covid conundrum yet, which means stations returning to full status quo from pre-pandemic days may not be here for a while.

I'm involved with recording and producing weekly radio segments with a wide range of business people, and the running consensus is that business, be it working in the office or meetings and business travel, would be altered almost permanently by what we experienced with distance solutions. The impetus for broadcasters to get back to "normal" is the lack of quality audio from many sources such as smart phones, compressed and washed out, inconsistent digital audio from the meeting services such as Zoom and Microsoft Teams, etc. But what if we could minimize the digital "interference" and reduce the lack of fidelity and still allow non-radio guests or external broadcast talent to join us remotely, but still sound as if they're in the studio.

To Spend or Not To Spend?

Is it worth investing in devices that will allow for better fidelity from distant talent – people that might still be limited from coming into our studios? Is it worth linking them in to keep continuity on air short term and at what cost for that equipment?

I might flip the questions above on their heads and ask, if we could use a device that would allow distant broadcasters to get audio to us, might well help even after the pandemic is eventually over. In other words, the equipment we purchase to get through the remaining months of Covid might well have uses beyond the pandemic period. What if we could bring in free-lance colleagues from other stations for recording sessions and create liners, interviews, and spots, in a sort of a swap of talent between stations. My talent will cut some spots for you – your talent will cut some spots for me. This could add more vocal variety to stations and add value to gear originally bought for Covid times.

Extra voices are just one way to maximize a CODEC unit which requires an encoder on the send end and a decoder on the receive end. That doesn't work well for a reporter in the field during an emergency broadcast or a guest who doesn't have a CODEC unit conveniently in their home or office.

Opal-Essence

There's a device that's been around for a few years that might have new uses during the latter pandemic time. The Comrex Opal is an audio "gateway" device that

utilizes their OPUS encoding to create near studio quality audio from a cell phone or a computer with USB microphone.



This takes us beyond the CODEC, or the simple and standard telephone hybrid that most of us have been using. Imagine trying to line up a guest or an announcer or reporter in another location. You, as host or producer, simply send an e-mail invitation to that person with a designated web link that they click to connect.

From their smart phone, tablet, laptop, or desktop, the remote guest connects from their consumer quality device, and the OPUS encoding and decoding create a quality far better than the standard dial up or cell phone connection. The device will handle two discreet "lines" coming in and has analog XLR and AES3 digital input and output.

Comrex touts that the guest receiving the message doesn't have to have any special or compander unit – or even any knowledge of technology. They click a link, enable the microphone on the phone or a USB mic on their computer, and they connect to the studio in far better than dial-up quality. The interface can utilize most standard browsers including Firefox, Chrome, and Opera, and for Apple users, Safari. The Opal receive device is a 1/2 U rack size. The general cost in shopping around is about \$1,700 for a Comrex Opal.

Even if we're not using remote connections such as a CODEC or devices like the Opal, why aren't we, as stations, looking into a voice swap system that might be as simple as dropbox or Hightail.com for sharing? We could take the "thinking out of the box" ideas that many stations may be using and make that part of the "new normal" in radio.

Two "Shure" Things

I wanted to follow up on a microphone I wrote about last issue and also one unsolicited "review" added by a colleague. The first I wanted to mention was a model I had a brief chance to sample. The Shure MV88 lightning connector microphone is a fairly inexpensive way to turn your iPad or iPhone into a recording device with a better microphone input than the standard built in microphone on the device itself. My Operations Manager, Dave Schram, is our resident Apple guru. We had the opportunity to try the simple "plug and play" MV88 microphone on his iPad with decent results.

We did not get the chance to record a broad frequency range with the small microphone, but the fidelity overall was good. I found this particular mic to be just a bit bright

or thin – a problem I've encountered with some of the built-in microphones on early Zoom handheld recorders (I still have two of the H2 models that work well for quick field recording). I wanted just a bit more solid bottom "umph," but for intelligibility. The MV88 is a stereo microphone and comes with a windscreens and nice case for between \$100-\$170 without any extra accessories.

Now, feedback I received from another colleague, Peabody Award-winning producer Mark Magistrelli. I have produced several projects with Mark and I trust his ear. He recently had the opportunity to listen in on

an announce test of another Shure microphone, the MV7 USB. This microphone, while not an exact copy, resembles in shape the long-standing audio staple Shure SM7B.

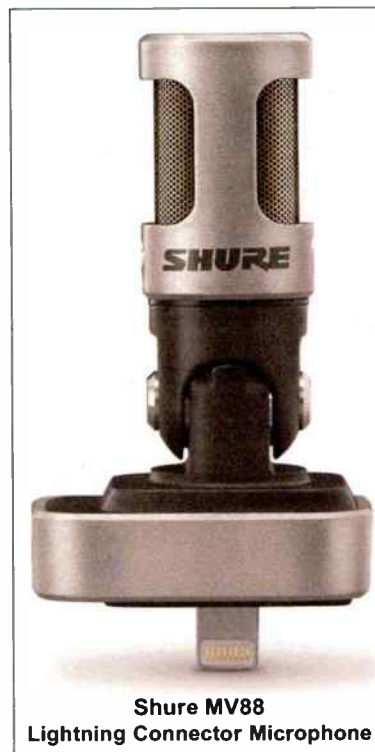
While the SM7B standard microphone will generally cost \$400-\$500, the slightly lesser USB version MV7 runs about \$250-\$300 and, as many newer USB microphones do, is a hybrid featuring both USB and XLR connectors. Mark's reaction to the MV7 USB was that it was near studio quality, high praise from a decent set of ears, and something I don't hear often from someone discussing a USB microphone.

While checking some reviews of the MV7 USB, one of the biggest complaints seemed to be that the USB C jack on the microphone

can loosen if treated roughly. Those who have used both MV7 USB and the SM7B seem to still prefer the more expensive version SM7B for non-USB use. If you're looking for an alternative to the often less than satisfactory built-in laptop microphones, the MV7 USB might be an interesting choice. The MV7 USB also has a headphone jack for monitoring.

Both Shure devices mentioned here are enhanced by Shure's MOTIV app, which is downloaded to the laptop or other device, and allows for a wide range of processing options including EQ, level control, and more. MOTIV can also allow the stereo lightning connector MV88 to switch pickup patterns.

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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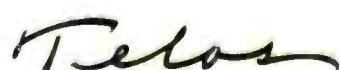


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Chief Engineer

Let's Keep It Clean!

by Scott Schmeling

I'm not talking about on-air program content or office conversation. I'm referring to something much less commonly thought of... even *more* "out of sight – out of mind" than our generators we talked about last time.

Last issue I chronicled various generator issues we'd been having over the years at a particular transmitter site. Toward the end of the article I mentioned that Tim, the Generator Services guy, talked about the "crud" in the diesel fuel plugging filters and that he had suggested I call a fuel and tank cleaning company. Until he mentioned it, I had no idea they existed – but I'm no mechanic!

I spoke with Taylor Hibbing of Midwest Fuel Polishing & Tank Cleaning, not far from us in Sibley, Iowa. He told me about the process and how important it was to have your fuel checked, and we scheduled a time for him to come and "polish my diesel fuel!" In the meantime, Taylor emailed me some information to look over and to share with you. Some of the items in this article will be taken directly from that email.

For us, generators can be considered Mission Critical because when our electric utility experiences a failure in our area, it's the generator that keeps us on the air. This is especially critical in times of emergency such as during or after a devastating storm or other catastrophe. For example, earlier this year when Texas experienced extreme (for them) cold weather causing multiple power outages over several days. In a case such as this, a generator (with clean fuel) will allow a radio station to stay on the air and provide invaluable service to its listeners.

I live and work in Minnesota. Let me digress here for a moment – Minnesota has a reputation with some people as being cold all the time. Yes, we *embrace* our cold winters, as displayed during the 2018 Super Bowl in Minneapolis when we literally *played* in the snow and ice. But right *now* we're in the midst of a hot summer with multiple 90-degree days. I like to say it's the extreme cold and intense heat that give us the beautiful average temperatures we love so much, but I ...

As Taylor's information says, Diesel fuel (and gasoline for that matter) is an excellent product that is highly refined and very efficient. Because of that, and the fact most generators don't run that often, the fuel tends to stay in the tank for a long period of time before it is used. Diesel fuel ages quickly. Within a month it is already losing some of its refinement specifications. And with the temperature swings, especially in this part of the country, condensation occurs, bringing moisture into the tank. That moisture can cause rust to form inside the tank, but can also cause microbial growth (algae) in the fuel. There are additives that can be added to slow this, but the inevitable will still happen – often in six months to a year.

Taylor defines fuel polishing as "dialysis" for your fuel. His service pumps the fuel and its contaminants out of the tank and through a series of filters and water separators. When the process is completed the fuel is refreshed and even better than new. (I *could* refer to this as a spa day for your diesel fuel – but I won't!)

On the agreed-upon day, Taylor arrived (slightly delayed because of a surprise road construction detour) and started setting up while he described what would be done.

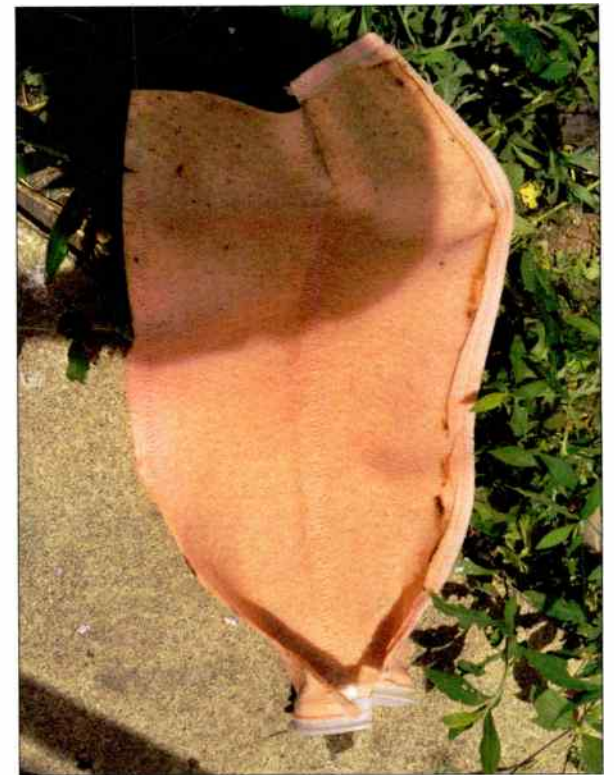
The process involves pumping the entire contents of our diesel tank through filters and into a large holding tank in his trailer. That tank is made of a white translucent material so we can see what is inside.

I mentioned that Taylor's process filters the fuel. Here is an illustration of how fine his filters are. A human hair is 80 micron. A person with 20/20 vision, however, cannot see anything smaller than 40 micron. Taylor's system polishes (or filters) fuel down to *one micron!*

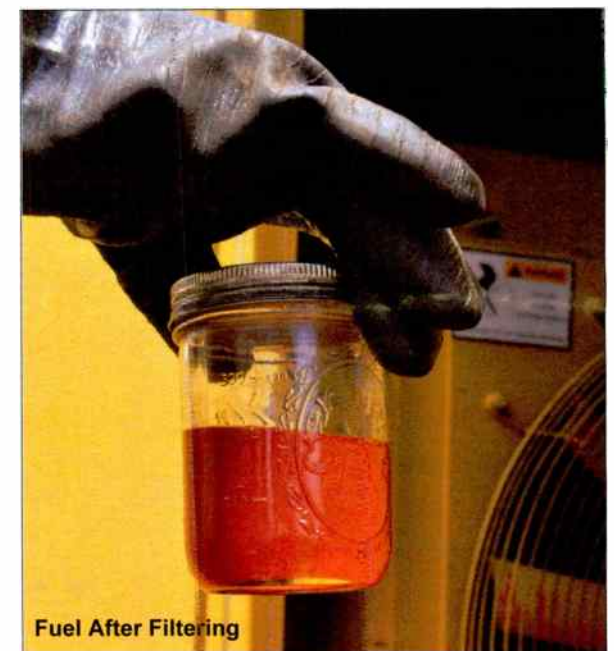
When all of our fuel was pumped into his holding tank, Taylor did an inspection of our empty tank, then reversed the process. The fuel was pumped (and filtered) from the holding tank in his trailer back into our generator's fuel tank.



It is recommended that diesel fuel samples be taken annually if the fuel is stored more than four months. This is a way to monitor the quality of your fuel and to prevent downtime.



As you can see in the above photo of the filter, our fuel wasn't too bad. But if you recall from the last article, when the generator engine was first fired up it only ran for a short period before everything bogged down – most likely because of a clogged fuel filter



Fuel After Filtering

Even though the filter Taylor used only shows a few contaminants, I'm glad we did this. Some of the fuel has been sitting in that tank for several years. Now I can be confident the fuel is good, and clean, and I can rely on it when the generator is needed.

Just like you, I like to learn new things. Now I've learned about diesel fuel and some of what is necessary to keep that fuel in good condition so the generator will be there when you need it.

We're on the down-hill side of summer. I hope it's going well for you – remember to use your vacation days if you can.

And until next time – Keep it between 90 and 105!

Scott Schmeling is the Chief Engineer for Minnesota Valley Broadcasting. He can be reached via email at scottschmeling@radiomankato.com

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Local Public Files: Their Contents and Retention

Refocus and Refresh ... and Clean House!

by Gregg P. Skall, Member – Telecommunications Law Professionals PLLC

We're now deep into the radio and television renewal cycles and learning a few things about the effects of the Covid-19 pandemic on the public inspection file of many broadcasters. Staff shortages brought about by the pandemic have compounded normal staff turnover and retraining problems. For many stations this had consequences for keeping their regular political and scheduled Issues-Programs public file entries up to date. The result has been a record number of consent decrees accompanying license renewals that include new required training and reporting on political and public file requirements. With many stations bringing on new staff as we emerge from Covid, it is time for a refresher.

For those who have been doing this for a while, also identified are which of the items are automatically uploaded to the file by the FCC, but an important note. While the FCC should automatically place a copy of these items in the correct folder of the station's on-line public file for the station, you should always check to make certain it has been done. The Commission has stated that the ultimate responsibility for a current public file remains on the licensee.

For stations that have had their FCC license renewed in the current round, it is time to clean out the files. Note the retention period for each category and clean out the old items no longer required to be retained.

The Materials That Now Are Uploaded by the FCC

FCC Authorizations: issued by the Commission that authorize broadcasting or other use of radio transmissions including licenses and construction permits: 73.3526(e)(1), 73.3527(e)(1) Retention Period: until replaced.

Applications and related materials: Examples include broadcast licenses, construction permits, special operating authority, or consent to the sale of an existing broadcast facility: 73.3526(e)(2), 73.3527(e)(2) Retention Period: Until final action has been taken on the application, except that applications for which waivers have been granted must be retained for as long as the waiver is in effect, and short term renewals must be retained until final action has been taken on the next renewal.

Contour Maps: Graphical representations or "maps" of the station predicted service contours: 73.3526(e)(4), 73.3527(e)(3) Retention Period: for as long as they are current, accurate and reflect current information regarding the stations' operation.

Ownership reports and related materials: Biennial reports are filed every other year and also in connection with the sale of a broadcast station. They reflect what entities and individuals hold "attributable" interests in a broadcast station (i.e., interests the Commission deems convey some influence over the station): 73.3526(e)(5), 73.3527(e)(4) Retention Period: until a new, complete ownership report is filed with the FCC.

The Public and Broadcasting – A Procedure Manual: This pamphlet, written by the Commission, explains the various aspects and purposes of the broadcast service, FCC regulations, broadcast licensee obligations. It also explains how the public can participate in the Commission's licensing and other administrative processes involving their local broadcast stations: 73.3526(e)(8), 73.3527(e)(7) Retention Period: the most recent version indefinitely.

Children's television programming reports: Commercial television stations must prepare and place in their public inspection files a report (Form 2100, Schedule H) each calendar year that identifies the educational and informa-

tional programming for children that they aired: 73.3526(e)(11)(iii) Retention Period: until final action taken on the station's next license renewal application.

Materials That Must be Uploaded by Stations

Citizen agreements: Agreements between commercial stations and citizens' groups into primarily for noncommercial purposes that directly or indirectly deal with the stations' broadcast service to their communities: 73.3526(e)(3) Retention Period: for term of agreement.

Issues/Programs lists: Quarterly lists prepared by stations of programs they aired during the preceding quarter that provided the stations' most significant treatment of community issues. They must include a brief narrative of the issue and the time, date, duration and title of each program. Due January 10, April 10, July 10 and October 10 of each year: 73.3526(e)(11)(i), 73.3526(e)(12), 73.3527(e)(8) Retention Period: until final action taken on the station's next license renewal application.

Political File: All requests for specific schedules of advertising time by candidates and certain issue advertisers, including lists of all sponsored material that mentions Political Matter of National Importance, a National Legislative Issue of Public Importance, any Legally Qualified Candidate or any election to Federal office, All should include the final dispositions or "deals" agreed to by the broadcaster and the advertiser in response to any requests, including the class and schedule of time purchased, the rates charged, when the political time was actually broadcast, and the name of the candidate. Also, if applicable, the candidate's authorized committee and its treasurer. Information must be placed in the on-line public file immediately, absent unusual circumstances. Although it is not necessary to Retention Period: any of the materials relating to the negotiation between the parties to reach the disposition, the file must also include the timing of any make-goods of preempted time, as well as credits or rebates provided the advertiser. The request and disposition must be placed in the file as soon as possible, which the Commission has determined is immediately absent extraordinary circumstances. The reconciliation information does not need to be placed in the file immediately, but the broadcaster must identify a person or persons at the station capable of informing an advertiser of the details of any reconciliation information: 73.3526(e)(6), 73.3527(e)(5) Retention Period: for two years.

Material relating to FCC investigations and complaints: Material that has a substantial bearing on an FCC investigation or complaint to the FCC involving the station and of which the station is aware. Material may be excluded from the public file at the Commission's direction (e.g., Letters of Inquiry from the Enforcement Bureau should be excluded in order to protect the investigation process). 73.3526(e)(10), 73.3527(e)(11) Retention Period: until notified in writing that the material may be discarded.

Equal Employment Opportunity file: All stations in Employment Units with five or more full-time employees, each year on the anniversary date for filing their license renewal application date, a report that includes: (i) a list of all full-time vacancies by job title; (ii) recruitment sources used to fill each vacancy identified by name, address, contact person and telephone number; (iii) the recruitment source that referred the hiree for each full-time vacancy; (iv) the total number of persons interviewed for full-time vacancies and total number of interviewees referred by each recruitment source; and (v) a list and description of EEO supplemental outreach initiatives.

Note: you *must* keep backup documents for each such event in a private file. The current year's report must also be posted on the station's web site, if any. An FCC Form 396 – an EEO Program Report that is filed with the FCC as part of the station's license renewal application: §73.2526(e)(7) or §73.2527(e)(6), §73.2080(c)(6) Retention Period: until final action taken on the station's next license renewal application.

Time brokerage Agreements or Local Marketing Agreements: ("TBAs" or "LMAs") Contracts or agreements that allow one or more parties other than the station licensee to provide programming, sell advertising time in the brokered programming or otherwise operate the station on a day-to-day basis. Confidential or proprietary information may be redacted from these documents: 73.3526(e)(14) Retention Period: for as long as contract or agreement in force.

Joint Sales Agreements: Contracts or agreements that allow one or more parties other than the station licensee to sell advertising time on the station. Confidential or proprietary information may be redacted from these documents: 73.3526(e)(16) Retention Period: for as long as contract or agreement in force.

Shared Service Agreements: Contracts or agreements for one station to provide station-related services to another station or for multiple stations to collaborate to provide such services. Station-related services include, but are not limited to, administrative, technical, sales, and/or programming support. Confidential or proprietary information may be redacted from these documents: 73.3526(e)(18) Retention Period: as long as contract or agreement in force.

Must-Carry or retransmission consent elections: Statements of a station's election to be carried on multichannel video program distributor (MVPD) systems, such as cable systems or direct broadcast satellite services, either by negotiated retransmission consent agreements or by mandatory carriage under the Commission's rules. Applies to commercial television stations or must-carry requests for noncommercial television stations: 73.3526(e)(15), 73.3527(e)(12) Retention Period: for duration of election or request period.

Class A TV continuing eligibility documentation: Documents that substantiate the continuing eligibility of a low-power television station for Class A status, which affords the station the same interference protection as a full power television station. A Class A station must broadcast at least 18 hours per day, and air at least three hours per week of locally produced programming: 73.3526(e)(17) Retention Period: indefinitely.

Local public notice certifications and announcements: Certification that the full-service broadcast station has made the necessary public on-air announcements following the filing of its application for renewal of its broadcast license. 73.3526(e)(13), 73.3527(e)(10) Retention Period: for as long as the application to which it refers remains pending.

Information on 3rd party fundraising by NCE stations: Information regarding the fundraiser, including the date, time and duration of the fundraiser and name of the non-profit organization that benefitted: 73.3527(e)(14) NCE stations that interrupt regular programming to conduct fundraising on behalf of a third-party non-profit organization pursuant to 73.503(e) (FM stations) or 73.621(f) (TV stations).

Website Link and Contact Persons: On the station's website (if any), a home page link to the station's On-line Public Inspection File, and contact information for a station representative that can assist a person with disabilities. In the station's On-line Public File, the station's current address and telephone number, and the email address of the station's designated contact for questions about the public file: §73.3526(b)(2)(ii) No expiration date

This column is provided for general information purposes only and should not be relied upon as legal advice pertaining to any specific factual situation. Legal decisions should be made only after proper consultation with a legal professional of your choosing.

Gregg Skall is a member of the law firm of Telecommunications Law Professionals PLLC. He frequently lectures on FCC rules and regulations, represents several state broadcaster associations and individual broadcasters and other parties before the FCC.

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Transmitter Topics

Installation, Care and Feeding of Liquid Cooled Transmitters

by Paul Thurst, CPBE

Liquid cooled transmitters have been around for a long time. High powered TV transmitters and very high powered AM and FM transmitters have been using liquid cooling or vapor phase cooling since the early 1930's. WLW's 500 kW unit comes to mind. In addition, shortwave and military use high frequency, low frequency and very low frequency transmitters that use various types of liquid cooling.

More recently, GatesAir and Rhode Schwartz have introduced liquid cooled transmitters FM (VHF) in the 10-40 kW range. These units have several advantages over their air cooled brethren. Removing heat from a piece of equipment or

a space without going through a refrigeration cycle saves energy – lots of energy as it turns out. In addition to that, reduced air conditioning loads also saves on maintenance costs associated with HVAC units and extends the life of compressors, condenser fans, air handler fans, filters and so on. Once installed, liquid cooled transmitters require less maintenance because air filters do not need to be changed, blowers

and blower motors do not need to be maintained and so on. Liquid cooling pumps and fans can occasionally need to be serviced, however they can often be maintained without having to turn the transmitter off saving down time. Transmitter RF devices are kept at a constant temperature while in operation, reducing heat cycling and keeping those delicate semiconductor junctions stable. While the initial installation is more complicated, the long haul costs will be lower.

When installing a liquid cooling system, it is important to keep in mind a few things:

1. The working pressures in the cooling loop are in the 20-40 PSI range.
2. There needs to be a system high point, where everything slopes away from, to facilitate removal of air and draining. A slope of 1/2 to 1/4 inch per 10 feet is sufficient.
3. At some point, the system will need to be drained. All drain fittings need to be accessible to connect drain hoses.
4. In most places, some type of antifreeze will need to be used.
5. In most places, an ice bridge will need to be built over the heat exchanger and cooling loop piping.
6. At some point, pump motors or controllers will need to be serviced or changed.
7. At some point, the heat exchanger fan motors will need to be serviced or changed.
8. The heat exchanger will need to be checked periodically to ensure that it is not getting plugged with plant dander or other dirt and debris.



**GatesAir Flexiva™ FLX
Water Cooled Transmitter**

For plumbing, installers have two choices; flexible rubber tubing or copper pipe. For shorter systems with a lot of bends, the flexible tubing is the better answer. That type system can be routed around obstacles and use gentle sweeps that reduce the pump head over the use of many ninety degree elbows.

For longer straighter installations, copper pipe is easier to work with. We purchased a Milwaukee 2773-20 press tool for these installations. The crimp copper fittings are somewhat more expensive than sweat fittings but they are much easier to work with.

The system high point should have an air purge valve, a sight glass and a system drain vent. When filling these systems, some air will be introduced into the cooling loop – this is unavoidable. The air will collect at the high point in the system to be purged out with the air purge valve.



**System high point with
air purge valve and sight glass.**

The heat exchanger needs to be placed in an area with plenty of air circulation. Most often this is outside, however, they can also go in a special room where large amounts of outside air is brought in to remove the heat. The installer also needs to keep in mind that there should be adequate room around the fan motors for service and repairs.

Good grounding is essential, not only for the transmitter cabinet, but also the heat exchanger and pump station. Especially at those rocky mountain top transmitter sites where lightning strikes on the tower are a normal occurrence. An ungrounded heat exchanger and associated copper piping can conduct EMP back towards the pump station and transmitter which will ruin pretty much everything.

Every system has a small expansion tank to compensate for HTF (heat transfer fluid) expansion and contraction due to changes in temperature. The pressure in this tank needs to be checked and, if necessary, air added to keep the pressure in the recommended operating range.

When first filling the cooling loop, the first thing that needs to be done is a system flush. This is to remove any installation debris and impurities. The system is filled with distilled or deionized water and pressurized. The circulator pump is run while the transmitter is off for a period of time pumping water around the cooling loop; 12 to 24 hours being typical. The cooling loop, pump station, power blocks and heat exchanger are checked for leaks. The water is then drained out and the debris strainer is cleaned or replaced.

After the flush, the system can be filled with Heat Transfer Fluid. Basically, the HTF (distilled water + antifreeze) is mixed in a container at a ratio appropriate for the climate. The higher percentage of water, the better the heat transfer characteristics.

A good guide line would be to look up the record low temperature for the area, then subtract five degrees because records get broken from time to time. This is really for the worst case scenario; the transmitter goes off on the coldest night of the year. Using a small impeller transfer pump, the HTF is pumped into the system in isolated stages. Filling first the pump loop, then the loop to the heat exchanger, then the loop through the first power module and so on. It is a good idea to use a specific gravity tester to check the water to antifreeze mixture.

When starting the pumps on the pump station, do not allow the pumps to run dry and cavitate.

On the pump station there will be a differential between the suction and discharge side of the pump. Depending on the speed of the pump and the head pressure on the system, it may range from 8-16 PSI.



Pump station, showing suction and discharge lines.

Transmitter manufacturers will have a recommended flow rate through the power modules/power blocks. These flow rates can be changed by increasing or decreasing the pump speeds. The flow rates can be balanced between power modules by adjusting the ball valves on the supply side slightly to decrease flow.

After installation and commissioning, the cooling system needs to be monitored for several weeks or months. As the air collects at the high point and leaves the system, more HTF will need to be added to keep the pressures in their operating range. Depending on the size of the system and the amount of HTF it can take several weeks for all of the dissolved air to come out of solution and be purged from the cooling loop.

Regular maintenance is pretty simple. Check the system suction and discharge pressures – especially as the season changes. Add HTF as needed to keep those readings within normal range. If the pressure drops a lot during a seasonal temperature change, check the pressure in the expansion tank. Air can slowly leak out of those vessels, especially if the Schrader valve does not have a cap.

Yearly, after plant dander season, check the heat exchanger to make sure that the fins are not being clogged with dirt and debris. If they are, rinse the fins only with low pressure water so as not to bend the fins and create a much bigger problem.

It is a good idea to switch between pumps every six months or so. This ensures that both pumps are working and it balances out the wear on each pump. In theory, the pumps and motors should outlive the transmitter. Sometimes, however, pump controllers can be damaged by electrical impulses.

Periodically check for small leaks, especially around valves, threads and fittings. Small leaks may not show up as fluid, but rather dried flaky antifreeze residue or green corroded copper.

The HTF should be checked every few years to make sure that the antifreeze still has the freeze protection needed. I know that the TV engineers normally send a sample to a lab every three years to make sure that the antifreeze is not acidifying and eating away at transmitter parts.

With a little attention, a liquid cooled transmitter should provide reliable and long lived service.

Paul Thurst, CPBE, is co-owner of Data Wave, LLC. He can be reached at paul.thurst@datawave.us

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Working remotely? RELAY virtual mixing, routing and monitoring software is AES67-compliant too — and ready for the cloud.

You Need Team Work

by Wiely Boswell

The broadcast world is changing rapidly and the costs associated with running a radio station are going up. Where do you reduce expenses? If you cut your tech support staff, downtimes will increase. If you put off replacing old equipment, downtimes will increase. Long outages will get listeners tuning around and they may find a station they like better. Understanding and correcting the reasons for outages is important.

Some of the biggest issues lately have come with the power company. My older transmitter tends to not come back up with a solid quick glitch – it has to do with IPA and PA protection that requires a manual protection reset. My newer transmitter has basically a high gain PA module with no IPA and there is no reset. Of course the power company can not prevent trees falling and poles from getting run down. I have contacted the power company and now having an engineering contact I can report or find out about outage issues a little more directly. It gets harder every day to reach people. We discovered that the incoming line through a short section of woods needed tree trimming. We talked about a single phase loss event and how there may be a way to make a single phase failure take the whole line down. We also discussed how the main incoming feeder to several transmitter buildings with separate transformers may not have correct size line fuse. Power glitches can cause huge surges as equipment comes back up. The main fuse will blow but not any of the fuses at the buildings service transformers. The newest technology allows line switching in the field remotely, and can bring parts of a grid back up by rerouting. This can cause a glitch. This are issues that we chase, trying to prevent outages.

In our region of the country, we have lost some very important, very experienced, and hard to replace special people. There really are not enough broadcast engineers to go around. I am reminded of this again because we just lost a fellow experienced engineer. It happened so fast. He knew a whole lot about his local group of AM & FM stations and worked for a national broadcaster. Being a radio lover his whole life and an experienced Ham operator, he thoroughly knew AM station components and antenna systems. We had been working together, even though in different companies. I assisted him in a lot of transmitter and facility issues and learned a lot about different brands and types of equipment. Now many questions will go unanswered and it frequently reminds me of who we have lost – it's almost like starting over.

If you depend on contractors or other stations for help, the down side is that, during a major storm event, help will become delayed as others work on their own outages. Most of us love what we do, want to fix everything, help our friends, and it is where we get our identity. It's in our blood. No one usually wants to retire or quit but getting overworked makes it easier to choose that. A lot of us do menial jobs at times. That might include cutting grass and killing weeds at transmitter sites. It might include a lot of tasks but a limited staff has to do what is needed. Yet who fills in when you want to take a week off and want to go a significant distance away? I can't rest anymore, when I'm more than 300 miles away without a

backup. A plane flight going somewhere makes it even more difficult for a quick return.

I have sites a long way off, which makes it much harder for a local friend to go and troubleshoot a problem. We also loan spare equipment to each other to keep stations on the air – it is a local repair team effort that goes between companies. Even though one may not know every thing about a site they are called out to help with, the chief engineer of the site can usually talk an experienced engineer through it. Many times it takes help on the other end of an STL or Internet issue.

Remote power reset equipment can be quite helpful at times, and so can the new UPS bypass devices like the Henry Engineering Failsafe Power Switch, to minimize downtime. (<https://henryeng.com>)



We need contact and the experience of our fellow engineers. Our SBE chapter keeps the community of engineers tied together but that has unavoidably loosened over the last year. Presentations that occur at SBE meetings are a way to keep up with new equipment and methods. We learn by various other sources like *Radio Guide*, *Radio World*, and other publications, as well as certain user groups. The Alabama Broadcasters Association gives free training classes to members and zoom meetings have really ramped up. So the broadcast world really needs “Elmers” to get new engineers started. The talents needed are in demand and are limited. We now have several Chief Engineer openings in Alabama.

Large facilities, especially TV broadcasters, will typically have two or more engineers, plus others employed that have some sort of technical abilities. They have the opportunity to rise in the ranks and can be mentored. They can have the opportunity to attend vendors' schools. They know the value of an educated staff.

Large nationwide radio broadcasters can share internal engineering resources but when they start losing people for various reasons, the service area increases. A market will typically have only one engineer. It requires somewhat long travel and then become stretched thin and that can make retaining talent harder.

Where are the replacements coming from? I have been here watching this need for a while. An owner of a small group of stations needs to consider the impact of

losing an engineer – especially us older guys. I would think more women would be involved in the field but I'm not really sure why. There are places to look for junior techs like Ham clubs, trade schools, or other tech fields that might have the RF desire. Give a presentation at the local Ham club. They would have to be ready to get woken up, be on call, and take a lower paying position, possibly part time. To get started you just have to find the right candidate. I would think it would be a younger person with the desire and be excited about the responsibility of keeping the station on the air. Being younger almost automatically makes them computer savvy and they do not have to be an expert. Hands on experience should appeal of course to a candidate and they may be tasked with tough projects like cutting grass or a studio build. The more jobs one can do at a station the more money is saved.

It will take intentionality to go after the right person. A local person is the most logical, and the older the existing chief engineer, the sooner you should look. (I can't believe I said that.) I would like to leave our station with an engineer if something happened to me without notice. It is a really tough position to work alone and, remember, best safety practice says you should have help doing dangerous things.



There is also the possibility of shared time with other stations, to lower the expense to small stations. An entry tech could eventually become a contractor that would also be of benefit to the broadcast community. I know a contractor in a nearby town that wants to retire or, at a minimum, just keep his one best customer – the one that appreciates and treats him the best. Another positive impact would be to support the junior engineers SBE membership and encourage certifications. A self starter is the ticket. Do they already excel in one skill such as audio mixing or installing satellite dishes? Perhaps even a car audio tech. They will also have a learning resource from broadcast equipment manufacturers' technical support (after studying the manual first). This candidate could also be evaluated during an initial period much like some use a staffing service.

Emergencies used to be like a battle cry ... “We are off air.” Vendors might even ship on the owners' word – not so much anymore. Remember, a lack of support in planning or funding spare equipment on managements' part, does not necessarily constitute an emergency. You can master equipment better when you're able to have time with each new piece of equipment that goes in. Installing a lot of new equipment at once is like learning from a fire hose. One new piece at a time can be like a chapter in a school book on broadcasting. Things to consider for tech team building.

Wiely Boswell is Chief Engineer of Faith Broadcasting, located in Montgomery, Alabama; CBRE, CBNE, and SBE 118 Chairman. He may be contacted at: Wiely@faithradio.org



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The Linux Connection, Etc!

Arduino Prototype Web Interface for Transmitter Sites

by Tommy Gray CPBE CBNE

Arduinos Galore

Well, since last time I have gotten thoroughly hooked on the little Arduino modules. My project, I started last time to be a comprehensive transmitter site remote control, has evolved into a really great piece of software. I currently am using an Arduino MEGA2560 module, as the UNO I started with did not have enough memory or enough I/O resources for all the analog and digital inputs I wanted to incorporate into the project. It was fine for a basic system but as it grew, it quickly ran out of capabilities. I am currently in the process of optimizing the code to make it run faster and it is coming along well. The screen shot below (Figure 1) will show you where I am currently in the process. Keep in mind that I plan to make the Sketch (the Arduino name for a Program/App) available to anyone who is interested. When it is ready to my satisfaction, I will post a link for download. I will first start with pieces of the code so you can experiment with your own project. I am guessing some time this fall it will be complete and ready for “mass consumption.”

Arduino Prototype Web Interface for Transmitter Sites, etc.

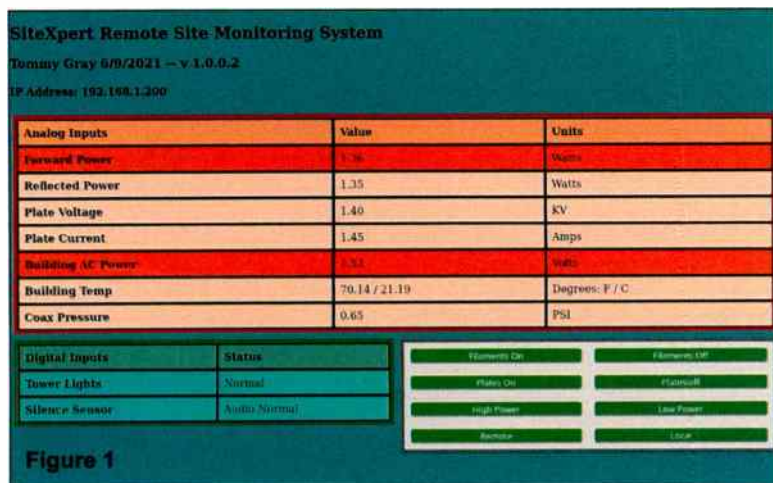


Figure 1

I have found that the Arduino is one of the best supported units of its type you can find. The available resources, documents, and example Sketches, are almost endless. So far, I have seen everything from robots that will bring you a drink from the fridge, to home security systems, environmental control systems – and the list goes on and on. The current project has a fully functional Web Interface that has all the Analog inputs you would normally use in a typical transmitter site. It has transmitter parameters for normal transmitter functions. It has building monitoring such as air conditioning, temperature, electrical power, and transmission line pressure. There are currently digital inputs that monitor silence sensor and tower light status. Control functions, so far, are for filament on/off, plate on/off, high/raise power, low/raise power and Remote/Local control. Of course you can easily customize these for what you need.

The really neat thing is that nothing in this system is complicated and the end user can easily customize the inputs and outputs to suit the local need. I have not had the opportunity to interface it with a real transmitter just yet

due to time constraints. At this time of the year everyone is trying to get all their site projects in before the fall and winter hits, and we are very busy right now. That will have to come later.

So far, I have controlled the unit through a computer web browser using Firefox, and with an iPhone using Safari. Both worked very well. The hardware right now is built up with a breadboard. It is comprised of an Arduino MEGA 2560, a 20x4 LCD display and an Ethernet Shield. I have a screw shield for my old UNO but it will not work with the MEGA so I am getting another one for it. (NOTE: The add-on boards for the Arduino are called “Shields.”)

In the picture below you can see my setup. I have some multi-turn pots to add for “in-the-field” calibration of the inputs. I have added LEDs to substitute for relays to trigger transmitter functions – controlling relays is easy with the Arduino. There are also some very inexpensive relay boards available to keep you from having to build everything up unless you just want to. Figure 2 is a picture of the prototype system bread-boarded up.

I have added a ready made temperature sensor (\$3 off Amazon – the little red board right under my finger!) but you can use a simple LM34 or LM35 IC to do the exact same thing. This one has an LM35 which is a Celsius sensor but the formula is simple to convert its output to Fahrenheit. The LM35 is cheaper and easier to find for some reason. The LM34 costs about twice as much and outputs in a voltage scale that equates to Fahrenheit degrees. I currently have it displaying in both Celsius and Fahrenheit just because I was experimenting with formulas. I apologize for the messy hookup. Due to time constraints it is functional but not pretty yet.

Bread Board Prototype

The system is currently powered through the USB interface but there is also a power jack on it that can easily be used to power everything from a simple “Wall Wart” power supply you probably have a ton of lying around from

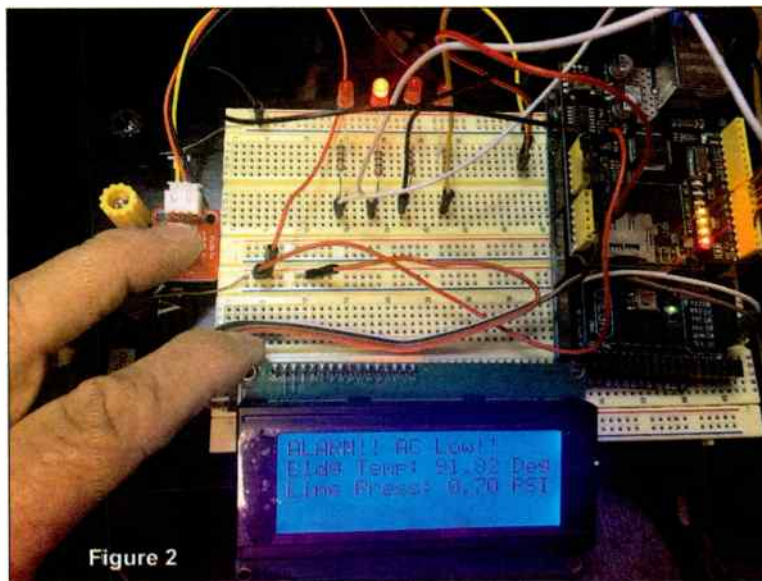


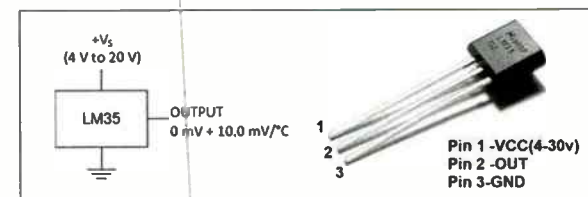
Figure 2

old equipment. I am using 5V for everything. The Arduino MEGA 2560, all the sensors, as well as the 20x4 display, are all being powered right off the Arduino buss which is getting power from the USB port right now. Once the unit is put in the field, if you don’t want to connect it to a dedicated computer, you can use external power.

The current code I put together (now up to well over 700 lines!) outputs everything to the serial port, to the LCD display, and to the web page through the Ethernet interface. The Web update is much faster when you comment out the serial and LCD write code, but if you want to use a hardware LCD display at the remote site where you connect up the system, you need at least the LCD part of the code. Without the Serial and LCD code the screen update is very fast and the response to the sensors and control commands is very quick.

LM35 Temperature Sensor IC

Below is a simple schematic of a simple LM35 circuit and a picture of the sensor IC.



You do not get much simpler than this little IC (It looks like a TO-92 cased transistor as you can see, but is really an IC). I got the power for mine from 5V. Actually it will work on any voltage from 4-30 VDC. I used 5V because it is right there available on the Arduino board itself. The output pin puts out a linear +10-mV/°C voltage. A simple formula will give you the temperature in degrees, either Celsius or Fahrenheit, whichever you desire. Just measure the voltage at the output pin and do the math. The accuracy of this thing is very good. Keep in mind that if you need a temperature sensor for your existing control systems these will work fine too. You may have to add a little in the way of RF bypass if you have interference issues, but it is a cheap and quick way to get one!

Do the Math!

Now there are several methods floating around out there to convert from Celsius to Fahrenheit and the most common is:

$$^{\circ}\text{F} = (^{\circ}\text{C} \times 9/5) + 32$$

There is a quick and easy way you will find and it is to multiply the degrees in Celsius times 1.8 and add 32. (If you are very alert today you probably already figured out that 1.8 is the same as 9/5). Then there is the old tried and true “ballpark” method of multiplying the Celsius temp by 2 and add 30:

$$(^{\circ}\text{C} \times 2) + 30$$

This will give you a figure within a degree or so.

In my next article I will start giving out pieces of the code to get you started working with Arduino modules. You’ll need an Arduino, and an Ethernet shield (You can also get a WiFi shield but I am using hard wire here and that is what my code will support).

Until Next Time!

Tommy Gray is a veteran broadcast engineer currently staying busy doing Engineering and IT nationwide, through “Broadcast Engineering & Technology LLC”, a Louisiana based Consulting and Contract Engineering Firm, serving the US. www.BEandT.com

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State of the Station

What Happened to College Radio?

by Steve Callahan

I was reading the other day that Dartmouth College in Hanover, New Hampshire is putting their Class A FM commercial frequency, student radio station up for sale. They say that it's been losing money and that student interest in the over-the-air station is waning. The proceeds of the station sale will go toward financing their on-line radio presence. This follows their move several years ago of turning in their commercial AM station license. Now before you fill my mailbox with comments, let me say that there are many college stations across the country that are still on the air providing a viable educational experience and a possible career for the students who choose to avail themselves of the experience.

Unfortunately, there are also many other college stations that are barely on the air because there are no students interested in doing an over-the-air radio show.

In a former life, I was a college professor in a Communications Department, where I was responsible for the construction and operation of the college radio station. The curriculum regularly welcomed 50 or 60 new students in the Communication Department every September and the schedule for shows on the radio station always filled up fast. One such student of mine chose to make radio his career and I'm very privileged to be working with him today. I freely admit that he had natural talent and sounds today just like he did the first day he did his show on the college station.

Of course, it is helpful if the college has an active and credible radio and television or communications curriculum with faculty members who have had professional experience and not just "book-learning."

A couple of years ago, Brown University in Providence, RI, sold their Class B commercial frequency student station to a national religious broadcasting network. The station had a hard rock format for years, which depended on paid employees to keep the station on the air. They say they used the proceeds of the station sale to enhance their on-line radio station. Several years ago, Johns Hopkins University in Baltimore sold their student radio station. Frankly, that shocked me at the time but signaled a trend that I didn't want to recognize until recently.

I think you can see a pattern forming. The cell phone is the student's communication device, their movie theater, their television, their radio and their research library. I once was asked by an employer to ascertain if a local college would be willing to sell their student radio station. The first thing I did was wander around campus and ask students randomly if they listened to their college station and what did they like about it. A vast majority of those I talked to didn't even know their college had a radio station and those who had heard of the station didn't listen. Today, that station is LMA'd to a large classical station in a neighboring state and there are no students participating in the on-air programming.

Within 30 miles of where I sit writing this article, I know of quite a few college stations which use continuous automation to keep some programming on the air.

Others utilize volunteers from the community, and even alumni, to come in and do niche programming to fill their station's program schedule. I keep a fairly close eye on the fines that the FCC hands out and I'm distressed at all the fines that go to college stations for late license renewals and big gaps in their quarterly issues and programming filings. Chalk this up to faculty advisors who don't know the FCC rules or even where the radio station studio is located on campus.

When I was embarking on my college student journey, I had two colleges to choose from. College A was a large university with a prestigious communications curriculum and faculty, along with their own radio and TV stations. College B was a smaller state university with a new communications major and no radio station. When the chairman of the communications faculty at College B interviewed me and learned that I had several years of professional radio experience and knew what it took to get a radio station, he made me an offer that I just couldn't refuse. I spent two years there preparing and filing a "long form" CP application which was the equivalent of doing a doctoral thesis. For those of you who remember those good old days, if you wanted to apply for a new station, you had to do the obligatory technical showing, which I did, and found an open Class C frequency in the reserved portion of the FM band.

You also had to do an extensive showing of the varied educational programming that you planned to air. You needed an exhibit detailing the cost for equipment and other start-up costs and an operating budget. After filing the two-inch thick document, you had to sit and wait for the FCC to consider it. This was before the days of filing windows or auctions. After I graduated, I learned that my application had been accepted and today that station is a 100,000 Watt NPR affiliate serving a wide swath of the state.

We complain that, when we do have job openings, we aren't getting experienced young people looking to make radio a career. Those who do approach us, come with little or no commercial or educational radio experience but I guess they should get credit for approaching. In all fairness, the colleges that still have communication curriculums focus on podcasting and on-line media. There's certainly nothing wrong with that but it signals a major shift which is unstoppable. When I owned my own station, I had a young man come to the station looking for an opportunity to do a radio show. He had some experience working for the local cable origination studio, but he wanted to try his hand in radio. I started him with a quick education in Radio 101 and gave him a Sunday morning shift where he could get the experience of running the station's varied Sunday morning recorded programming. I'm pleased to say he continues to do a great job and is now producing and voicing his own Saturday morning "news around town" show and planning to major in radio in college.

A good friend of mine, Edward Perry, who owns award-winning WATD in Marshfield, also operated

Educational FM Associates, a firm that, back in the 70's and 80's, specialized in educational FM applications for colleges and high schools. If you went to an IBS or Intercollegiate Broadcasting System yearly convention in those days, you would have seen

Ed at his vendor table and most likely would have asked him if your college could get its own radio station.

Ed once told me that he was responsible for one third of the new educational FM station applications in that time period. I recently spoke with him and his take is that

there was a TV show back in the 70's which featured a high school radio station and that started the interest to get high school or college radio stations. Recently, the interest that religious organizations have shown toward getting their own radio voices comes at a time when college administrations are seeing that those, now underutilized, student activities can be turned into big money. It's a trend that I don't see stopping anytime in the future.

Steve Callahan, CBRE, AMD, is a member of the engineering staff at Entercom Boston. Email at: wvbf1530@yahoo.com



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Emergency Prep

Wind and Rain and Debris, Oh My!

Generator Enclosures and Maintenance

by Michael Bradford

As I write this article, hurricane Elsa has hit Florida and our south eastern seaboard, and is headed north-east along the coast line with substantially less wind and rain than on July 7 when she made initial land-fall. With peak winds reported over the Lesser Antilles of 70 mph, she hit Florida with winds from 65 to 45 mph. Torrential rain was another major factor along with flooding, downed trees and power lines and subsequent power outages throughout the stricken region. Of course, many radio and TV stations were impacted by the storm, as were hospitals, shelters, fire stations and cellular telephone facilities. Knowing in advance of the impending storm, I'm sure many engineers were busy as a chicken on a June bug making sure their customers' generators were ready for the assault. Fuel was topped off, batteries checked, radiator levels and hoses checked, engine oil levels checked and topped off as needed. How about air intake systems? I know up here in the "north" the cottonwood debris often clogs air intake screens and filters overnight which can cause a generator to overheat if called into duty for more than a few minutes. No intake air equals no exhaust air, which equals generator overheating.

In the May issue of *Consulting-Specifying Engineer* magazine, I read an article by Paul Pouliot, PE and Michael T. Alford, AIA, on "How to Design Standby Power Systems to Withstand Storms," and noticed design parameters similar to those I saw years ago at several AT&T remote tower sites. This article provided some important considerations for design professionals, relating to protection from severe weather and day-to-day debris, and rain penetration into structures housing standby generators. (See the article on-line at csemag.com)

From that article, **Figure 1** shows the external sheltering walls designed to greatly reduce wind, rain and debris entrance into the intake and exhaust ports of a standby generator enclosure. Consideration to prevailing wind direction should also be a factor. Well, these sheltering walls are wonderful for new construction, but how about existing enclosures? If your sites have ever had previous wind/rain/debris damage, perhaps erecting an external wall, as in the diagram, would be a good investment. The article in C-SE magazine provides specifics for "after the fact" construction.

A 10 mile per hour wind, in normal weather conditions, will usually have no effect on the air intake/exhaust system for your generator. At heightened wind speeds, as in a hurricane or major storm, high wind pressure could actually cause an overheating situation because the air flow through the radiator could be compromised. The simple formula for calculating wind pressure is $P = 2.56 \times V$ squared, divided by 1,000 where V is the wind speed in miles per hour. One should also take into consideration the "drag quotient" of a flat surface, which has been calculated to be 2. So, for a 10 mph wind speed and an exhaust opening of 4 x 5 feet, there will be a wind pressure a little over 10 psf (pounds per square foot). But, with a wind speed of 50 mph, the pressure

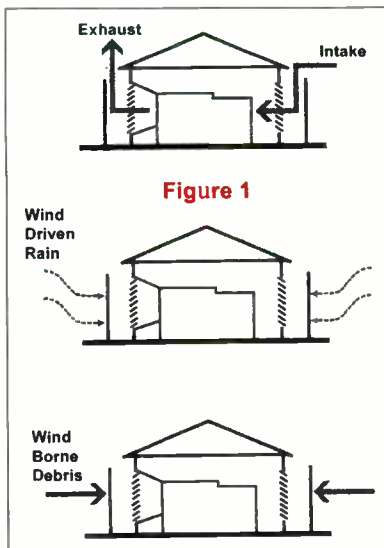


Figure 1

becomes over 256 psf, perhaps enough to choke off the air-flow from the generator's radiator and cause overheating. An external wall, as in **Figure 1**, may keep that situation from happening.

I found another situation with a generator recently that I know you'll find interesting. The client called to say their standby generator failed to start. When the manager got to the site, he found there was an alarm light on the generator for "low coolant" and the generator was in "shall not start!" mode.

The manager removed the radiator cap and checked the fluid level, which was up to the top. The "low coolant" alarm would not reset so he called me.

Upon arrival, I noticed no apparent coolant leak, no ruptured hose anywhere but the coolant recovery tank level was at the "add coolant" point. I topped off the coolant level in the recovery tank, reset the alarm and the generator started easily.

Upon further inspection, I found two loose connections on coolant hoses that caused a dribble but only when the generator had been running for a while. Not enough to be noticed but enough to lower the coolant level over time and trip the alarm. I also noticed the coolant level-detect sensor was at the lowest point on the recovery tank, which means when the alarm goes off, it's too late to respond if the generator is running at the time. I did some research and found a nifty little sealed float switch

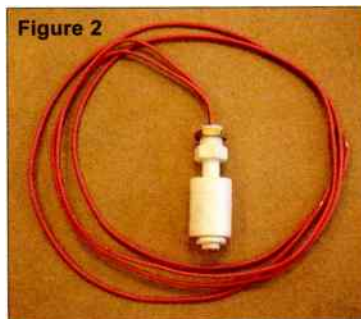


Figure 2

(**Figure 2**) at www.liquidlevel.com. I determined the half-way point on the coolant recovery tank between "full" and "add coolant" and used the website specifications chart to select this little sensor. I drilled a 3/8 hole adjacent to the filler cap on the recovery tank and with the long leads on the sensor I was able to fish them down the filler opening and up through the 3/8 hole, then pull the sensor up through the 3/8 hole and secure it with the brass nut. Now I have an alarm that lets me know when the coolant is "low" before it's so low that the generator goes into "shall not start!" mode. This sensor is now an integral segment of the overall alarm system for the generator.

After much investigation and T&E I have chosen the RPE series of cellular-based alarm systems from Ayantra, Inc. of California for remote generator monitoring. **Figure 3** shows a typical 3.5" x 5" communication module. The units employ weather-resistant gaskets and input/antenna connections and utilize 4G-LTE-M communication protocol and an internal keep-alive battery.



Figure 3

Although these modules can easily be mounted inside most generator enclosures, I choose a Stahlin JW series weather-tight enclosure (**Figure 4**) for most of my installations to keep the communication device, antenna and interconnect wiring handy for visual inspection and away from the heat of the generator. I do not like to commingle alarm systems at a remote site between the generator and the actual transmitting equipment. I also do not like to commingle alarm contacts with the generator alarm sensors. I prefer to use the auxiliary relay contacts available on most on-board generator control panels or a separate sensor. Most generator manufacturers offer "auxiliary" contact options for

their control panels if you order them with the generator. I have had difficulty in getting diagrams or part numbers for after-sale installations. I understand that manufacturers don't want to be liable for an alarm failure in an "added-on" situation.

After talking with Corey Vincent, Service Manager at Superior Industrial Sales & Service in Jackson, Michigan, I determined that the highest number of generator failures is caused by weak or failed batteries. Lead-acid batteries do not like extreme heat or cold, do not like being over-charged, and have a finite life-span. Any battery more than 3 years old is living on borrowed time.

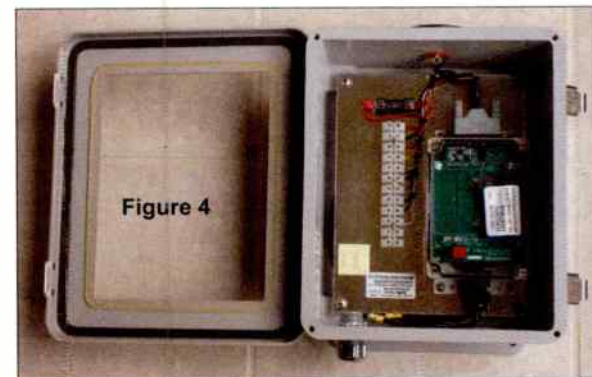


Figure 4

Another feature of the Ayantra RPE series of remote monitoring modules is the ability to use a small interface relay (available with the monitor) installed into the battery charging circuit. This relay will turn the charging voltage off for a chosen time and then measure the battery voltage. In this fashion, the battery voltage is not influenced by the charger. The monitor constantly monitors the battery voltage and all other connected sensors and will send email and text notices when any parameter surpasses a predetermined limit. The web-site for each unit allows you to easily set all limits and label each input in clear-text for immediate recognition of the source of any alarm.

I have seen several generator installs using an under-body fuel tank that raises the generator several feet off the ground. This makes for a small foot-print but makes even simple service difficult. Imagine carrying a 75-pound battery up a ladder or even changing the oil/filter via a 6-foot ladder. Now imagine having to do the same projects in the middle of a violent storm or in knee-deep snow.

I suggest you invest in a torque-screwdriver for checking radiator hose clamps and fuel lines that use the adjustable clamps. Manufacturers specify the proper clamping strength for their hoses and clamps that are so tight that "your knuckles turn white" may damage the hose. More than once I have seen old hoses that have been split in half by tightening the clamps way beyond what's specified. When hoses get that old, replacement is the only option and I recommend silicone hoses. Silicone hoses benefit from better flexibility over their lifespan and will not split, harden or suffer from dry-rot unlike rubber hoses. If you have the luxury of specifying a new generator, insist on silicone hoses. Also, when entering items for the next year's budget, recommend silicone hoses for all existing generators in your stable.

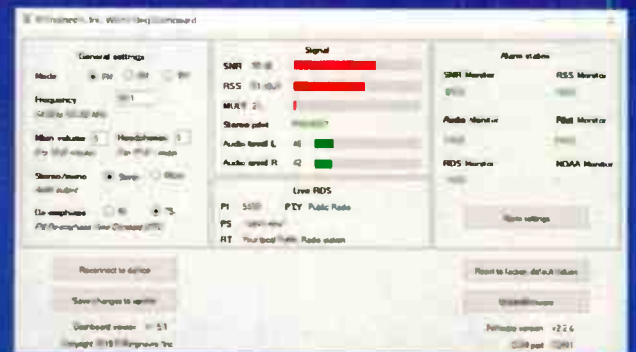
I also recommend using a diesel fuel-scrubbing service for remote generator sites, especially those with large capacity tanks and infrequent long run-times. With seasonal or even daily changes in humidity, moisture tends to condense inside diesel fuel tanks, providing a home for algae and other nasty contaminants. Once a year fuel scrubbing by a reputable firm will remove water, clean existing algae, filter out rust and otherwise provide a clean fuel source for your generator. Couple this service with your weekly inspection and routine oil changes to guarantee you won't have to make a service call in the middle of a raging storm!

When setting up your maintenance budget prepare a narrative for management to discuss "probability of failure" and costs and the "consequence of failure" and costs if you don't plan for a failure.

Michael Bradford began his career at WCCW in 1962, A CPBE since 1984, and currently a contract engineer. You may reach him at: mbradford@triton.net

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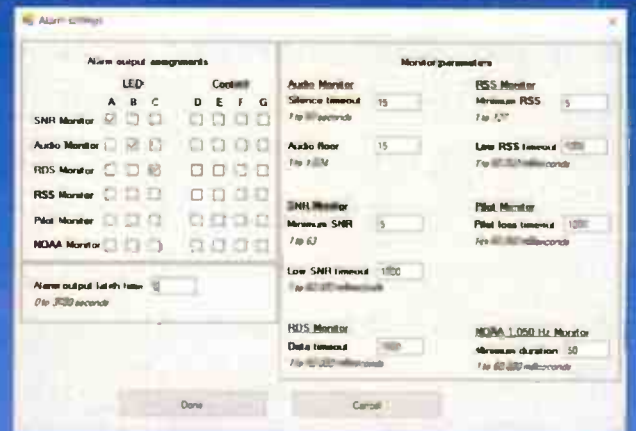
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More Short Takes

by Bob Reite CBT

We Are Broadcasting on 75 Meters!

I got a call from the owner of an AM station on 1280 kHz that an amateur radio operator was hearing the station on 75 meters. That would have to be the third harmonic at 3840 kHz in the General Class portion of the phone band. I took a drive out there with my FIM-41 field strength meter and, while the third harmonic was detectable at the usual place I do the annual measurements from, it was within FCC limits.

I called the station back and asked if he had any contact information for the Ham who gave the report. Since I also have a Ham ticket, we hit it off and I told him that I did not doubt him one bit, but I could not catch it in the act. He did report that it "comes and goes." I asked him to see if he could find any pattern to it and get back to me.

I decided to go to the site and hunt for the harmonic. I did find a rusty chain and padlock on the fence that was making harmonics, but they were below the 10 uV/M noise floor 100 feet away. I decided to clean this up anyway replacing the rusty chain and lock with a new lock that fit the relatively new galvanized gate hardware, eliminating the need for a chain.

I also found the guy wires were rusty and really in need of replacement, but for some reason these were not

generating problems. So I went home and waited to hear back from the Ham.

About a week later, I got an email from the Ham with a video file with sound. The video was of his top-of-the-line HF transceiver tuned to 3840 kHz with a spectrum analyzer plot. It was our station all right and very "dirty." Not only was there recognizable program audio but just overall noise. It was not steady but cutting in and out, but mostly in during the length of the recording. He said that the interference was the worst on windy days and that rain would sometimes aggravate it. Could it be our rusty guy wires? I would soon find out the next windy day.

I got to the location 0.6 miles away where I do the annual measurements to start taking readings and, at first, I thought it was not going to show up again, now that I was there. But as the wind picked up the third harmonic noise got bad, exceeding FCC spec by 10 dB. I swung the meter around to find the directional null and I was just close enough to the site to determine that the harmonic "grunge" was not coming from the 1280 tower. The null was at the cell phone tower, which is about 1/4 wave away from our tower.

Did the detuning apparatus go bad again? Time to drive to a point where I could stand and have the two

towers at a 90 degree heading from my position. I could then null out our tower and prove it was coming from the cell phone tower.

Sure enough, when I nulled out the 1280 tower, the harmonic was worse, if I nulled out the cell phone tower the harmonic was quite a bit less.

Visual examination of the tower showed the cause. This time, it was not the detuning skirt, but the safety climb cable was loose, flapping in the breeze and it would strike either the detuning skirt wires or the unipole cell phone tower itself.



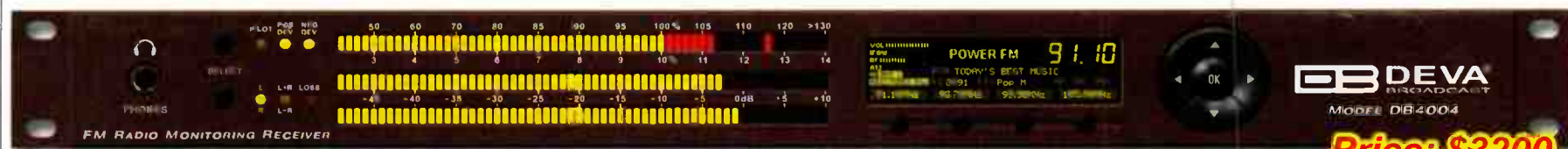
Harris MW-1A Won't Stay On The Air

I got a call that the station would not stay on the air. The staff kept restarting it and it would come back up with normal readings. None of the overload indicators were wired into the remote control, so I told them if it goes off mid day to leave it off, and tell anyone that calls that they can listen to the translator married to the station and then call me. I went out and found it had tripped out on high SWR. Examining the site revealed weeds and saplings growing into the tower past the base insulator.

(Continued on Page 28)



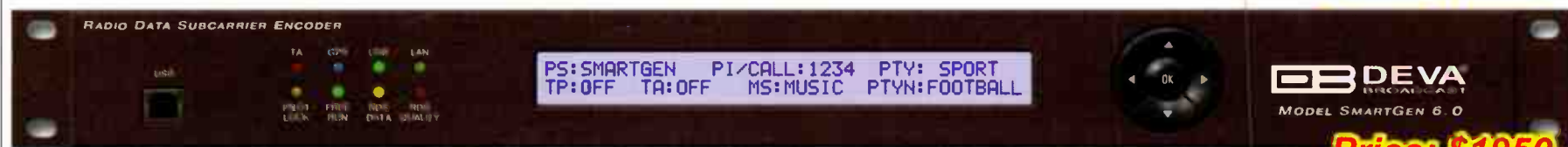
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More Short Takes

— Continued from Page 26 —

I figured that clearing the weeds would solve the problem and it did for three days. Then it started dropping off the air again. This time no VSWR trip or other overload indicators were lit. On the MW-1A, there is no separate indicator for loss of air flow, the “Off” button just illuminates. But the big muffin fan was replaced not that long ago as well as the sail switch. I checked the time delay on the airflow circuit and it was correct at about five seconds. The filter looked like it had just been replaced. It then dawned on me that this was a more “premium”



brand of filter which might get rid of more dust and dander, but it cut the air flow back enough that the sail switch would drop out. Going back to the “el cheapo” filter solved the problem. This may also explain why I see a lot of Harris MW-1As and the earlier MW-1 with no air filters at all. One can get away with this, short term, if the building is dust free or one is willing to come out every so often to clean all the dust and insects that might get into a transmitter without an air filter. However, a workable upgrade of some sort is warranted.

The Remote Control Doesn't Like My Password

I got a call from a Sine System user about a month ago, that they could no longer log into the site.

I went to the site and confirmed that the Sine System worked OK from the local phone. Then I verified that they were using the correct password. Next, I called from my cell phone and sure enough, it was behaving as if I had entered a bad password, but only sometimes. Other times it acted as if I had not touched any keys at all, eventually timing out. I never was able to log into the Sine System by calling into it. So I called the site number again from my cell phone, but this time picked up the local phone before the Sine System could answer. When I tried to play myself DTMF tones they did not come through.

This site, as is becoming more common these days, does not have traditional POTS (Plain Old Telephone Service) over a copper pair. They are using one of the cellular based “Home Phone” units. These have an antenna to get a connection over the wireless network, a power supply, often a backup battery and an RJ-11 jack that is supposed to simulate a POTS line, but they are far

from perfect. There are only a couple makes and models that work for this application, the Verizon 4G LTE Broadband router with Voice and the AT&T device pictured below. This site has the AT&T variant which worked until about a month ago.



As of press time the issue hasn't been resolved. For now, someone drives up to the site once a week to take transmitter readings. I'll let you know how we make out next time.

Bob Reite operates his contract engineering firm, Telecentral Electronics, Inc. servicing radio stations in Pennsylvania and New York state and may be contacted at br@telcen.com

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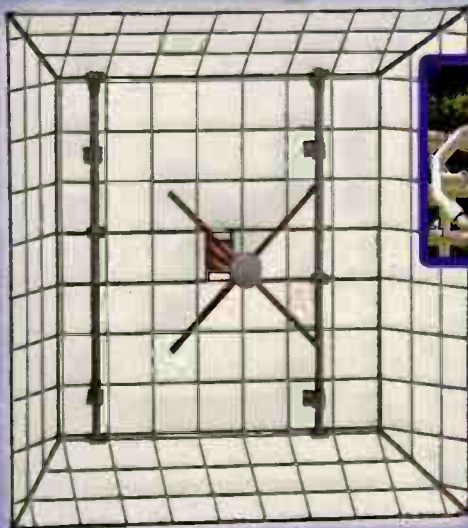
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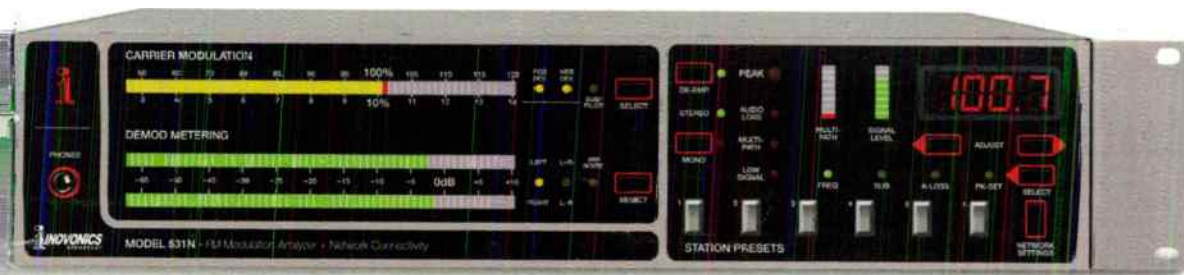
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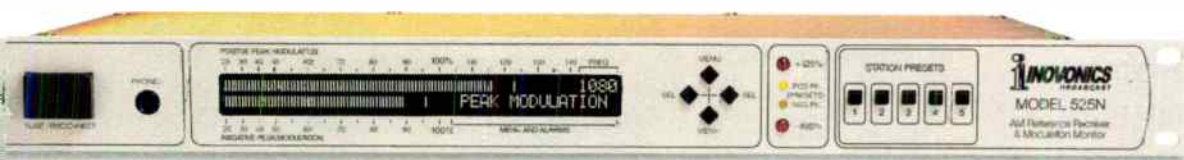


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All Hung Up

by Jim Turvaville

Those of you who have followed my articles the past several years know that I'm an efficiency nut, not just in operational matters but in space saving as well. I live in an overgrown tiny house (525 sq ft), program and run my five rural radio stations in a very small operations center (450 sq ft), and just always seem to be trying to find a way to make something work in a smaller space. My thoughts for you today follow along that line, and just might give you some usable ideas for your specific needs.

Not being an "early adopter" person, I tend to be one of the last to embrace the new stuff. My wife says I'm just an old curmudgeon who is resistant to change; which is not anywhere near being the truth – I am resistant to change just for the sake of change. When something new comes along, I like to evaluate it to know if it's just something new because someone wanted to be the one who invented something new, or if it really does solve real world problems and really does work better than previous things in the genre. Oddly enough, flat screen TV's fell into this category for me.

Not that I did not like those new flat screen TV's when they came out. Being born visually challenged, I have never really enjoyed watching TV, because I had to sit so close to comprehend all that was going on, that it was just impractical to be comfortable doing so. So the idea that we now could have a really large viewing area, and it not take up so much space, was instantly appealing. I had gone through the horrible years with that gigantic CRT TV that took up

massive real estate and weighed as much as a small elephant, so that part of flat screen technology was instantly embraced. And for several years, I enjoyed a newly found viewing experience for video entertainment. As the technology advanced to our desktop computer monitors, I was even more thrilled to have desk real estate being used in a much more efficient manner. I was an early champion of the little shelves to set the monitor on and have space under it for the keyboard, drawers for pens, etc. and even when dual monitors became available that shelf just got bigger.

Then it happened... someone created a mount to put that flat screen TV on the wall instead of on that TV stand, and my alarm bells started ringing. Do they have any idea how many of those are going to fall off the wall and splatter on the floor, and even maybe on some child playing nearby? The untold carnage of destruction that awaits the general public from such a reckless use of technology, with apparently no regard for the laws of physics and mechanical engineering! Yes, I was convinced wall mounting TV's was the most untested and carelessly thought out creation of the 21st century; and I avoided them for years. If I went somewhere and one was mounted on the wall, I walked on the other side of the room from it, just in case the inevitable breakdown was to happen and I would get caught in the fallout.

Then it got worse – my own brother purchased one of those wall mounts for his 55 inch flat screen TV, and then he actually asked me to help him install it. What was I to do?

Now my own flesh and blood family was going to be subject to certain injury and loss of property because of the reckless design of a piece of home entertainment hardware. I had no choice but to participate in the endeavor, so I began like absolutely no decent engineer worth their salt would ever do – I read the directions.

While the multi-lingual set of directions was poor at best, from a literary standpoint, the exploded drawings and sequence of assembly was really quite easy to comprehend. I began to understand the physics of how the weight of the TV was getting distributed to the mounting arms and wall bracket, and started to embrace the design. Since this was my brother, then his motto of "anything worth doing is worth over-doing" then the wall anchors were never a question in my mind – there would be plenty and they would be larger than specified.

None of using those cheesy plastic anchors and #8 screws; no, this called for 1/4-20 thread 3-inch toggle bolts. And not 4 or 6 but at least 12 would be used to support the unit on the bracket. This particular mount was one of the wall-extension and swivel types, so it had plenty of mechanical aspects for me to test and evaluate. And sure enough, not only did it work; it worked really, really well. After my brother's death, when we were emptying out the house, this bracket was just about the last thing left to be removed since I knew it would take a long time to reverse engineer what we had installed. In a momentary stroke of genius, I decided to leave it for the next occupants of the home – you know, just in case they wanted to have a TV in the exact same place.

With my fear of certain calamity now calmed, I found myself beginning to embrace wall-mounting of things myself. After all, once convinced of how well something works, we might as well go all-in, right? I mounted my own TV on the wall in my tiny house (I had reserved a place for one, just never quite got it done) and then took that idea to

(Continued on Page 32)

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– Continued from Page 30 –

the next step and mounted 3 computer monitors on the wall over the large desk shared by my bride and myself for our home office. (Figure 1) The desk folds up when not in use and a dining table folds down.



I took the idea to the office; and in Studio A (like we even have more than one studio in 450 sq ft.) I traded the over-the-console shelf with a pair of monitors, for a pair of wall mounts to the left of the operator, out of line-of-sight to guests. (Figure 2)



I then upgraded my office manager's workspace with a larger monitor attached to the wall, with the addition of a mic arm to use for production. (Figure 3)

In my case, I found the medium sized wall mount kits, which are rated for up to 25 inch screens, listed on Amazon were more than sufficient. (Figure 4) While they are not meant for any rigorous use, in

all of these instances the position remains almost totally static, requiring next to no adjustments except for the occasional realignment after dusting and cleaning. I was concerned about their quality for the low price I paid, but to this date I've had no failures at all, only a couple of minor tightening required for the older and heavier 25 inch monitors on my home office.



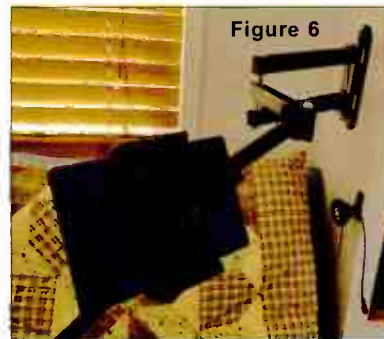
To really put the icing on my wall-mounted cake, I have recently incorporated this same wall mount with a tablet mount. We do weekly videos in our studio for Instagram, and I had gone through several mounts looking for one to hold a phone for the shot. We use a lapel mic plugged into the phone for improved audio, but needed stability for the video; so the 360 degree rotating clip holder (Figure 5) on a tripod has worked great. I found that the holder has a standard 1/4-20 thread for tripods, and comes in a larger size to hold tablets. Being a tablet junkie (I have 6 of them) I created a combination



of that same wall mount and tablet holder with a short piece of black PVC pipe and 1/4-20 all-thread cut to length to create the unit that mounts at my bedside to allow me to lay in bed and watch video on my tablet comfortably. (Figure 6) This would also work in a studio or office to hold a tablet or phone for video needs. But with mine mounted bedside next to my Nato mount that holds my phone, I'm all set for always being in touch and having entertainment at my fingertips. I can now party all night long – or at least until 9:00 p.m.



Jim "Turbo" Turvaille is semi-retired from 43 years in full-time Radio Engineering and lives in Rural Wheeler County Texas in a "tiny house" where he maintains a small clientele of stations under his Turbo Technical Services (www.jimturbo.net) operation providing FCC application preparation and field work.



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Misc. Tech-Tips and Thoughts

With the busy schedule I have, it's always a challenge to find the time and material to put into this column. One of the sources I have is you, the reader. I always welcome thoughts from readers who can spare a few minutes to send an email. Emails from my readers make writing this column worthwhile.

Letter From Readers

I recently received an email from H. Jay Melnick of ColoRadio Communications Group, Green Valley, AZ. He wrote to express his concern about the scams out there on YouTube. He writes:

Steve:

Here are some things to take a look at: These are Scam Baiters, whose sole purpose is to waste and destroy Scammers operations. You may have heard about Jim Browning already. These are all YouTubers, so you can see their work. Also the work of how the scammers operate, much in the same way the hackers get into our sites. Take a look at The following YouTube sites: Jim Browning, Lewis Tech, Scammer Payback, pleasant Green, Kitboga, scam bait central. There are a lot more than just these people. Stay healthy Jay.

Jay speaks from his own experience, and I can't confirm or deny his findings.

Privacy Invasion

This part of my article is going to feel like a conspiracy theory piece, but with the advanced technology we have today, I think we are dealing with a new reality. I mentioned YouTube above, and I will mention them here, too. Go to YouTube and search for "Rob Braxman tech." Spend a little time watching his videos and you eyes will be opened to what's going on in America. You may also want to visit his website: <https://brax.me/home/rob>

Monitor Confusion

I recently finished the on air-studio for the station where I am both the general manager and chief engineer. Imagine the jokes I've heard about holding both



positions. I had noticed one of my computer screens from our on-air playout systems was looking greenish (Figure 1). I have installed a few studios in my day and had never seen a monitor with a greenish tint before. This one had me scratching my head for a while. The video from the workstation was connected to a local KVM and the other end to the remote KVM. At first I thought one or both of my KVMs were defective. Then the idea came to mind: Was the VGA connector all the way into the connector on the back of the work station? I disconnected the VGA connector on the back of the workstation and carefully plugged it back in, making sure it was fully seated. When I checked the monitor again, it was working properly. I am sharing this embarrassing moment with you so if you ever see this, you will know what to try to correct the problem.

Great Web Resource

When I had a little more time in my life, I would make frequent visits to The BDR. That stands for the Broadcasters Desktop Resource.



(Continued on Page 36)

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“...very good right out of the box”

“VOLT wins, period!”

“marvelous”

“per-fect”



Misc. Tech-Tips and Thoughts

– Continued from Page 34 –

Located here: <https://www.thebdr.net/> it's a great place to learn engineering, or relearn some things you may have forgotten. If you have time on Thursday afternoon, Barry Mishkind hosts a Zoom meeting for engineers. He often has some excellent guests who talk about some great topics. I have enjoyed the lunch meetings I attended but, unfortunately, I am usually too busy to join the live meetings. Barry tells me he records and archives all of the meetings, so you and I can watch these meetings when it is more convenient.

Nice Engineering Apps

There are some apps for iPhone and Android you might want to download to your phone. You never know when you might need one of these. All of them are free and ad-supported. Some of the apps will let you upgrade to an app that is add-free.

There have been times when I wanted to use a signal generator to give me some audio. I would wish I had brought one with me, so I had to forget about setting levels or testing an audio input. Now I have a signal generator on my Android phone. I went to the Play Store and downloaded "Signal Generator." Anytime I need some audio, all I have to do is launch this app, and I can send audio out of my cell phone. I can select nearly any

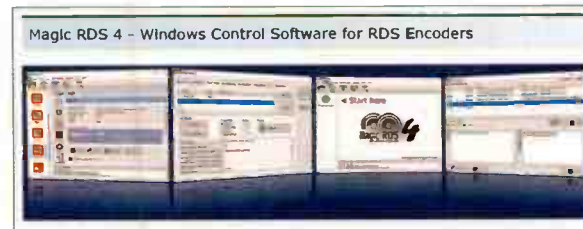
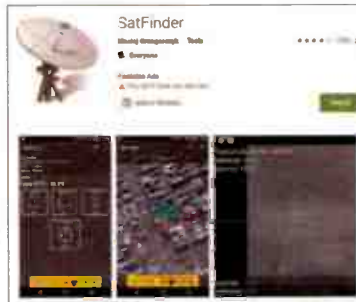
frequency and intensity, and I can see levels going into an audio console from a microphone.

Another handy application is called "Sat Finder." And, as the name implies, you can locate a satellite with this bit of software for your smartphone. It, too, is ad supported, but you can upgrade to an ad-free version for a price.

If your station has an Internet stream, you may want to use this free bit of software to monitor the audio. It's called the Pira Silence Detector, and it's available here: <https://pira.cz/show.asp?art=silence>

As far as system resources are concerned, it is very light. Once your stream goes silent, Pira can be set up to send you an email. If your phone is set up like mine, your phone will make a sound when you receive an email. Then you will know that your stream needs attention.

At the same website, you will also find software for sending RDS data over the air through a subcarrier. This software is also free. https://www.pira.cz/rds/show.asp?id=magic_rds_4



Looking for Input

Are you an engineer who has learned something new? Maybe you discovered a cool app that you love having on your smartphone. Or perhaps you found some software that is very helpful. Whatever gem you may have discovered, I would love hearing from you. Feel free to contact me at stuzeneu@sbe.org – your useful information will be appreciated by my readers and me.

Thanks for reading my column. I hope you found something interesting or useful.

The thoughts, ideas, and opinions in this column are my own, and do not necessarily reflect the views of Radio Guide or its publisher.

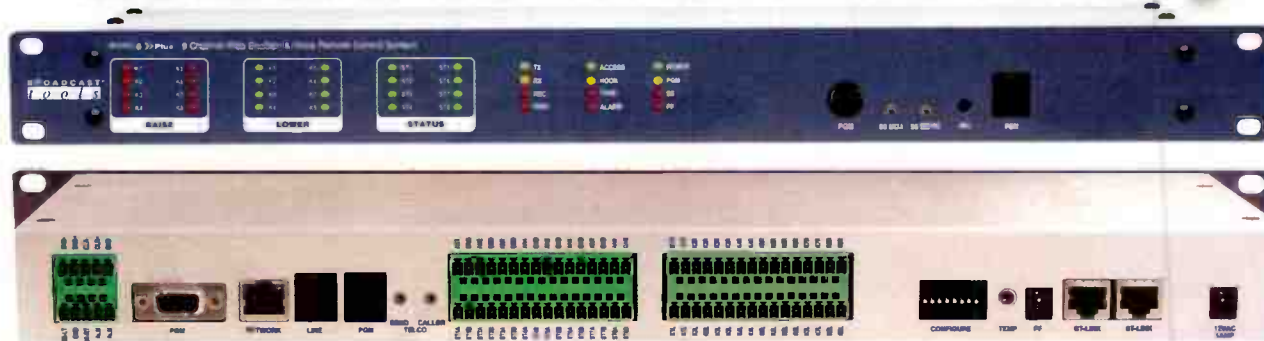
Steve Tuzeneu, CBT, is the general manager and chief engineer for WIHS 104.9 FM in Middletown, Connecticut. He is a member of the SBE, and an extra class radio amateur.



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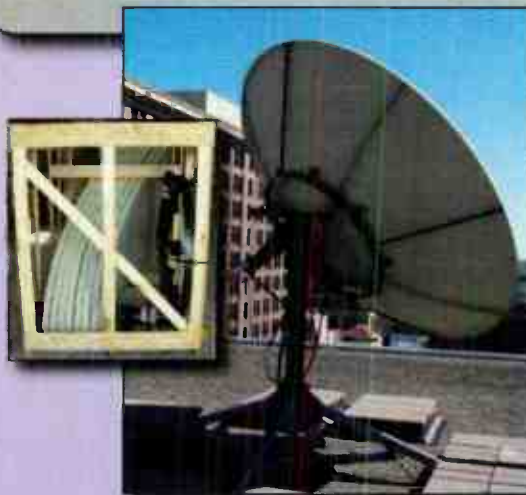


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Just Blowing Off Steam

by Roger Paskvan

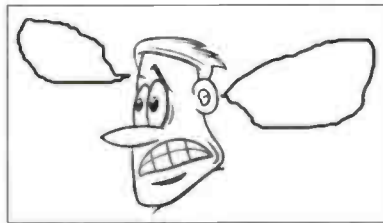
Radio provides entertainment, talk, information and of course a critical link to weather and other services demanded by the public. All in all, the FCC declares radio an essential service to the general public. This was made very clear over the past year of Covid lock down. We *must* stay on the air.

The lock down hurt many small market stations more than other businesses, since radio thrives off the success of these community businesses. In a small market, by its very definition, that means the pickings are less. For radio stations in these small markets, essentially, the only hardware store is closed, the only four restaurants are closed and the scenario repeats itself in the next small market town. Encompassing your coverage area, that's most of the advertisers that are paying your bills to stay afloat. For a time, almost every business was either closed or on limited hours. All advertising was basically shut out of the budget. Let's face it, no people are coming into these stores and they just don't have the money to advertise. Like the old saying goes, "If you have to cut expenses, the ad budget goes first."

When the FCC made it mandatory that broadcasting stay on the air, for some small market stations, this became a serious problem. Staffing and people not coming in to work became critical. There are only so many radio services that can be done, working from home. Our

small market sales staff did not want to have face to face contact with clients during this period. There are only so many sales that can be closed by email and telephone. Most clients just said ... *No*. So many of these small market stations lost thousands of dollars and have no way to recover that loss. Some operators reduced staff and learned new ways of saving cash. For some, payroll became financed by government PPP loans just to stay on the air, as the only essential service in some areas. Most of these loans were forgiven which helped some of the pain go away.

So here we are one year later. It feels like we are digging out from a hurricane disaster. Businesses are trying to open since most of the mandates have been lifted. Many small market business cannot find help to reopen. Of course the stupid unemployment \$300 political bonus just made things a lot worse for these businesses. Why work when employees can stay home and collect the same money for doing nothing. A ride through a typical small market town has a fleet of "Help Wanted" signs on every door. Even fast food



restaurants are having to close during the day – they just can't find enough help. This translates into loss of revenue for the local radio stations in so many small markets. When will this come to an end and life return to normal?

The news is also full of scary political proposals such as raising the corporate tax on businesses. What will that do? Just make it harder for small market businesses to recover and get back to normal. This will affect our radio station's bottom line. No one needs more expenses, especially now. Many stations, due to budget restraints put off buying equipment and repairs that now must get done. Engineers are getting hard to find these days, especially in small towns. I've heard stories of stations having to import engineering services from five hundred miles away. That only makes the bills big, but also calls out the critical need in these broadcast markets.

Recently, the car dealers are now cancelling ad contracts because they cannot get any new cars. Yes, some 89 cent chip, made in Japan, is stopping thousands of cars from being built. No cars, translate into no sales, and car dealers cutting ad campaigns. The sad part is that most car dealer packages are pretty hefty and this really hurts small market radio.

So small market radio is facing the brunt of the lock down. Many stations have simply gone bankrupt through no fault of their own. When businesses won't advertise, there is simply no revenue coming in the radio station door. As I'm writing this, I'm hearing on the news that there is talk of a second Covid strain, more mask mandates and the possibility of a second shut down. When does this come to an end? Small market radio has never faced so many challenges to just survive.

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

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- CRITICAL GENERATOR MAINTENANCE** (1:11:52)
- AUDIO BUILDERS WORKSHOP** (1:15:14)
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Air Cooling Blues – Part Two

by John L. Marcon, CBRE CBTE 8VSB Specialist

In Part 1 (*Radio Guide May/June-21*), I talked about two types of set-ups for a transmitter room air cooling system. The first one described the closed loop where the air coming out of the transmitter exhaust is circulated inside the room. The second one was about the open loop where a blower draws air from the outside to cool the transmitter and the hot air from the transmitter exhaust is ducted out of the building.

In this second installment, we will look at the effects of inadequate cooling on a solid-state, air-cooled transmitter. The tricky part of this story is the fact that the transmitter was OK in the beginning but, as the months went on, some components on the amplifier circuits started failing and no one knew why. There were other problems unrelated to cooling but they were ironed out during the warranty period. The long running issue were the overheating RF transistors and electrolytic capacitors.

The transmitter consists of three cabinets and two blowers. The first and second cabinets share one huge blower while the other blower is on the third cabinet. There has been an unintended consequence with this arrangement, which we shall see later. A cabinet contains eight power amplifier (PA) modules with eight push-pull Field Effect Transistors (FETs) per module.

Even after a few months after the installation, the engineers noticed that some transistors had higher flange temperature than the others. While many were in the high 60s °C or low 70s °C, there were transistors with 85°C (185°F) temperature or higher. Upon inspection, we found out that the drain leads (terminals) of these FETs were burned. The drain lead connects to the output combiner circuit of the module.

We initially considered all the possible causes of the failures, not just the cooling part. We thought that the problem could be due to oscillation, poor connection, or a case of premature device failure. Destroyed capacitors can be caused by overvoltage. However, this was unlikely because the other capacitors were OK and they share a common power supply, and the damaged capacitors were only on certain places. With a high temperature on the pallets, the capacitors reached their end of life much sooner. A consequence of a capacitor failure was that it also took down the connected transistor. Transistors failing early can also be due to a bad batch in the manufacturing process. Also, the failures would happen maybe one to three times and then it would be quiet for a long time. In our case, the faults were more than three times, as we shall see later. It also seemed to happen at random.

Soldering and Thermal Compound

We ordered new soldering tools, with new FETs and capacitors to replace the defective components. While we were doing this, I noticed that the thermal compound underneath some of the FET flanges had dried out. Sure enough, when we used new thermal compound, some of the modules' RF output improved.

However, even after the repair, the transmitter could not be pushed to more than 87%. Pushing it higher, even for a few days, would result in transistor failures.

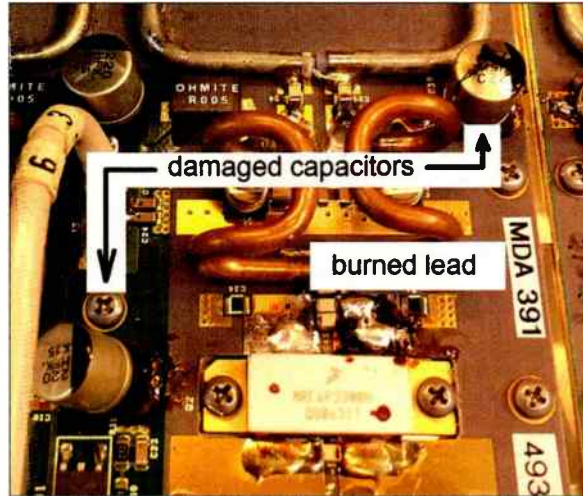


Figure 1: Burned transistor lead and destroyed power supply capacitors. Amazingly, after I cleaned and re-soldered the leads, the FET still worked.

Another thing we noticed was the incomplete surface solder on some of the gate leads. As shown below, in **Figure 2**, the solder did not spread underneath the terminals of the FETs. Soldering these surface mount type components is usually done in bulk, and wave soldering was often used in bulk PCB soldering of big components.



Figure 2: With the FETs taken off, we noticed that there was no solder under the gate leads. There was also one solder joint that cracked. Thankfully, it worked fine after we re-soldered the joint.

I am uncertain whether incomplete surface soldering can happen in wave soldering, so it may be that they soldered these manually. However, doing it manually would be too laborious because of the quantity of the boards. It may also be that the soldering tip might not have been hot enough. In the end, we do not know what really happened here. However, most of the FETs do have good solder connections.

Airflow and Temperature on the Heatsink Fins of the PA Modules

The next thing we looked at was the airflow and temperature on the heatsink. Each one of the PA

modules have four pallets mounted side by side on a heatsink base. Pallet 1 is in front followed by 2, 3 and 4. As per record, there were six failures in pallet 1, eight failures in 2, also eight in 3, and fifteen failures in pallet 4.

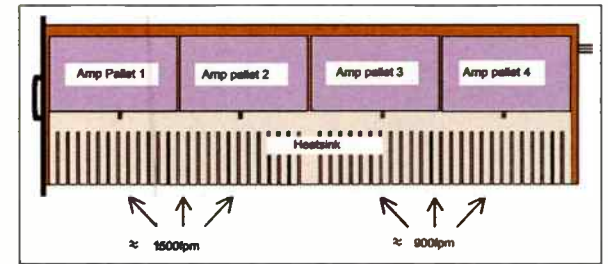


Figure 3: A power module with four amplifier pallets. Airflow in feet per minute as measured from an open slot.

I needed to know the relative temperature along the heat sink. The temperature of the FETs are displayed on the front panel but this was actually for pallet 4 only. The actual temperatures of the other three are not on the screen. Since it was not possible to do readings with a thermometer when the PA module was plugged in, I did it immediately after the module was pulled out from the cabinet. The readings showed that the heatsink at the end was indeed hotter than that at the front.

We then looked at measuring the airflow going into the heatsink structure. As we can see from the drawing above (**Figure 3**), it shows that the airflow on the first two pallets was much greater than that of amp 4. This fact correlates with the high temperature reading on amp 4 and the number of faulty FETs that we recorded. In short, the lesser the airflow, the more failures occurred. The temperatures would have been worse except the transmitter was unintentionally operated at a lower power for some time – the readings would have been higher if it was running at full power.

Why was the airflow not uniform throughout the length of the PA module? The search for the answer began with the centrifugal blower. Centrifugal blowers are used in duct systems with high static pressure. In comparison, axial blowers easily lose airflow when used in high static pressure load. While the centrifugal blower has a relatively more stable airflow even at high static pressure, the air coming out of it is actually uneven or not uniform.

I believe that the designers knew about the weak airflow at the back pallets. In fact, the flange temperature sensor is connected in pallet 4 and this was the hottest part of the module. They may

have assumed that if the temperature on the last pallet was OK, then the rest of them should also be OK.

The illustration in **Figure 4** (next page), shows the airflow leaving a fan did not reach a uniform flow profile until several duct diameters from the outlet area. The first few feet of the duct should be straight and must reach 100% effective duct length to achieve uniform airflow.

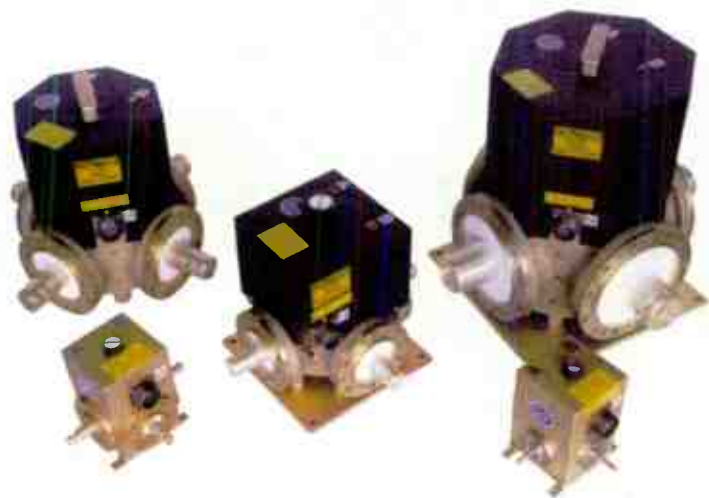
For 100% effective duct length, the formula is as follows: $L = (fpm/1000) \times (\text{duct diameter})$. At 5,022 total cfm (cubic feet per minute) airflow volume and 1.5 ft diameter duct, 100% duct length = 4.2 ft.

(Continued on Page 42)

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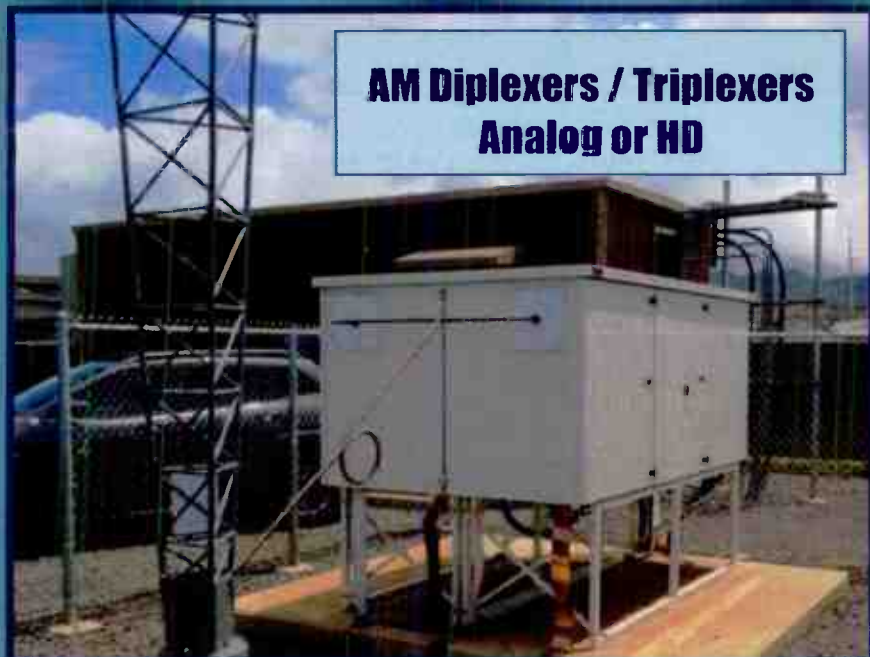
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– Continued from Page 40 –

The straight section in our transmitter is much shorter than this length and in fact, there is an elbow downward right after the blower. In addition, before the air reached the amplifiers, it had to go through the power supply, combiners, and so on. These all contributed to the non-uniform airflow.

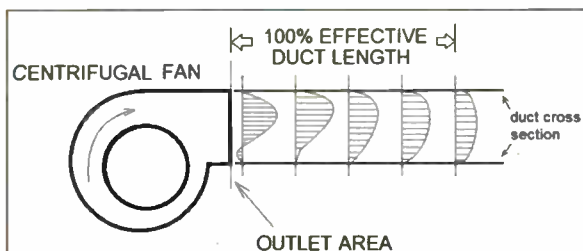


Figure 4: Airflow characteristic of a centrifugal fan.

There has been another consequence from this uneven airflow. We would think that the airflow from the one big blower should have divided equally between the two cabinets. However, the airflow in cabinet two has been 600 cfm less than the airflow in cabinet 1 (Figure 5). As a result, cabinet two temperature has been 4.5°F higher than cabinet one. We do not know why they used only one blower instead of two but it was possibly for economic reasons. However, if there were a blower for each one, there would be equal airflow on the two cabinets.

Upon further analysis of the complete cooling system, we figured that the AC needed to be replaced with a bigger unit. With a new AC, the flange tempera-

ture of the transistors improved, and the amplifiers became more stable with this change. Thus, despite all the problems with airflow, and the soldering of the transistors, the situation was better.

I also replaced all the capacitors, since most of them were also affected by the high operating temperature. A good but unintended effect of all the work was that we have become more skilled in repairing the modules.

Despite the cooling issues, I believe that the amplifier boards were well designed because it has become more reliable since the replacement of the air-conditioner. The driver, pre driver, and Pallet 1 amplifier, all in front, in all of the 24 modules, have been near trouble-free in the 12 years that this transmitter was in service. I believe this is another proof of a good amplifier design. In this regard, if the modules had stronger airflow at the back, would it have reduced the failures? What if they used a bigger blower? Certainly, re-designs would require more resources and engineering time, which they may not have had back then. The way the combiner and power supply got in the way of the flow of the air, it was just hard to make a uniform airflow for the modules.

John L. Marcon, CBTE CBRE 8VSB Specialist, is the Chief Engineer for Victory Television Network (VTN) in Arkansas, with international experience in both Radio and Television Broadcast, and has an Electronics Teaching background.

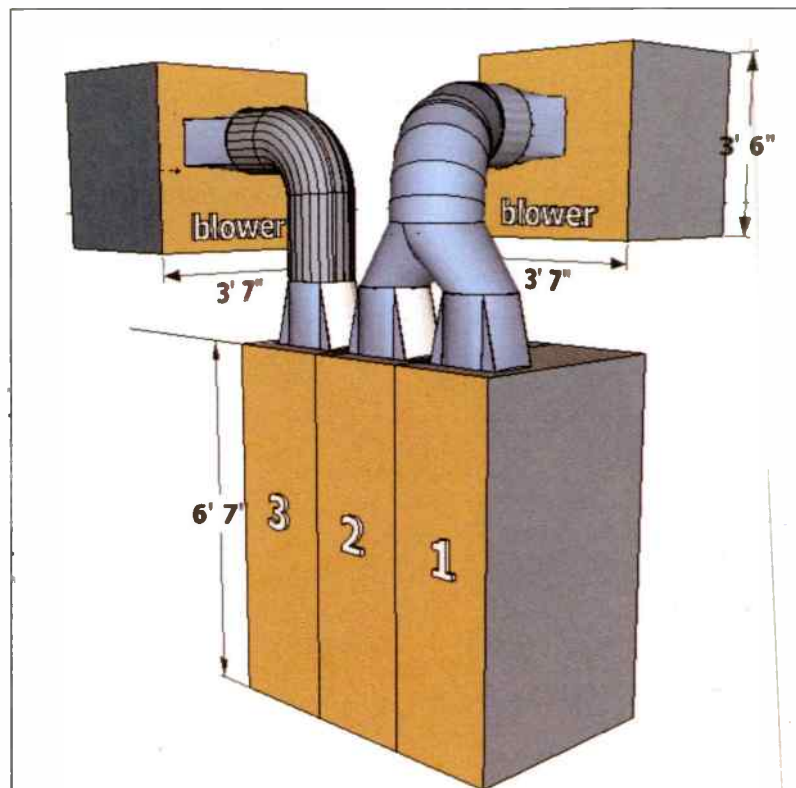
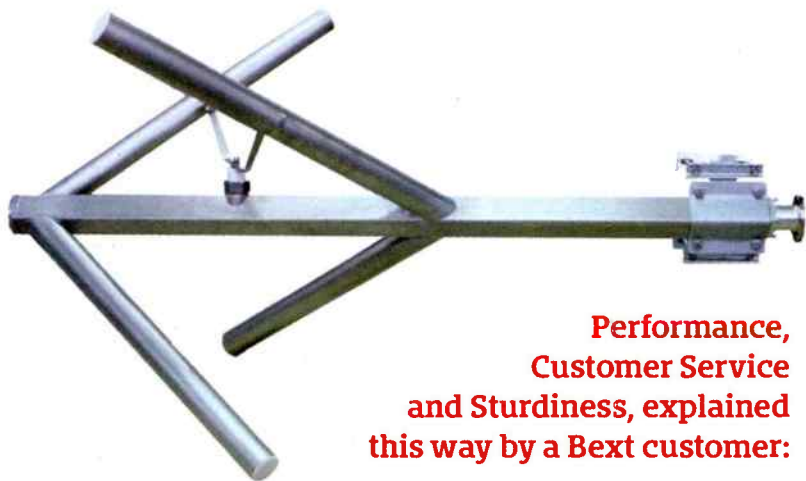


Figure 5: The short duct between the blower and transmitter cabinets 1 and 2 resulted in uneven airflow and as an added consequence, the split of the airflow between cabinets 1 and 2 was also uneven.

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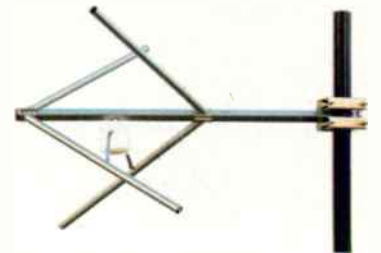
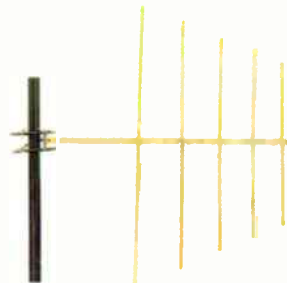
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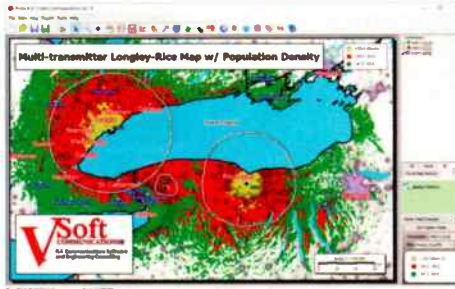


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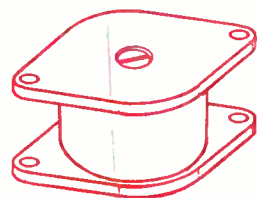
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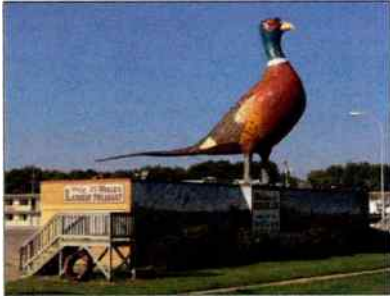
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Everyone loves a good story, and as true success stories go, this is one of the best I've come across. Our story starts in Huron South Dakota. According to Wikipedia, the greater Huron SD area is now home to about 30,000 people and also home to the world's largest pheasant. I couldn't resist including a photo.



Huron has three public elementary schools, one middle school, and one high school.

It's 1994 and Huron High School is where we meet student John Small. Huron is also home to Radio Stations, KOKK, 1210 kHz and KIJV. John managed to land a job on air, on he afternoon Oldies Show on KIJV while still in school, but his interest in radio dated back to a fifth grade field trip to KIJV. When he got his first job at the station, the news director said that he remembered John from the field trip. John recalls asking him how he could remember one kid out of the whole group. The KIJV News Director replied, "You asked more questions on your own than any other entire class tour." Our story will circle back to KIJV later.

After High School and like the Harry Chapin song, *WOLD*, John Small worked for several Mid-West radio stations. He's been the morning man, the program director, a salesman and eventually working up into station management – always with an interest in engineering. John said he knew just enough about technical stuff to "keep him in trouble," as he put it during our interview. It was a move from South Dakota to Iowa that might have been fate or destiny, for it was there that John met Heidi. I'm not sure of the exact timeline but we know that John and Heidi became husband and wife. After that, a job in Nebraska radio added to his resume, and it was back to South Dakota.



Heidi used to "play radio" as a child and for her pretend radio station she picked the call sign KZOY. Fast forward to 2010 when dreams started coming true for the Small couple. They bought an AM Daytime radio station in Sioux Falls, they added an FM Translator at the same time and yep, you guessed it, they got the call letters, KZOY, aka: Sunny Radio, Faith, Freedom and The Best Music From The 80's & 90's.

The station had in place some fairly old equipment including a Harris MW-1A Transmitter. I found a picture on the net. This is not a photo of KZOY's unit, but it was actually a photo from WINE in Connecticut. Photo courtesy of website: <https://www.engineeringradio.us>

If you'll indulge me a short side-story, I was fairly new to engineering when I had to install a brand new Harris MW-1A. The older tube Gates transmitter was fried and we could only coax 79 Watts out of it using a vacuum variable capacitor we borrowed from a local HAM operator. We waited for weeks for the new transmitter to arrive. I took the manual home and studied every page, then one night, went to the transmitter site to install it. The install went smooth and seamless until I powered it up – it was on the air, I could hear the carrier, but not one meter was operating. I lifted the top meter bridge and looked inside. All the wires were in place, so I called the factory and was transferred to the overnight on-call engineer. After spending three hours on the phone trying everything he suggested, he finally said, "Did you remove the meter shorting wires?" "Meter shorting Wires," I echoed. I swear there was no mention of this in the book anywhere, but I looked closer this time and hidden at the very top of each meter there was a black in color, small stiff clip across each meter, shorting it out. I flicked them out with my needle nosed pliers, and I'll admit to saying some not so nice words as I was doing it. I fired it up and all the meters came to life. Back on the phone I reported success but that those instructions were really not anywhere in the book. He said, "Oh yeah, we ship all new transmitters with shorting wires."

Back to our Small story, John told me that their MW-1A was struck by lightning in 2013, so they took this opportunity to replace it with a new Nautel J-1000 and they updated all of the audio chain at the same time. The J100 is a rack mountable, small format AM transmitter which can be field tuned to any frequency. It has great sound and is very dependable, however I have one complaint about it. The

center front cover must be removed fairly often to clean the little foam air filters. I think Nautel should consider an update to the way the cover is mounted.

Their FM translator was originally 99 Watts on 92.1 FM and they accomplished that with a Crown 250W transmitter. In 2016 they used the 250 Mile rule to move to a different frequency and increased power to 250 Watts. Now at 93.3, they have a BW Broadcast 600W transmitter that kicks out great audio to their Armstrong antenna.

When the Smalls bought the station in 2010, their friends encouraged the couple to work together, because they have such a fun give-and-take type of chemistry during their conversations. They started doing a live morning show together and while John was a seasoned air talent, Heidi had never worked in radio, let alone being on the air. The "Husband and Wife" morning show was a hit locally and many people could relate to their relationship. An opportunity for expansion came along in 2014 when they purchased a station in Sioux City Iowa. Suddenly they needed to provide programming to the new location and John got the idea that perhaps other stations would like to take the "Husband and Wife Morning Show."

John made a half dozen calls to radio stations and CloudcastRadio.com was born. The show elements started sharing with an FTP delivery and now is also available on Dropbox.

It all started with "The John & Heidi Show" but now they also offer shows from Cindy Scott, Chris Russell and Terry Dean. These shows offer 10 breaks each weekday, while the John and Heidi show offers 12 breaks each weekday and a weekend version that can run on Saturday or Sunday. All on a barter basis with details at www.cloudcastradio.com Remember KIJV in Huron? They also are now taking the John & Heidi Show.

"The John and Heidi Show is on about 275 stations today from AM & FM stations to LPFM and even Internet stations. Most of these stations are in the United States, but we have a few in Canada, England, Australia and New Zealand. We also discovered that we're on at least one station in Africa," John stated.

Now you know why Small has made it Big. He also offers a couple of short form shows like the one minute "Market Beat" and "Motivation Minute," both of which I added to the format of KHJ FM, the LPFM I operate in Albany OR. www.khjf.com is the website.

Ron Erickson may be reached at 541-460-0249 or at ronerickson@gmx.com





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The studio side of CallMe is this brilliant little box. Notice the lack of buttons and screens? There's nothing to adjust, no menu trees to climb, no parameters to twiddle. That's because it's designed to do exactly one thing: make fast, flawless IP audio connections. And the sound quality is amazing, thanks to the OPUS algorithm. Rock-solid, reliable, and ready for air.

And since you're wondering, yes, CallMe is compatible with pretty much all of the other codecs out there — even those needlessly complex and expensive ones.

Visit AngryAudio.com/callme to learn more.



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