Radio Guide

Radio's Technology Resource

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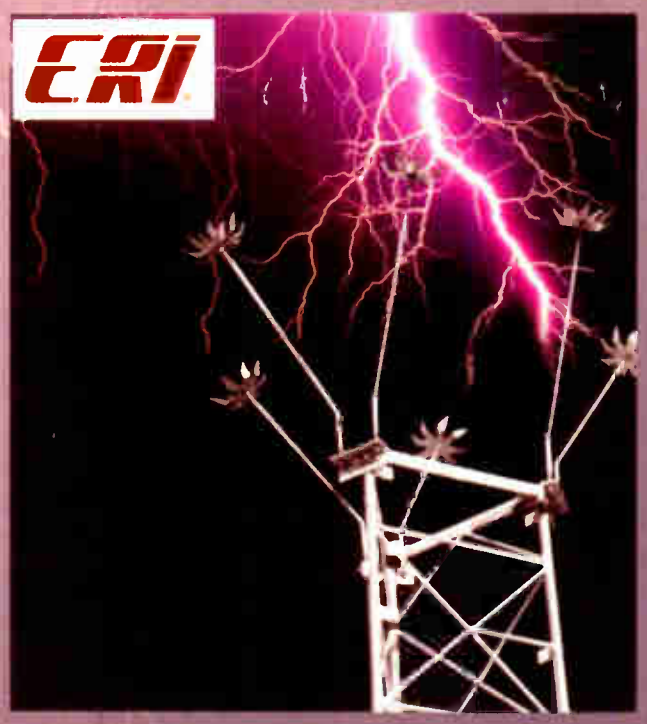
August 2003
Volume 11 Issue 8

Nature's Awesome Power



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Radio Guide, ISSN 1061-7027, is published monthly, 12 times a year, by Media Magazines Inc., PO Box 20975, Sedona, AZ 86341.

Columns & Articles

Radio Guide

Volume 11 Issue 8
August 2003

Goodness, Gracious, Great Balls of Fire

Page 4 – Blue balls of fire, and part failures by the dozens. This is life at a Tampa Bay transmitter site, during the lightning season.

Here are a few tips on how to prevent or limit damage from surges and lightning.

DA Low Down – Part 3

Page 10 – Planning the layout and design, bidding on phasing and coupling gear, and finalizing building plans.

Audio Processing – Part 8

Page 14 – Digital Signal Processing (DSP) design considerations. Sampling, resolution, aliasing, and oversampling are all discussed.

Networking 101 – Part 7

Page 22 – Tren Barnett discusses using command line utilities. Useful operations from the C:\> prompt screen.

Our thanks go to ERI for the front cover inset photo of their lightning spurs

Also to www.strikingimages.com for the cover lightning photo. Check their website.

A Collaborative Process

One theme you will see repeated over and over in **Radio Guide** is that radio engineering is a community. Sure there are corporate imperatives, competitive issues. But the bottom line is that we all have the same goal: producing the best audio possible for our dual masters – the station management and the listeners.

Continuing education is essential, whether on the RF side or the computer technology. With the increasing workloads laid upon broadcast engineers, finding the time – much less the energy – to get that education is getting harder and harder. Mentoring and intern programs are fading away. Budgets to send engineers to the NAB and SBE conventions seem to be coming up "zero."

We view our mission is to be helpful in putting information in your hands that will help you do your job today and tomorrow. The historical articles and "war stories" are also of interest, we hope. But dealing with today's issues has to be our focus.

To achieve that goal, your feedback is of great value. After all, you know if the articles in **Radio Guide** are useful to you. We are gratified to hear how many of you look forward to reading each issue. And our advertisers also appreciate your support as they, in turn, make it possible for us to publish.

But what about those topics on which you would like to see more written?

This is where we invite your assistance. Tell us what you need to know. Even better: share with us some of your observations and experiences. If you are nervous about tackling the writing of an article, thinking you are not good enough, stop worrying! We will help you communicate your story. Let's have some fun! After all, it is a collaborative process.

Goodness! Gracious! Great Balls of Fire!

by Donald Kimberlin, NCE

[Along with warmth, vacations and mosquitoes, summer often brings rains and those light shows that cause us to hold our breath and double check to see if the pager or cell phone is working. Sometimes it seems like those tall pieces of metal stuck into the sky are just asking for a "hit."

Yet, without them, few people would hear our product. Can we co-exist? In this series, Radio Guide pauses to appreciate the power and glory of lightning as well as the dangers, and what can be done to protect all those microprocessors (and people) near those sticks. Ed]

[LANDIS, North Carolina – August 2003] Long before there was Disney World, life as an AM transmitter operator in Florida's Tampa Bay included a live daily electrical show – you could set your watch to it at 3 PM. The breezes would slow to a stop; the semi-tropical humid air would boil up into anvil-shaped cumulonimbus clouds. And then the heavens would open up into a combination of blindingly thick walls of water and multifold lightning bolts!

When I took up the job, the wizened souls who already worked there seemed completely blasé and took it in their stride. No way would Florida Power be able to keep the juice flowing, so cranking the generator, shortly after the clouds were seen moving in from the Gulf of Mexico, was routine. In fact, we would often switch to generator power during a station or commercial break, simply to avoid a program break.

When the clouds arrived, the show would begin. Perched along the Gandy Causeway, WTSP (5 kW DA-N) had a 455 foot, 225 degree central member, and two 90 degree members added for night operation, which of course floated in the daytime. It was not unusual for the tall tower to take 25 hits or so during the half hour of violent weather each day. The thunder was deafening, largely because the base of the 455 foot tower was just 50 feet from the open back door of the transmitter building.

RCA BTA-5F ... Photo: Jim Bender

Both the AM and FM transmitters cycled off and on repeatedly, sometimes in step with the repetitive pulses of the instant lightning bolt. Those strokes were often so strong they would divide into several forks and repeatedly hammer all three towers for five or ten seconds.

Over the course of years of experience, the wily WTSP crew had reworked and overworked the bonding and grounding in and around the whole building, to the extent that most of the lightning had a place to go outside the building. Unfortunately, that did not keep some from getting into the AM transmitter's RF amplifier cubicle, where a buzzing volume of ionized air emitted a nasty atomic-like pulsating purple-blue glow.

Occasionally, the entire cubicle would fill, and a buzzing ball of blue fire would emit from the crack of the door closure, rolling across the asphalt tile floor, spitting and buzzing until it hit the far wall and burst into nothing with a sort of "Piff!" sound.

At the time, there was a Western Union clock on the wall opposite the transmitter control desk above the FM transmitter's face. When lightning hit the telegraph line that brought in time setting pulses, the entire clock would take on a buzzing blue glow of ionized air. Its appearance was like some fiendish device in Doctor Frankenstein's Laboratory.

SPARE PARTS

Parts failures? By the dozens. Parts that never seemed to fail in other areas of the nation: Like rectifier filament transformers, control relay coils, heavy 1940s-50s steel boxed, iron-cored power supply chokes and blower motors. The loss of chokes, transformers and motors was so common at our plant and all the others in the area that we all relied on Tampa Armature Works' stock of rewound units on hand for the broadcasting stations of the state. We lost mica transmitting capacitors and 200 watt resistors by the box full, and vacuum capacitors really were not much relief. (Blown-up Faradon capacitor filler was really messy, sticky stuff to clean up, let me tell you!)

Yet, so far as I knew, this was normal life for everyone with a similar job nationwide. Only after WTSP was sold to some Northerners, and their VP of Engineering came to town, did I begin to realize Tampa Bay was in the lightning epicenter of the United States. He was in town one August afternoon and happened to be in the transmitter building with me when the show began.

I was, of course, seated behind the steel transmitter control desk, pushing reset switches and scribbling transmitter log entries. I eventually noticed he had backed himself up on tiptoe into the steel cabinet racks behind the desk, and that all his color had drained to his feet. As I asked him what was wrong, he pointed at a blue fireball rolling across the floor and exclaimed, "What happens if you touch one of those things?" My candid and truthful answer was, "Golly, I really don't know. I never tried to touch one."

Now, if you live in coastal California, you might say, "Don, your imagination is working overtime." That is because the US West Coast has one of the lowest incidences of lightning in the world – an average of only 5 days per year with any lightning. But Tampa Bay has more than 100 lightning days a year.

Later, when I changed careers to go to work for AT&T's (then monopoly) Long Lines Department, I saw a US map called an isokeraunic chart. In the years before weather radar and lightning detection networks, one of the records weather observers kept was a notation if thunder was heard that day. Since the sound of thunder typically can be heard up to about ten miles from its source, it meant the charts had large blank areas for places in which there were no weather observers within ten miles.

Isokeraunic charts have obviously become much more detailed and accurate since then. They used to show a line that encompassed Interstate Highway 4 from Tampa Bay to Daytona Beach as having more than 100 thunderstorm days a year. That line is more detailed today, but Tampa Bay remains as the Lightning Capital of the US.

RISK FACTORS

There are several factors to consider about lighting risk, and frequency of activity is but one of them. If you look northward on the charts from Tampa, the entire Southeastern US steadily trends down in frequency until a level of about 50 days per year is reached in the Carolinas. However, the soil conductivity up there is something like 30 micromhos, giving that lightning far less "drain" to dissipate itself. The net result is a similar potential damage risk for the entire Southeastern region.

And tropical weather is not the only cause. Dry air can sometimes cause incredibly high static buildup. There is an area in Arizona where isokeraunic charts show 60 days of activity per year. I have been told engineers there commonly see balls of St. Elmo's Fire atop towers, and arcs approaching 150 feet in length between towers have been seen. When a spark gets that much voltage behind it, damaging currents can be induced in wires for a large nearby area. True, the Arizona lighting arcs may not build to the monstrous 200 kiloamps of a large Florida bolt, but their effect may be just as destructive.

Why? Because soil conductivity is what controls the quantity and rate at which the earth can dissipate the lightning. It is a whole lot easier to get 5,000 micromho southeastern saltwater swamp to dissipate lightning than 10 micromho desert sand or Vermont granite. Thus, even though the lightning might be less frequent and even smaller, its damage can easily be as large, simply because at best it has nowhere to go.

All of this makes understanding how to avoid damage a complex and variable picture. It is clear the primary defense is bonding and grounding. If lightning hits, your best defense is the lowest impedance path to earth you can provide for it. Lacking that, the lightning will create its own path – usually by destroying something you did not want destroyed. The damage might appear to have been capricious, but if you really understand the issues and investigate what happened, you probably can devise a change that will offer the lighting a less harmful way to dissipate itself.

DE-FENSE DE-FENSE!

Still, that is only part of the story. It can be just as important to make your plant less attractive to lightning in the first place. Over the past half-century, many studies and improvements have been made to the understanding of just what attracts lightning, and lightning avoidance can in many cases be very effective. A special separate Lightning Code, Part 78 of the National Electrical Code, has existed for some years. It offers descriptions of how to handle lightning and how to minimize exposure by placing "air terminals" on buildings. You will see these on the roof parapet of new buildings these days.

There have been a number of significant proofs of the effectiveness of air terminals. Perhaps most spectacular is the dissipation array festooning the 13-story-high Space Mountain at Disney World right in Florida's lightning alley. If you had not been told about it, you would probably never notice the carpet of spikes atop Space Mountain. While Disney's Fairy Tale castle a short distance away gets its pointed spires blasted regularly, Space Mountains' grounded, many-spiked dome has never been hit.

(Continued on page 6)

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Goodness! Gracious!

Continued from page 4.

It simply offers no single point to attract a hit. Similarly, during testing of the efficacy of air terminals some years ago, a direct comparison of lightning hits to the twin towers of the World Trade Center showed no hits to the tower with air terminals, while the unprotected tower took multiple hits.

AM broadcasters have some very simple first lines of defense to employ. You should have some form of series reactance, even down to a one-turn loop in the tower RF feed, in every wire going onto

the tower. And, you should have a spark gap across the tower base set nice and close. Some broadcasters set their gap by modulating the transmitter 100% with tone, tapping the base gap together until it arcs over from the transmitted signal, then tapping it open enough to break the arc. Those operators also polish the gap (with the transmitter off, of course!) to keep it from growing "whiskers" which would close the gap. The overall result will be a tower base gap much closer than any textbook setting you were taught.

Lightning avoidance techniques may well have a place in your plan for protection against lightning damage or interruption. But, let us look at a different line of defense that many people mistakenly think is the first and only one: surge suppressors.

Surge suppressors are used to reduce the pulses conducted in on your power and phone lines. (If lightning actually hits the power or phone lines near your plant, the conducted pulse will likely be so huge it will probably destroy the wire itself as well as any surge suppressor.) You can really only expect surge suppressors to be capable of conducting pulses induced into the wire by nearby strikes.

Worse, if you do not or cannot give the surge protector a low-impedance path to ground, its effectiveness can be reduced to worthlessness. Fight off the obsessive tidiness of coiling up surge suppressor power cords. If the only ground path you can provide is a power receptacle's AC power ground filled with twists and turns, safely housed in nice steel tubing or BX that makes it into a nice series inductor, you can forget what suppressive value your "surge protector" might have!

Intervening years since the start of this story have seen a panoply of test and measurement methods to evaluate and quantify the risk of lightning damage at any given location. Indeed, one can spend many thousands of dollars for a lightning risk audit. That would be prudent. But, by learning just a few simple precepts about the nature of lightning, you can reduce the potential or the recurrence of lightning damage where you work.

WHAT LIGHTNING IS

Basically, lightning is simply a giant Low-Frequency flow of pulsating Direct Current electricity. Where an engine starter motor may draw 500 Amps at 12 Volts and melt connectors with the slightest resistance, a small lightning bolt is probably a current of 10,000 Amps at several million Volts. In other words, even the smallest lightning bolt is gigantic. And the "big" ones? They have been calculated to run up to 200,000 Amps.

Impossible to handle, you say? No more so than handling an 800 pound gorilla. It will go where it wants to go, but *if you give it an easy path to take, it will choose that path*. The lesson: Make ground wires short, straight if possible. Leaving a drip loop in an outdoor ground wire is lighting suicide. The lightning will not go around the corner. It will simply jump to some other nearby convenient path, and usually do some damage while doing so.

The simple way to understand what happens is to follow the principles we all learned from Michael Faraday and others: There is a magnetic field that surrounds a wire conducting electricity. When that electricity is lightning, the field is enormous – for an instant. The wire has incredible amounts of self-inductance – for an instant.

The enormous magnetic field surrounding the wire induces large currents in everything else near it, so everything in the vicinity is suddenly charged. Since the amount of current induced in all those nearby things – even electrical power boxes themselves – varies widely from device to device. All manner of secondary arcs can occur in devices that were not even hit.

That is why a massive, low inductance ground is essential for lightning protection. Your objective is to try to get and keep everything at the same low potential. Perhaps a short "war story" will illustrate:

INSTALL A GOOD GROUND

One location I was called to had a computer RS-232 line run from its newswire satellite receiver in one building to its printer in another a few hundred feet away. (Yes, 1200 bps async data can be run for significant distances – possibly as far as a mile – using RS-232 interfaces.) The problem was that the connection kept blowing up the little IC chip driver/receivers used in RS-232 interfaces. "Why," asked the locals. "Did the interface cable not have a common ground wire in it?"

Yes, it did. But that wire was only a 24 gauge solid copper conductor, and any currents induced in it would drain to earth through the chips. They could really only handle about 50 milliamps of current to ground. The actual devices never got hit. All the lightning in the area hit other things, but it blew those chips due to currents induced in the signal return "ground" wire of the RS-232 cable.

The solution was to bond the power ground terminals of the two buildings together with a Number 8 AWG wire to meet the National Electrical Code. Lo and behold, after that wire was installed, not only did the RS-232 failures ceased, but a variety of other strange failures ended, too – like light bulbs that burned out if lightning was in the vicinity.

Tidy electricians, and even tidy engineers cause one lightning bugaboo that is often seen. They will dress wiring and power ground wires with nice, square bends along walls. If you have seen much lightning damage, you have seen the burns where lightning jumped across the square bend, or even jumped off the wire onto a nearby wire to change its path to ground. It usually causes some damage in the process. So, undo those nice, tidy square bends. Change them into nice, gradual turns with very large radii. The larger the radius, the less likely you are to have lightning damage where you least expect or want it.

Therefore, keep an eye out for tidy but long extension and power cords. Neatniks will obsess over messy cords and coil them up out of the way. It is possible to create an reactance of one Ohm in a coiled up cord that is 50 feet long. A simple Ohm's Law calculation shows that one Ohm of reactance to just 10 Amps of induced current can produce 10 Volts for a few microseconds. How long would you expect a microphone to survive if you plugged it into 10 Volts? One microsecond? Ten microseconds? Does it matter? The microphone died and nobody knew why, because the lightning hit the next building – or "the tower took it."

Finally, if your protective ground system has been doing its job, its connections will actually get heated, and will develop a carbon layer in the joints that must be cleaned. So, all the connections and joints of your protective grounds need regular inspections, with cleaning if carbonized joints are found. This might best be done with a megger or similar device, just for the sake of an accurate test.

While not every transmitter site gets to experience the Daily 3 PM Great Ball of Fire Display, there still are plenty of potential dangers to equipment and to people. So, to repeat the bottom line: Make all paths to ground as straight and short as possible, and then keep them that way. That is what those wise old owls in Tampa Bay were doing a half century ago, and it still works today.

Don Kimberlin is a NARTE Certified Engineer, based in Landis, NC. He has written on many technical topics, both current and historical, and loves to go hunting for history. You can reach him at dkimberlin@earthlink.net

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What is This Thing Called Broadcasting?

Radio History

And Now a Word From Our Sponsor

Part 13 of a Continuing Series

by Barry Mishkind

[TUCSON, Arizona - August 2003] It is the lifeblood of our industry, yet at the same time it is often the most criticized feature of radio programs. Listen to your favorite radio station, and before long you probably will hear it: the commercial.

Without commercial advertising to support it, radio broadcasting in this country likely would have taken an entirely different direction, perhaps similar to some of the systems in countries funding broadcasting from receiver licenses or other tax revenues. Some might disagree, pointing to the BBC, other state broadcasters, or even NPR as examples of quality programming accomplished without commercials.

But the robust experimentation and creativity that characterized early broadcasting in the US simply would not have been possible if all programming were controlled and administered by government bureaucrats. (Even the BBC had to reach "out of their box:" BBC Radio One was a reaction to American style broadcasting from the North Sea.)

Indeed, when Secretary of Commerce Herbert Hoover convened a Conference on Radio Telephony in early 1922, to address various issues affecting the fledgling broadcast industry, program content and advertising were near the top of the list.

NON-COMMERCIAL BIAS

The Conference favored a total ban on "direct" advertising. Summing up the general view regarding broadcasting in those days, Hoover stated: "It is inconceivable that we should allow so great a possibility for service, for news, for entertainment, for education, and for vital commercial purposes to be drowned in advertising chatter."

You will notice the word "commercial" is used in contrast to "advertising." Although the Department of Commerce licensed "commercial" stations in the early 1920s, the word "commercial" was not synonymous with advertisement as it is today. "Commercial" was more closely related to "enterprise." Hence, a commercial station was essentially a station owned by a business that made or sold products or services to the public. The first commercial stations were not even "broadcast" stations. They were used in the business of transmitting messages by wireless, not too different from telegraph companies.

Of course, the first broadcast stations were not initially constructed to make money from their broadcasts. They were built to attract attention to the owners' business – KDKA and WBZ's owner Westinghouse made receivers, WWJ, WGN and WSB's owners ran newspapers, WOR was built by Bambergers (a department store), Doc Herrold ran a College of Wireless and Engineering in San Jose, and so on.

Nevertheless, other businesses quickly realized the benefit of having their names attached to some of the programming attracting the attention of people all over the country. Early on in the history of broadcasting, Wiley Allen provided records for Doc Herrold's station in return for an announcement as to where the public could buy them.

Another music store, Remick's Music Store sponsored a weekly program on KFC, Seattle in March 1922 (No relation to the fried chicken chain). Listeners were invited to come by Remick's and purchase the songs they had just heard. On April 4, 1922, car dealer Alvin Fuller was purchasing time on WGI, Medford Hillside, MA. In time this activity came to the attention of the bureaucrats.

"STOP IT!"

In mid-April Department of Commerce (DOC) Radio Commissioner Charles Kolster wrote a "Cease and Desist" letter to WGI, demanding they stop doing "direct advertising," which was forbidden by Hoover's interpretation of the DOC Regulations. The advertising industry piled on: *Printer's Ink* editorialized "Handled with tact and discretion, radio advertising might become effective and profitable; on the other hand, it may easily be handled in such a way as not only to defeat its own purpose, but also to react unfavorably upon advertising in general. It will not do to forget that the public's good-will toward advertising is an asset of incalculable importance, and advertisers will do well to consider all side of the radio proposition rather carefully." Clearly, these folks never anticipated ten spots in a row!

With newspaper editorials and listener groups of the time echoing the attitude of Secretary Hoover and *Printer's Ink*, stations were cautious in presenting advertisements for businesses other than that of the station owners. But since all local stations originally shared a single frequency, shorter form advertisements would not have been efficient at that time anyway; advertisers would need to buy time on each station to ensure regular exposure.

An effective alternative was to sponsor a program featuring popular local artists, with the program itself carrying the name of the client. This worked reasonably well at first, when many artists appeared on radio to promote their other appearances, and were not a major expense for the station. But as radio became more popular, performing artists wanted larger payments for their work. This did not leave much from the sponsorship fees for the station. There were some groups willing to take up contributions to pay for artists on WEAF, in New York, for example, but other stations were worried, as there was not enough money donated to provide income for all the stations on the air.

In a kind of strange way, this worked toward reducing the clutter of stations in many cities; some companies decided the costs of their stations could no longer be justified, and either closed them down, or sold their time allotment to another station. That left the unpopular commercial announcements as income sources for the remaining stations, assuming they could get it past the DOC bureaucrats.

TOLL BROADCASTING

WEAF was owned and operated by American Telephone and Telegraph. Naturally, the folks there were acquainted with the concept of transmitting brief material for a fee. They looked at the airtime of WEAF as an extension of their long distance services, and came up with the concept of selling airtime in small segments to run advertisements, calling it "Toll Broadcasting." Among the urban legends in broadcasting is the erroneous "fact" that the first commercial was broadcast on August 28, 1922. Many books and internet web sites repeat this. However, as noted above, paid advertisements had aired earlier; the August 1922 date came from the book *"The WEAF Experiment"* which was written by an AT&T employee. While a lot of good information is in there, the book does shade things a bit in favor of AT&T.

Regardless of who was first, the The Queensboro Corp., sponsor of AT&T's was said to be very pleased with the results. WEAF moved to capitalize on this success and within a year had over 30 clients. And, as the other stations moved to emulate WEAF, who at least seemed to have enough "juice" to handle the government, AT&T tried to prevent anyone else from running commercials, claiming a patent on the entire concept of charging for announcements.

Well, as one can imagine, this started something close to a war among the competing companies. There was a great anguish in the press about this "monopoly" that AT&T was trying to set up and defend, as shown by its lawsuit against WHN for the purpose of getting the courts to certify their monopoly on radio advertising. The short story is that WHN's owners spent a lot of money and, to the relief of everyone but AT&T and the DOC, WHN prevailed, so the concept of supporting station operations by commercial advertising was available to all.

CREATIVE SALES AND PROGRAM EFFORTS

Despite the monetary opportunity, advertising was by no means an extremely lucrative proposition in the 1920s. The smaller stations scrambled in order just to survive. For example, KMED in Oregon would shut down and send everyone out to sell airtime. When they succeeded, they returned and put the transmitter back on.

Some stations became even more creative in seeking income. More than one religious program was suspected of being involved in the "numbers" game, and we do not mean ratings. Long lost to antiquity is the name of the person who first realized announcing certain scriptural citations at a certain time would give listeners the "number" of the day. Of course, from time to time regulators would discover the ruse and over the years a few stations lost their licenses.

National Prohibition was also a factor in the 1920s, leading to another novel scheme at a Seattle station well known to the authorities. KFQX owner Roy Olmstead never seemed to lack sufficient operating funds for his station. Although an ex-policeman, it was virtually an open secret that Olmstead was the "king" of Puget Sound rumrunners.

The Olmsteads maintained the station was built because wife, Elsie Olmstead figured Prohibition would not last forever. Elsie thought radio was "the coming thing" and a good investment. It had one of the strongest transmitters in the area, originally 600 watts, then more.

KFQX certainly benefited from Elsie's talents. She wanted to broadcast concerts, plays, and lectures to the community, and spent a lot of time developing quality programming and making the station popular. KFQX had the best of the local bands. Plush studios were built in downtown Seattle for this purpose. Remote lines were installed to broadcast dance music live from the clubs. Elsie herself became "Aunt Vivian" each night at 7:15 on KFQX's most popular program, reading bedtime stories for the children.

Or were they just bedtime stories? Somehow, husband Roy's booze boats managed to learn just when and where to unload their cargo of Canadian liquor. Was there a "secret code" in those children's stories?

In any event, time was running out for KFQX. Federal agents were closing in on the Olmsteads, anxious to stop their non-broadcast activities. One rainy Monday evening Elsie was doing the "Aunt Vivian" show with Nick Foster running the transmitter. Suddenly, Nick felt the cold steel of a .45 automatic on his neck. "Turn that thing off," said the man with the gun. And Nick did so without delay!

The commotion made the front page of the local papers, and in due course Roy Olmstead was convicted of liquor conspiracy and sentenced to four years at hard labor. KFQX survived however, leased out to Birt Fisher, who changed the calls to KTCL, then KOMO. (Over the years, the Olmstead station evolved into KFGA, KXA, KRPM, KMPS and now KYCW on 1090 kHz at 50 kW. Fisher went on to develop a different KOMO – but that is another story.)

So, the next time you hear programming "pause for these important announcements" think back to the time when broadcasters had to fight hard for the right to have them in the first place. It is a large part of what made broadcasting in this country the vibrant force that it has been for over eight decades. *– Radio Guide –*

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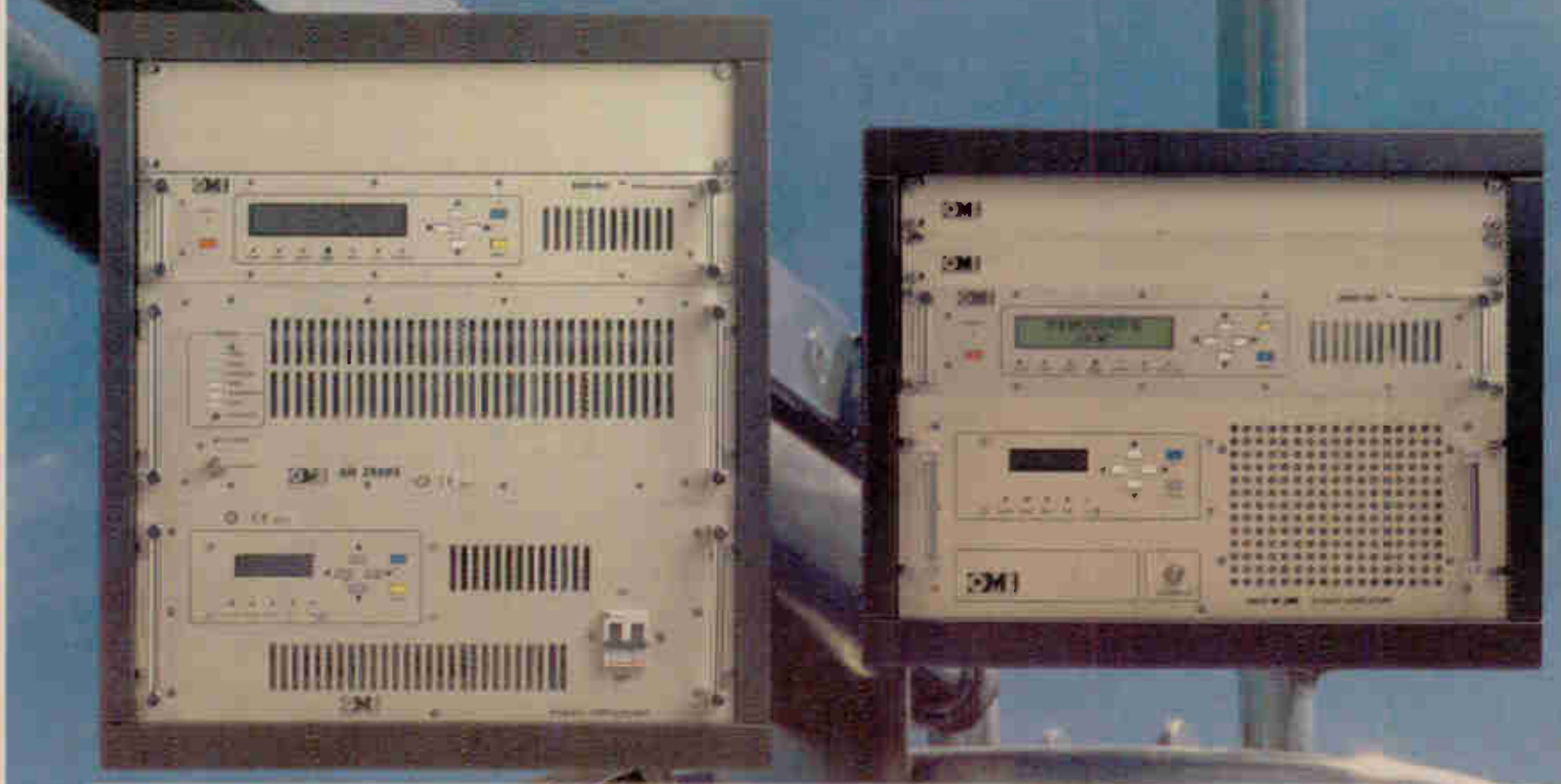

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DA Low-Down

So You Want a DA? – Part 3

by Wayne S. Reese

[COLDWATER, Michigan - August 2003] Perhaps you have decided a directional array (DA) might allow your AM station to make significant improvements. But how do you know what pattern to use? How many towers will it take? How much land?

If you have a construction permit for your AM directional operation, you are ready to start planning and building. This installment of our series will focus on where to start when you are authorized to build. There are six elements which must be considered before forging ahead in construction:

1. Planning the layout and design
2. Bidding for phasing and coupling equipment
3. Finalizing building plans
4. Assembling equipment
5. Adjusting equipment
6. Obtaining a proof of performance.

We will examine the first three elements in this issue. Next time we will continue with the remaining sections.

LAYOUT AND DESIGN

Once you receive the construction permit authorizing you to build, you must decide how to place the antenna system on the transmitter site. If you have gotten this far in the process, you have already settled on tower spacing and orientations. These have been specified in the construction permit. Now it is time to plan the location of the antenna design on the available land.

Doing this requires the cooperation of several people: You, your consulting engineer and your surveyor. We cannot stress enough the importance of making sure your surveyor calculates all orientations using *True North*. Over the years, there have been a handful of arrays built on Magnetic North.

Problems may crop up if this orientation is used: Nulls which are supposed to move up and down symmetrically end up moving asymmetrically. Some arrays are able to tune against the error while others have to be *dismantled and re-erected*. Many times this error does not show up until the tuning takes place. By then it is very expensive to correct.

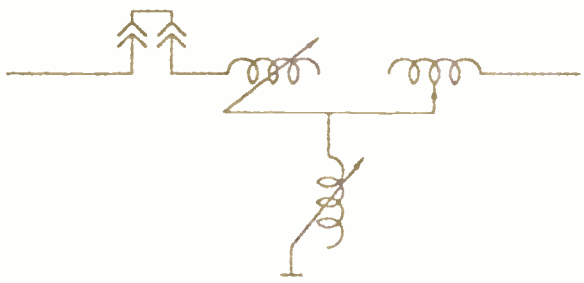
Once you figure out the orientation of the array and arrive at a blueprint which will produce it, you are ready for phase two – obtaining equipment!

PHASING AND COUPLE DESIGN

There are several components to the phasing and coupling equipment which are worth discussion: the power divider and the antenna tuning unit. The *power divider* is usually housed in a phasor cabinet near the transmitter. As the name implies, a power divider distributes the required amount of power to each tower. Unless the phasor cabinet is adjacent to one of the towers, the power will be transferred to each antenna tuning unit through a transmission line.

Most modern transmission lines in AM broadcast facilities have an impedance of approximately 50 ohms. Power is transferred most efficiently when the source and load have the same impedance as the transmission line used. Therefore, the power divider must not only set the right power level, but it must also provide an impedance match to the transmission line.

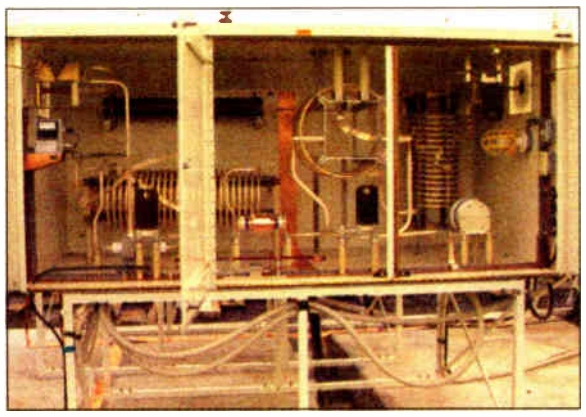
In addition, there is an *antenna tuning unit* (ATU) at the base of each tower. At the tower end of the transmission line, the ATU must match the operating impedance of the tower to the transmission line. This is most often done using a "T" network. A "T" network has input and output "arms" with a "leg" to ground in the middle.



This "leg" is often called the "shunt" leg; the overall circuit diagram resembles the letter "T." These networks can be built on open panels mounted on the wall of small buildings (commonly called "dog houses") at the base of each tower. Alternatively, they can be constructed inside weatherproof enclosures.

Which one should you use? You get to choose! Here are the tradeoffs. Dog houses offer the ability to get out of the weather if it becomes necessary to perform maintenance in rainy or snowy conditions. You can even put a small heater in the building if work is required in the winter. However, dog houses cost more to build. They require foundations, construction materials, doors, etc.

Weatherproof enclosures, depending on the overall size, can normally be mounted on a pair of poles – although extremely large units may require a concrete pad. They are essentially complete as shipped. Once they are mounted, no additional construction is required. However, maintenance will be an environmental adventure since you are in the open air. The environment of the site (not to mention the temperament of the engineer!) will be a critical factor in making this decision.



The supplier of the equipment, working in conjunction with you and your technical consultant, usually does the overall design of the phasing and coupling equipment. Remember, you want this system to last a long time – in most cases, a minimum of 10 to 20 years. Therefore, always get more than one bid, and resist the temptation to choose the winning bid on price alone! The quality of workmanship, convenience of maintenance, completeness of documentation, and long-term availability of parts are important factors that are hard to measure in dollars.

GETTING WHAT YOU WANT

To get accurate bid comparisons, you will need to supply phasor manufacturers with a number of items. Just as with quality kitchen cabinetry, phasing and coupling equipment is custom designed and built; there is no "one size fits all." The phasor designer will need the pattern parameters your technical consultant used to generate your pattern.

Since the phase delay in the transmission lines is fixed and cannot be adjusted, the designer will need precise line length measurements. The phase shift in the various networks will then be designed to produce the needed relative phases at each tower base. Warning!!! Once the transmission line lengths are "set" and the lines are being installed, do not cut any excess line either at the tower base or phasor end. Excess line should be coiled and buried.

Also, be sure to let the designer know any special needs your station may have. If you have more than one mode of operation (multiple patterns or non-directional and directional operation), the phasor will need to switch between modes. This involves extra wiring and control circuitry. The designer will need to know what kind of AC power you plan to make available at the base of each tower. You will also want the phasor control circuitry to easily interface with your remote control equipment.

Before you select a bid, you should have everyone involved in the project review the specifications. This includes your technical consultant and your technical staff. These can be complex systems, and it can be easy to overlook something or introduce a typographical error in the design process. Fixing mistakes now is a minor problem. Fixing them after everything is built is usually very expensive!

This is not a time for secrets, assumptions or guesses – this is a time for open, honest communication. Be certain you know what is (and is not) included in the bid. By all means, discuss delivery time and payment arrangements. Ask for references for each supplier. You are going to spend a lot of money and live with the results for a long time. Be sure you get what you want!

LET THE BUILDING BEGIN!

There is a chronological way to approach construction. Initially, you should be concerned with erecting all towers and buildings. Follow that by trenching the transmission and sample lines. Finally, install your ground system.

A couple of things must be remembered with respect to the construction of the towers. Attempt to keep the ground elevation of each tower the same. And do not forget that guy wire lengths must be broken up with insulators. Fiberglass rods attached at the towers seem to work better than a series of johnnyball insulators immediately adjacent to the tower. We normally specify the length of the guy wires between insulators to be a tenth of a wavelength or less.

Alternatively, non-metallic guy wires can be employed. In this case, no insulators are needed. However, metallic guy wires still should be used for the first ten to fifteen feet near the ground. This is to prevent grass fires from melting and/or burning the material used for the non-metallic guy wires.

GROUND SYSTEM CONSIDERATIONS

When trenching for the transmission and sample lines, care should be taken to put a layer of sand underneath and on top of the lines before the rest of

(Continued on page 12)

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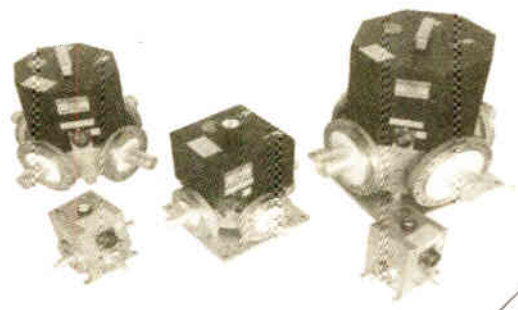

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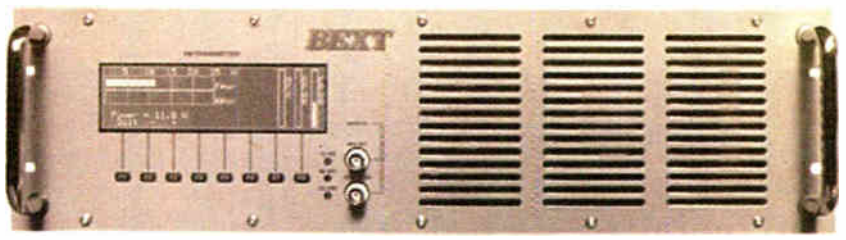

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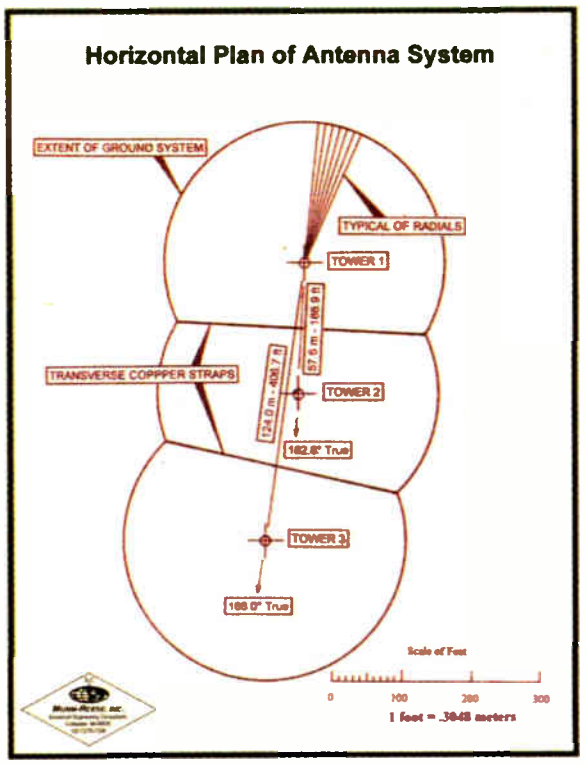
DA Low-Down

Continued from page 10.

the trench is backfilled. Some installations use PVC pipe to protect the lines. The depth of the trench can vary based on what part of the country you are in. In the North, it is preferred to get the lines below the frost level.

A standard ground system consists of 120 equally spaced radials of #10 AWG soft-drawn copper wire. Each wire is a quarter wavelength long and, thus, varies in physical length by the operating frequency.



In a directional array, ground wires are terminated at copper straps located midway between adjacent towers. These straps are placed perpendicular to the line of towers. Installation is pretty straight forward for in-line arrays, but will test your geometry skills with complicated arrays!

In the event the property is not large enough, the radials should be shortened or "cropped" at the property boundary. Taking this liberty too far can create sub-standard ground systems. While our firm has never studied the effects of an irregular or highly cropped ground system on pattern shape, it is well known that the efficiency of the array will be diminished. Once you figure out the pattern of wires, they can be buried just under the surface of the ground (about 2-6 inches deep).

It is now important to pinpoint the precise location of the transmitter building and doghouses or weatherproof enclosures with respect to tower locations. Be certain, for example, that the feed from the bowl insulator to the tower is simple and direct. Also, be sure the doors of weatherproof enclosures do not open towards the tower.

The location of the buildings will determine the minimum length of the transmission and sample lines required. The amount of phase delay introduced in moving the energy from the phasor cabinet to each tower is directly proportional to the length of each transmission line. Thus, it becomes an important factor in the overall design of the phasor system. The sample lines should all be of equal electrical length and phase-stabilized at the factory.

Join us next time for the continuation of our series. Until then, keep planning, bidding, and finalizing. If you do, hold onto your hardhats, because you are sure to strike success!

Wayne S. Reese is President of Munn-Reese, Inc, a Broadcast Engineering Consultant firm in Coldwater, MI. You can contact him at wayne@munn-reese.com

Radio Conference Guide

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TAB Convention - August 20-22, Austin TX
National Radio Club - August 29-31, Dallas-Fort Worth
NAB Fall Convention - October 1-2, Philadelphia PA
SBE National Convention - October 14-15, Madison WI
Broadcasters Clinic - October 14-16, Madison WI
NAB Satellite Uplink Operators Training - October 14-17 NAB, Washington DC
CBI Convention – November 6-9, Dallas TX

From the Transmitter Shack

Stop, Look & Listen!

by Dave Dunsmoor

[MINOT, North Dakota - August 2003] Stop, look and listen. I learned this lesson early on, when first crossing a street on my own. It also applies all these years later to resolving broadcast equipment or systems problems. I am going to guess most of the old guys reading this will gloss over it thinking, "Yeah, I know that already, I don't need to read this." And they do know it. I know it. Yet, from time to time, I still have to stop and recall it to mind.

Sometimes, I have gotten wrapped "all around the axle" trying to find the fix to what I thought was a mystically elusive, hi-tech tough-dog for the big guys with the $100K worth of test equipments. And usually this is the result of some "I-am-out-of-time-the-show-must-go-on" induced anxiety – not yet having stopped to consider: "If I wanted to make this happen to an otherwise normally operating system, how would I do it," and then go about chasing down those possible causes. You have been there too, right?

TAKE A BREATH

So, stop what you are doing and relax a bit. Go outside, go down the hall – go home to nap – whatever is appropriate, given the situation in which you find yourself. Obviously, if you are off the air, you do not go home to nap (!), but you get the idea. Remove yourself from the anxiety for a bit, and rethink the situation.

When we started getting satellite receivers, I became anxious about installing and aligning my first one. I knew the theory of where the birds were, that the dish was parabolic, had a focal point, and LNAs were required and all that – but how do I put this into practice to actually get audio in the studio? The book indicated that the use of a spectrum analyzer was necessary. But ... "I don't have one, now what?"

SOLUTIONS

Stop and relax and think a bit. What is the end product (audio), and what do I have that will let me know when I have the proper audio? A small Marti unit, and a VHF hand held receiver. I connected the Marti to the satellite receiver, and carried the HT in my shirt pocket to listen to the satellite audio while moving the dish to and fro. Anxiety is gone, and audio is in the studio ready to air.

When the new digital satellite equipment started showing up, it was a pain to align because it did not have an audio output that would come and go as you scanned the AZ/EL, trying to find the best signal. No (or wrong) digital signal, and there was no audio to use as a guide. Again, "Now what do I do?" Several options came to mind, but running an assistant up to the roof to do the physical AZ/EL work while I watched eb/no numbers on a cheap PC seemed to do the trick. No assistant? Run some cable up to the antenna farm and use a cheap laptop up there, doing the AZ/EL work yourself.

Some years ago, I began to notice that the antenna current on my one AM antenna would vary greatly during differing weather conditions. What was causing this? I did not have access to an antenna bridge, nor an OIB. And if I did, what specifically would that tell me anyway, I wondered. I thought about the situation and checked all visible physical attributes of the system: the connections inside the coupler box, and the antenna wires (it is a self supporting tower with an LPB skirt on it). I had a welder run up the tower and weld all joints, but the problem continued.

DIAGNOSIS

I noticed coverage would increase during wet weather, as indicated by my primitive signal strength measurement method: my truck radio and my ears. Then, a little investigation with a shovel revealed there were almost no ground radials intact any longer, even though plenty of them were attached to the tower base (although with ordinary solder, not silver solder, with most not making good solid contact). A conversation with my "Elmer" revealed this particular antenna location was in a flood about 20 years earlier and the National Guard had built dikes across the radial field, then removed them after the flood had subsided. Hmmm ... I wonder where the copper went!

I explained the situation to the GM, and we bought the necessary copper. I spent about 8 weeks plowing in new ground radials with a walk-behind type wire plow. New copper straps to each leg of the tower, the tuning box, and the transmitter were silver soldered to the new radials and the antenna current stabilized. At my far-field monitoring point (about 130 miles to the west in a little town where I often worked) signal strength was increased and now steady.

Yes, there are times when "good sense and good luck" just cannot produce the proper resolution to a problem, and test equipment is absolutely required. And it is always easier with proper test gear at hand. But even without those tools, by being ready to stop, look, and listen, we can solve a lot of problems more easily than we may have thought possible.

Dave Dunsmoor is a contract engineer in the Minot, ND area, as well as a Navigation/Communications (NAVCOM) ET for the FAA, a friend of mooses. Contact him at mrfixit@min.midco.net

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MP-3	$980	0.8 Kw.	GP-3	$1,900	6 Kw.	SGP 3	$3,595	10 Kw.
MP-4	$1,280	0.8 Kw.	GP-4	$2,600	6 Kw.	SGP-4	$4,500	10 Kw.
MP 4-R	$1,820	2 Kw.	GP-5	$3,150	6 Kw.	SGP-5	$5,300	10 Kw.
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Audio Processing From the Ground Up

by Cornelius Gould

Part 8 – DSP Design Considerations

[CLEVELAND, Ohio - August 2003] Last month we discussed how DSP Based Audio Processors have changed the way we do audio processing – mostly for the better. However, implementing DSP technology for audio processing has its own set of issues & solutions, many of which are still being worked out even as you read this article! This area of audio processing is just getting started, and there is a lot of evolving yet to come.

As we delve into things digital, you will see current DSP audio processors can – in some ways – be compared to a similar phase that analog processing went through in the mid 70's. In many other ways, it is "the ultimate" in audio processing technology to date. In this article, after we take a look at a few basic things a digital audio equipment designer has to deal with, we will see how these factors can become a real challenge to the audio processor designers of the present and future.

ANALOG AND DIGITAL

Although we are dealing with digital audio and DSP processing in this series of articles, all discussions and examples are just as valid for any other digital medium.

Samples & Sample Rate: When sending audio into a digital system, it is not really linear, as in analog tape. With analog tape there is a continuous copy of various audio waves appearing at the recording microphone at the tape head, which varies the magnetic field across a strip of magnetic tape. Playback is simply a case of passing this electromagnetic energy back over the tape head, creating an electrical copy of the original signal which eventually plays from a speaker as an amplified copy (of the copy) of the original signal.

As far as an analog processor is concerned, the audio also is in the form of a continuous linear electronic signal. In this case, each amplifier in the processor is creating (and amplifying) a continuous real-time copy of what is happening in the previous amplifier stages (or in the case of an analog filter, you have a continuous real-time electrical copy of a portion of the signal from a previous amplifier stage).

The advantage of digital vs. analog in recording, is that the individual sample frames are instantly converted to binary data. In binary code, everything is expressed as a series of 0's and 1's. The 0's and 1's can be expressed as voltage transitions (such as 0 volts for "0", and +5 volts for "1"), as light and dark areas of an optical medium, or whatever. Anything that is not matching a valid "on or off" signal is ignored, so no matter how many times you copy the 0's and 1's, the quality will not suffer from "noises" introduced by the recording (or transmission) medium.

In the digital audio processor, this binary data is manipulated by specialized microcomputers called Digital Signal Processors (DSP). The DSP chips are used to manipulate the binary data to create compression, limiting, and clipping.

HOW DIGITAL AUDIO WORKS

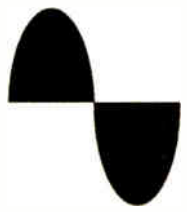
Digital audio can be thought of in a similar manner as movie film. It consists of taking a sequence of still "pictures" (a picture of the audio level at an exact moment), and sequentially playing them back at a sufficient speed (sample rate) to create a realistic representation of the original (analog) audio.

In a typical digital audio device, a master clock determines the sample rate. For standard CD's, the master sampling clock runs at 44.1 kHz, providing 44.1 thousand samples (snapshots of audio levels) per second. How many "bits" of data used to make up a single frame of data (a data "word") determines the overall quality of the samples (the amount of detail each sample can hold). On a CD, this resolution is 16 bits.

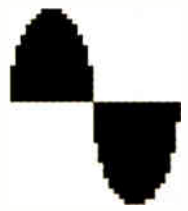
The bit resolution used in a digital system can be compared to the quality of film used in a movie. Low quality film results in a grainy picture. Using too few bits in each audio sample results in noisy or "fuzzy" audio for our listeners.

BITS IN DETAIL

We say the number of bits determines the "resolution" of the audio because the more bits you have, the more accurate the capturing and reproduction of analog signals will be. In a 16-bit system, you have 65,536 "steps" available to describe the audio level that is captured. The captured audio level will be converted to the nearest "level step" in binary language, and stored.



The original signal presented to an analog-to-digital converter.



Too little bit resolution causes errors in the approximation of levels in the reconstructed audio wave form.

For digital audio equipment, bit resolution is first determined by the design of the analog to digital converter (A/D Converter). The more resolution you have to work with at the input, the more dynamic range you have. It can also be compared to the noise floor on the input stage of an analog processor. The lower the bit depth (number of bits), the higher the noise floor, which also limits how far down the processor can go to grab those quiet passages before noise becomes unacceptable. If the A/D converter had to run at, say, 8 bits of resolution, that would mean really quiet signals would contain a large amount of digital noise. The signal to noise ratio (S/N) of 8-bit resolution digital audio, for example, is only 48 dB, about the same as analog audio cassette tape!

As a rule of thumb, every "extra bit" of resolution increases the signal to noise ratio by 6 dB, so the signal to noise ratio of 16-bit resolution digital audio is about 96 dB. I have audio examples of the differences between 8 bit and 16 bit audio on my web site at **www.cgould.com/radioguide/digitalaudio**. Figures 1 and 2 (from the recordings used there) give a visual aid to what you are hearing.

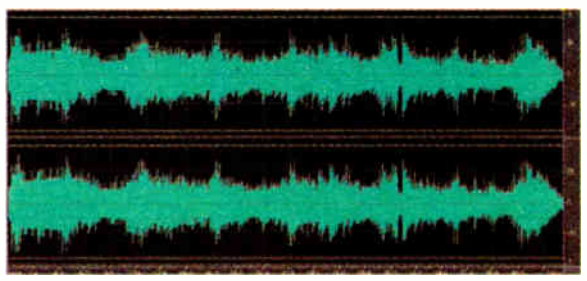


Figure-1: 8 bit audio, 10% level, raised to 80% by processing. Note the jagged edges.

Figure-2: 16 bit audio, 10% level, raised to 80% by processing. Note the smooth peaks.

NYQUIST AND ALIASING

In a 1928 paper for AT&T called "Certain Topics in Telegraph Transmission Theory," the Swedish born physicist, Harry Nyquist described issues involving the sampling of continuous linear signals for transmission, and how to reconstruct these samples into an accurate copy of the original at the destination point. His theory quite accurately states that in order to accurately capture a continuous signal using sampling, you would have to sample at a rate of no less than 2X the highest frequency contained in the signal of interest.

Fast forward to today with digital audio, and you will find this theorem identifies the highest audio frequency you can pass through a digital system at a particular sample rate before you begin to have severe problems. Simply put, the Nyquist of any digital system is 1/2 the sample rate used. So, the maximum audio frequency response of a 44.1 kHz sampled digital audio system is 22.05 kHz. Exceeding this limitation by sending audio information above 22.05 kHz, you will create a condition known as "aliasing."

Assume we are performing a tone sweep on a digital audio device, sweeping through the usable range of a 44.1 kHz sampled system. On the output of the device, the tone is being faithfully reproduced. However, if we exceed 22.05 kHz, we will no longer get the original tone. What you get is a new tone starting at 22.05 kHz and sweeping DOWN the audio spectrum as the input tone continues to sweep UP beyond 22.05 kHz. This false tone is the "aliasing" from exceeding the Nyquist of the system.

Whenever you have complex waveforms (such as music or speech) that exceed the Nyquist, the aliasing created by and heard on the system output also becomes complex. The aliasing produced this way resembles a "scratchy sound" most noticeable on the high end of the audio (the treble frequencies). Digital audio system designers refer to this scratchy sound as "aliasing distortion." To prevent this, all digital audio equipment contains what is known as an "anti-aliasing filter" in some form on the system input. This filter behaves as a sharp "brickwall" filter in front of the A/D converter, removing any audio signals that exceed the digital Nyquist.

Building an analog filter for the input of the A/D converter would be difficult. The main problem we would have is that to protect the system from audio exceeding 22.05 kHz, we would have to start severely rolling off the audio before we get to the maximum permissible audio frequency of 22.05 kHz. The best, most expensive filter design would only pass about 19 kHz before rolling off, and a more cost effective filter would have to start rolling off at 15 kHz or lower!

Something better was needed.

OVERSAMPLING

With oversampling, you run the input analog to digital converter at a sample rate of, say, 4 times the system sample rate. What this means is that with a 44.1 kHz sample rate in the main system, the A/D converter would run at 176.4 kHz. The Nyquist of the 176.4 sample rate is 88.2 kHz. With this approach, a more linear and gentler lowpass filter is used in front of the A/D converter, since the goal now is to eliminate any frequencies that may exist at or above 88.2 kHz.

The steep filtering needed to prevent aliasing distortion in the rest of the digital audio unit (which operates at the 44.1 kHz sample rate) can now be done in the digital domain, where very steep filtering can easily be accomplished cheaply and effectively. Using this technique, a 44.1 kHz sampled system can routinely have a flat frequency response out to 22.0 kHz – pretty darn close to the 22.05 kHz Nyquist frequency response limit!

Rats. Just as it gets interesting, we run out of space! Next month, we will finish our digital definitions, and jump into what this all means for the digital audio processor designer.

Cornelius Gould has a passion for audio processors, and has built his own! He is the Chief Engineer for WJCU 88.7 FM in Cleveland, Ohio, as well as Senior Staff Engineer for Infinity Broadcasting, Cleveland. You can reach him at: cg@radiocleveland.com

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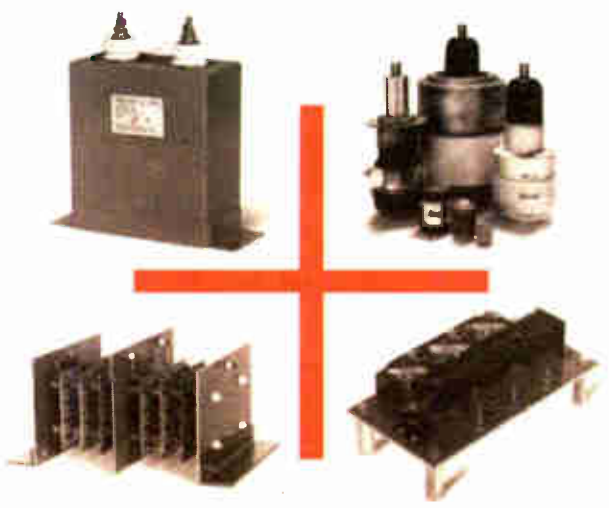

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FCC Focus

The Alternative Inspection Program: Years of Vivid Memories

by Ken Benner, NCE

[TUCSON, Arizona - August 2003] Over the past few months, I have enjoyed providing some brief glimpses from behind the scenes of the Alternate Inspection Program (AIP). Along with the good, bad and ugly moments, it has been a fascinating tour covering 18 states from Alaska to Ohio with my good friends: Engineer Jerry Miller, retired from WCCO-AM, Minneapolis and AIP Program Coordinator, Jim Wychor, retired as President of the Minnesota Broadcasters Association.

During our rounds, we have had the opportunity to visit the widest possible range of station facilities, from extremely well maintained plants to a few where we just had to blink our eyes a couple of times to believe what we saw. We have seen transmitters perking away with tubes glowing red hot, air filters plugged solid, interlocks bypassed, transmitter sites unlocked, tower fences rotted, modulation monitor pegging plus one hundred per cent on negative peaks, rampant distortion, over power, etc.

On more than one occasion, we have visited a transmitter site to find the transmitter sitting in a pool of water, a site that had not been visited for a year or more, an abandoned transmitter where someone forgot to turn off the signal when the station hit hard times ... or a directional antenna with frozen transfer relays, out of tolerance and rust and rusty unpainted towers inviting a plane crash waiting to enhance the wealth of some attorney.

Occasionally, it seemed like we would find a site with all these problems at once!

For example, in Wyoming I found a transmitter that had literally melted down. The thermal interlock had been bypassed, the blower fan loosened itself on the motor shaft, the building temperature must have reached well over flash point. Apparently it was only the lack of oxygen that prevented the place from exploding.

Of course, for each station whose operation strained the definition of professional, I have encountered dozens of highly dedicated broadcasters who have truly earned their Certificate of Compliance.

KNOM AM/FM, Nome AK, GM Tom Busch proudly displaying awards, including an ABA AIP Compliance Certificate.

Some of what we find is very educational, as we uncover some unique problems. There was this beautiful new FM in Dubuque – all new equipment, built, owned and operated by a family professionally dedicated to first class broadcasting, with an excellent contract engineer. Everything was top notch, except for an annoying "birdie" on their transmitted audio.

All equipment checked out clean – the STL "had to be" the problem. Hundreds of dollars were spent testing, retesting and shipping equipment. Finally the FCC in Kansas City was invited to investigate. With their monitoring truck, the culprit was traced to an abandoned Army Corps of Engineers' transmitter on the banks of the Mississippi almost a hundred miles northward. As I have said many times: "The FCC is the best friend Broadcasters have."

At first, Jerry really angered another manager when he asked; "What are you running here – a hamburger joint? Don't you know this is serious business. You're lucky I'm not an official FCC inspector or you'd probably be off the air besides facing a huge fine." Fortunately for the manager it was not long before he realized how much had been neglected and began to appreciate the advice offered to get back into compliance.

WHERE IS THE TOWER?

I have to tell you, every time I think "I have seen it all," another wild experience hits me square in the face. I learned the hard way to compare the registration number and the coordinates on the tower with the registration number and coordinates on the 854R tower registration form. More than once I have found errors which would have cost the station a lawsuit if a plane hit the tower after a beacon outage was reported to the FAA with improper information.

One tower I inspected was registered (by typographical error) one degree of longitude off, which put it 70 miles from its actual location. Hypothetical scenario: A station is certified under AIP; Management is certain all is copacetic. Then a beacon burns out and the station reports the outage with the registration number to FCC. But, if a plane hits this tower located 70 miles from where the pilot is expecting an unlit tower, lots of people could be killed. And, the *big* question: Who is responsible?

Then there was the little fishing village in Naknek, Alaska. My GPS indicated a substantial variation from the coordinates on the station license. The tower is only about 400 feet from the airport runway and had previously been taken down with a plane. Turned out when the previous tower was replaced some distance from the original tower, the licensed coordinates had not been updated.

You can see why these alternative inspections cannot be merely a "rubber stamping" affair as were many of the proof-of-performances conducted by the roaming proofologists of yesteryear. Of the 4,000 plus inspections I have conducted, seven included towers that had been struck by airplanes within the previous fifteen years, each with a loss of lives.

The need to maintain tower fences and gates in proper order has been highlighted by various stories shared of drunken, suicidal idiots attempting to impress their girlfriends by climbing towers and then parachuting or sliding down a guy-wire bare-handed. (No, you do not want to know how gory it was.) I think it was Dubuque where the night DJ called the engineer stating his signal was intermittent and noisy. At 2:00 AM the engineer arrived at the transmitter to find a frantic, incoherent, intoxicated woman pointing up the tower at a humongous man, frozen in fear, desperately holding on to the beacon and sobbing pathetically, after sobering up from his climb.

NO FOOLIN'

Then there was this smart-alecky engineer fresh out of radio school who thought he could pull the wool over ol' Dad. We were out measuring monitor points and it seemed to me something was not right. We certainly had traveled more than the license indication of 2.2 miles from the tower site and I also suspected we were in the wrong direction.

Sure enough, my GPS meter indicated we were almost 6 miles from the antenna system and at almost 90 degrees off the proper radial. That little weasel knew his monitor points were out of tolerance and he had located a few places where we would find the field intensity under the permitted maximums. I just smiled and let him sweat after he knew I had called his bluff. Needless to say, he did not pass.

Another incident was at an FM station that had no business being on the air. It involved a wise guy manager who liked to drink. With no posted license, no tower registration, no EAS system, stereo levels out of balance etc., I had declined to pass his station. A few months later, assuming his station had not signed on to the inspection program, in walks the FCC inspector.

"Oh b-b-but I signed onto the AIP program, in fact here's a copy of my sign-up sheet," explained the manager to the FCC inspector. A few days later, after a few too many beers with his radio colleagues from other stations, he boasted about how he had cleverly hoodwinked the FCC. It was not long before the FCC showed up again and Mr. Smart found himself facing hefty fines.

INSPECTION BENEFITS

One of my basic tools is the plastic end of a cheap ballpoint pen. It is amazing how many AM tower feedline connect points I have touched and melted the plastic to indicate to the manager or engineer how much antenna power they were losing in heat resulting from a corroded or poor connection at that point.

Then there was the manager who complained about how expensive it was to replace transmitter modules after every lightening storm. I suggested the one-inch gap at his Jacobs ladder lightening gap might be a tad large. He reduced the gap to a bit less than a quarter inch and has not lost a module since.

Another AM station was found to have its licensed five kilowatts at the base of its tower by direct measurement – then by indirect measurement, a transmitter output of less than one kilowatt. That is known as, "Mighty hefty inverse transmission line loss," resulting from a thermo-couple ammeter out of calibration at the tower base. A new Delta toroid to replace the defective meter permitted the station to increase its power-output 500 per cent, after which the manager was quite happy.

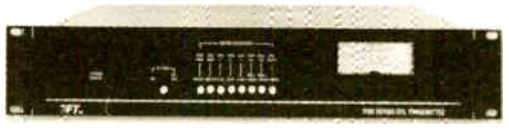
Of course, from time to time we encounter stations which have recently had severe system failures from any number of causes including lightning. Certainly, we are not going to fail a station because they are not at full power due to such an incident. But, we will expect them to be taking appropriate actions, and have the paper trail to show. Even low power non-directional operation from a damaged DA is not an obstacle to an inspection, so long as the monitor points are within limits.

Dennis Weidler, GM of KICY AM/FM, Nome AK, showing damage to transmission coax.

We are not done yet. The AIP program continues to provide positive benefits for participating stations all across the country. Perhaps, one of these days, it will be my privilege to visit your facility under the auspices of this fine program.

Ken Benner, a retired broadcast engineer, resides in Tucson, Arizona. Showing his brains, he is again spending the summer roaming around the very far north performing inspections under the Alaska Broadcasters Association program. Ken can be reached at bennerassociates@aol.com.

"Still The BEST...



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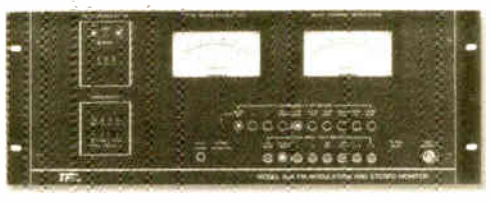

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	10 kW	1991	QEI FMQ10,000B
	20 kW	1976	Collins 831G2
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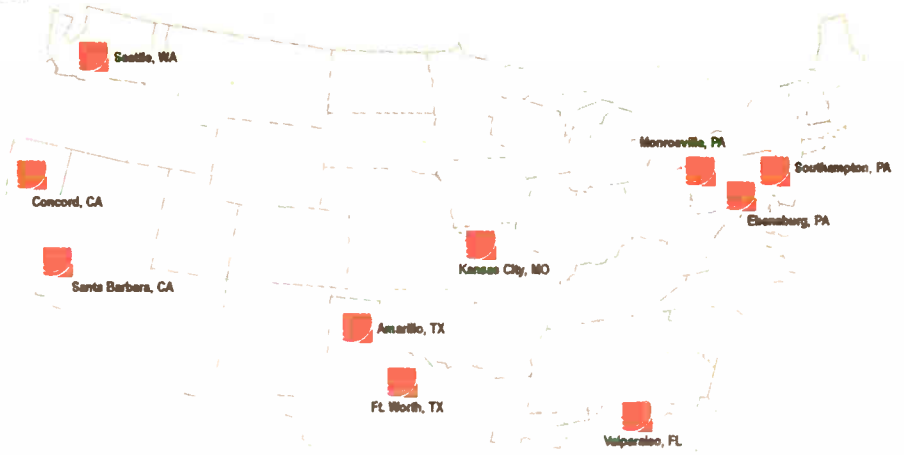

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"Our House is a Very, Very Fine House"

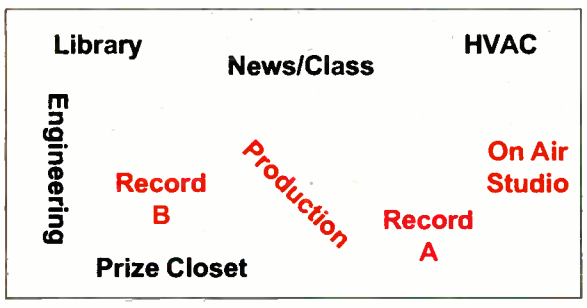
by John Devecka

[BALTIMORE, Maryland - August 2003] OK, so where were we...? Oh yeah, I was just starting to get into the nuts, bolts, crimps and frays of our new facility, the new WLOY radio station at Loyola College in Maryland. I landed here after 12 years at LPB doing station design, supply, repair, and other strangeness on a global scale. The school had a budget and wanted to make sure any facility they built would be a technology showcase to help attract new Communications students to the College. They brought on an Architect, a Sound Consultant and little old me, Underdog, to make it happen. When it was all mostly finished, they called up some friends from Baltimore's Little Italy section and made me an offer I could not refuse...

We already covered the planning and layout process in the last column, so let us start with the basic functions and equipment in each room and devote more focus on the "what and why" questions, OK?

COME ON, FEEL THE NOISE

WLOY has 3 news desks in the main room, which doubles as a classroom, an On Air Studio, two Recording rooms (A & B), Production, a Library and my windowless cave in Engineering. Each of the rooms is wired back to the Engineering space so we can feed them anywhere – in or out of house, as needed. Since the On Air Studio was the focus of the initial design and build, we will start there, and consider the details of the other rooms in our next column. Since certain commonalities exist through the whole facility, such as microphones, CD players and such, the On Air Studio is the model for the other work stations and rooms.



On Air had to include interview capability in case other studios were not available. So, with help from Vince Fiola at Studio Technology, we designed furniture that would fit the space, allow good visibility, and be comfortable for up to 5 people. Vince worked with our budget to come up with a nice piece of furniture his guys could install in a few hours, yet looked like it cost a lot more! We have been very happy with the use of the space and managed to have 5 people interviewed simultaneously, although a bit tightly. It really helps, since we need to have the other studios free for classes and production work as much as possible.

Our campus, like most, runs a digital PBX which tends to wreak havoc with telephone hybrids and codecs. Fortunately, our telecom folks are very flexible and worked to put analog lines into several places for our JK Audio Innkeepers. I had tried these at a number of NABs over the years and started using them in installations at LPB.

We always had great response, pardon the pun, and their survival in college stations made them a sure bet. JK introduced a new interface for PBX systems at NAB 2003 and I hope to start using them in the fall. I assume it will do what we need (Joe does seem to be able to do that consistently!) and we will use them in other spaces around campus for remote connections.

Since we have students as our DJs, we needed a delay. Just as we were ordering products for the project, Symetrix discontinued their low cost analog delay, so in went a Symetrix AirTools Digital Delay. Which leads me to a rant: The cost of delays is nuts! Someone out there *has* to be able to make one at a reasonable price. They are wonderfully simple units, from the flashing light to the big red "Dump" button, and the students got the message very quickly. But a starting point of $2,000 is prohibitive for most educational station budgets. I'll bet someone making a $500-750 unit would clean up in lesser markets!

KICK OUT THE JAMS

Microphones are always a tough choice in a studio, especially when they could be used for all sorts of applications. In an effort to keep the whole feel uniform, reasonably priced and sounding good, we went with Studio Projects B1 microphones in all the main positions in the station. It is tough to argue with a good sounding sub-$100 condenser! If you have a chance, try to check out their line, it is very nice for the price ($100-$1000 range including higher end tube models).

We have used 15 of the B1s and a handful of the rest in WLOY and only had a few broken shock mounts (which has been redesigned). Of course, the LPB Silent Boom holds every microphone in the place (as though I would use anything else!). I am still waiting for that patent paperwork, though, Tom.

Microphone Preamps are almost as tough a choice as microphones. We had space considerations as well as budget issues to deal with here. The Aphex 207 offered dual microphone preamps in a single rack unit, which allows us to squeeze 5 channels into 3 RU, and keep things clean. They provide enough basic button control to deal with typical interviews.

We are considering some more specialized changes in the interview area as so many of our discussions include inexperienced speakers. Some very basic multi-channel limiting will probably be added shortly just to keep a cover on those that cannot decide whether they fear or want to eat the microphone.

Main mixing is through the LPB Dynamax MX18 console, which allowed us to bring all the sources in on single channels and only double up inputs for remote studio feeds. We did need to use some Henry Super Relays to fire the LPB On Air lights, which are located in our airlock and outside the studios. Henry Logiconverters help with the interfaces of some machine remote starts and the console.

BOOM, SHAKE THE ROOM

Studio monitoring in all the rooms is via LPB Spatial Ones, fed by Hafler P1500 or P1000 amplifiers. After a number of tests at NABs and installs, I have found the Hafler units sound great at low power levels and work very well with the highly efficient Spatial Ones.

We have nice clean sound, even when the students get a bit overzealous and try to blow out the windows. One of the first additions to the equipment rack was a locking security cover for the P1500 to make darn sure that the students could not *actually* knock out any walls!

We have 2 CPUs in the air studio, one for production and one for automation service. Cool Edit Studio (4 track) does duty as a quick editor for students that want to record callers, and play their requests later. We considered a number of options here, but Cool Edit gave us the best quick editing and matched our plans for the News desks.

We run ProTools in the Recording and Production rooms, but that is another story. Cool Edit really makes things simple for students, giving them the ability to also produce quick news pieces and run them back as needed. We have been very happy with it, but will wait and see what happens with Adobe ownership of Syntrillium – maybe they will port it to the Mac?

The second CPU pulls automation duty and runs 11 Software's Jockey Pro LT for our automation needs. We have the audio server located in the Engineering office, but pull files to the Air computer for playback of schedules. The software has very simple percentage-based schedule controls and allows manual creation as well.

The students have picked it up very quickly and make fewer mistakes than I do! We have been live 24/7 since March 19th with the Jockey Pro LT system filling in all the gaps in DJ times and running solo all summer. So far, I have rebooted the on air machine 3 times, only once for unknown reasons. The server holding the 23,000 song library – yes I did say 23,000 (and growing fast) – has NEVER had to be rebooted. OK, it is an IBM x345 running Windows 2000 Server and very little else, but hey, Jockey Pro LT was only $99!

All of our studio audio is routed around to various devices and other studios using Broadcast Devices UTA-200 DAs that were custom built for each application. Individual cards are adjustable and include LEDs for easy level monitoring. We feed Audition and Program feeds back to Engineering, as well as the delayed air feed.

Bob Tarsio, at Broadcast Devices, went out of his way to make sure all our needs were met in configuring the DAs. These DAs reappear throughout the station, but really are the core routing for the Engineering room. Six of them take the Audition and Program feeds from the various studios and feed them to all of the other studios so that we do not need a router.

For the basic input and output devices, the studio includes a pair of Technics SL1200 MKII turntables (although many of the students wonder what they are), which are just indestructible in my experience. We used a variety of Denon units in the studio, including the 620T CD-Cassette combination unit and the Denon DNC630 CDs based on experience.

The debate over CD unit selection is a lengthy one. There is a school of thought that says you can buy dozens of cheap CD units for the cost of one really "pro" model. I would agree, but you also need to consider the downtime and the appearance to the students of the equipment. I have found that they show more respect to "pro" grade equipment than they do to "consumer" gear they recognize.

One of the keys to keeping students involved and concerned about the station is to make sure they know it is special. Denon's units are very durable, look different than consumer gear and do not really cost two arms and a leg. And, unlike the old cart-style boxes, you have no issue getting students to understand them. The combi-unit gave us the cassette needed for students to tape shows and provided a backup CD unit for them to use for music beds under their reading.

It took a lot of time to find components that let us make a solid, functional studio, that would endure college students and still meet our limited budget needs. While there may be some upgrades in the future, most of the original material will stay right where it is until we wear it out!

If you are interested in more details on any of these choices, please feel free to contact me and I will try to help. There is very often a middle ground between budget and desire and I think we have managed to stay there and give the students the best of both worlds.

John Devecka is the Operations Manager of WLOY at Loyola College in Maryland, and former Sales Manager of LPB Communications. He has spent a silly amount of time working with odd situations and low budgets to make educational radio stations happen. He is available at wloy@loyola.edu or 410-617-5349.

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Answers to Your EAS Questions

EAS Q&A

by Clay Freinwald

[Again this month, Clay answers your questions on EAS and how to make it work. Keep those questions coming! Ed.]

Q - Recently, our local sheriff's office installed an EAS Encoder/Decoder so they can send tests and messages via a VHF Radio to local stations. The problem is the local LP-1 station was to be the only one sending RMT's. How do we resolve this?

Clay - Your state or local EAS plan is the key to resolving this issue. The plan should spell out exactly who is responsible in your area for originating tests. Of course, by now you likely know my feeling on this subject: I am very much opposed to *any* broadcast station initiating EAS messages or tests. The purpose of EAS is to get information from government entities (NWS, Emergency Management/Services, Law Enforcement, etc.) to the general public – *not* to generate such information.

Broadcasters' role in EAS is to act as a conduit between the sources of EAS messages and the general public. Sounds to me like it is a good time to have a meeting of your LECC and get all the parties together to hammer out how you wish EAS to function in your area.

Q - Our state plan calls for specific EAS Box inputs to be used for specific sources. Recently, we had a broadcaster request a waiver of our state plan so his Input #1 could be used for NWR. What do we do?

Clay - This is the first I have heard of an EAS plan assigning specific tasks for inputs to your EAS Box. In my view, it's more important for EAS plans to spell out which sources are required to be monitored, but encourage stations to monitor as many direct sources as possible. ("Direct" is a source of EAS messages as opposed to other broadcast stations that may be relaying them – that "Daisy Chaining" was one of the major "gripe items" about the old EBS arrangement.

Assuming NWR is not on your *required* list, I would encourage this station to plug this source in any way they want. For the voluntary part of EAS to really work, it will usually require monitoring at least 4 sources.

Q - We have been hearing all about AMBER Alerts, including some "success" stories. But one of the big problems with AMBER (and even EAS itself) is a short, one-time, message is inadequate when it comes to delivering information to stations that can then be repeated on the air with the frequency the AMBER proponents and plans wish. What can we do to make EAS better suited for this mission?

Clay - Yes, it has been a problem. All parties need to understand the limitations of EAS for Amber. From an EAS perspective, AMBER is just another Event Code. From an AMBER perspective, EAS is just one of their information distribution tools.

Q - So then you are saying that AMBER messages and information should not just rely on EAS?

Clay - Exactly! Where EAS can play a significant role is via its ability to quickly distribute the *initial* message of an abduction. That is what I call the doorbell. It can alert broadcasters and the general public about an abduction, and alert everyone to go to a common location and/or source of detailed information that EAS simply is not designed to handle.

Q - What about the goal of most AMBER plans to have broadcasters repeat messages every few minutes? Does this mean re-sending the CAE EAS message every few minutes?

Clay - This would likely only work in a few very small markets. Otherwise, broadcasters are not going to tolerate hearing "Buzzaps!" on their air every few minutes. What broadcasters need is to send out the initial AMBER Alert via EAS, using the buzzaps and then communicate to their listeners, information that will help with the recovery of the child.

Q - Where are broadcasters going to receive this "additional" information?

Clay - Some real improvement appears to be on the horizon. For example, the Washington State Association of Broadcasters (WSAB) is a founding partner of a "web portal" for AMBER Alerts. WSAB, along with several other states, plans for the portal to provide a uniform, secure and centralized Web Site allowing law enforcement agencies to upload information about an AMBER Alert, including downloadable photographs.

When activated, the AMBER Alert Web Portal will provide a single, authoritative source from which to access initial AMBER Alert information, as well as detailed updated information throughout the duration of the alert.

A major advantage for broadcasters will be the ability to print out the EAS message itself, thereby avoiding the current need to hand transcribe the EAS message in order to repeat information on the air. The folks working on this project understand the limitations of EAS and are beginning to see how EAS can be "door-bell" (or signal) for all to go to a central point for details, in order to make AMBER successful.

In a radio station, the time may come soon for stations to run a CAE or AMBER Alert and have it viewed as the signal to go to that book-marked Web Site where all the necessary information to deliver a detailed message to your listeners will be ready to be read.

Q - This sounds great, but how do we know that this information will be factual and accurate?

Clay - Law enforcement will be uploading the information onto the Web Site. At first it might be limited initial information, but as additional information becomes available, it will be updated, again by law enforcement.

Q - Will this information be secure and be just for broadcasters? What will prevent others from getting it?

Clay - AMBER Alert information needs the widest distribution possible – the more who have access to the information the better chance we have of a successful recovery. Use of EAS – in combination – with the Web Portal will enable not only Broadcasters but the general public to make the AMBER program more successful.

Q - What about highway signs? They have become popular visual targets for TV news organizations to the point they are often called "AMBER Signs." There has been a lot of discussion in our area about what should go on these signs and more specifically should a specific station be displayed. What is your view?

Clay - AMBER is a problem for the folks that operate those electronic signs. They understand only too well that folks traveling at 60 mph are only going to be able to read a couple of lines and – whish – they are past it. The question is what can you put on the sign to inform the motorist there is an AMBER Alert and cause them to use their radio to get more information? Another variable is the signs themselves: Some are able to scroll information, others are restricted to limited text messages.

Probably the most effective message is one stating: "AMBER ALERT, TUNE 710 AM." This tells the motorist they can tune their radio to 710 AM where, by previous arrangement, the 710 AM station has obligated themselves to repeat the AMBER Alert, and do so often. The rub is that other broadcasters in a given area might not view this as being fair and take action to oppose it. There is a certain degree of pride (and perhaps money making opportunities) associated with a station singled out of the pack for a DOT sign.

Some have suggested, when faced with objections from "left out" Broadcasters, that the sign should simply read: "TUNE AM RADIO." However, there may well be 25 or more AM stations from which to choose, so how would the motorist know which one will be running the detailed information, it being unlikely all area stations will be doing so. This is a complicated matter where, perhaps unfortunately, the competitive aspects of our business may well get in the way of doing the best thing.

Q - When will this system start?

Clay - Due to the time lag between the time I write this and its publication date, I would suggest you check with your State EAS Committee (SECC) or State Broadcasters Association. My point person on this is Mark Allen of the Washington State Association who is actively involved in this project.

Q - Our radio group has three stations. Can we use one EAS Box, with remote panels for each station? Is there a down side to this?

CLAY - The quick answers are "yes." My recommendation is for each station to have their own EAS Equipment. Here is a good example of why: Let us say the common EAS equipment has received an RMT on their Sage receiver. The rules state the RMT must be forwarded or relayed within one hour. Suppose the unit is programmed for the message to be held in "pending" mode until a break in programming, and Station A (of the three station group), elects to run the RMT – perhaps 20 minutes after receiving it.

If three stations share an EAS box with a multi-station panel, what is going to happen? Station A will transmit it during a natural break in programming, while stations B and C get it when A wants it to run. If these stations all have different program directors, you can let your imagination work from there.

Another situation would be where differing formats may well call for different priorities for EAS messages. Perhaps Station A runs a news/talk format, while B is a Classic Rock licensed to a different area and C is Classical. How can a common EAS unit be programmed so the interests of each station will be accommodated? The answer is not very easily.

Stay with a separate EAS box for each station. But *do* use common monitoring receivers, providing each of these units with as many EAS direct sources as possible. Again, when I say direct sources, I do not mean just start plugging in additional broadcast stations, but rather receivers tuned to get EAS messages from the governmental entities creating them.

Q - I heard of a station in the South was running their RMT's *during* programming instead of as a program segment. Is this possible?

Clay - This may make certain programmers happy, but might not be amusing to the Commission, or others depending on the station for EAS information. The FCC's rules make it very clear that certain modulation levels must be maintained for EAS events. I do not recall the Rules addressing this approach. In fact, I rather suspect no one really thought a station would try and mix EAS tones with programming of any type. (Come to think of it, there are some formats whose listeners might not know the difference!) I would not do this for the simple reason that down-stream decoders may be unable to decode the digital information as the signal to noise ratio deteriorates.

Clay Freinwald, Senior Facilities Engineer for Entercom in Seattle, is Chairman of the SBE's EAS Committee as well as chair of the Washington State SECC. He welcomes your questions about EAS at k7cr@wolfenet.com

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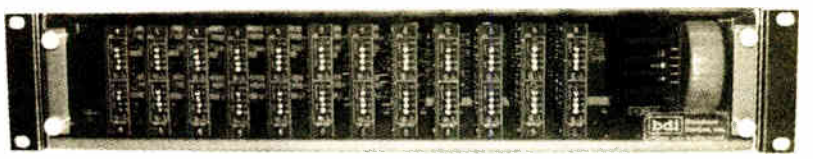

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bdi

Networking 101

by Tren P. Barnett

Part 7 – Using Command Line Utilities

[TUCSON, Arizona - August 2003] Do you remember the "good old days," or maybe they were "not so good old days?" There was a black screen with white letters, and a C:\> ("C prompt") waiting for you to tell the computer what you wanted it to do. If we go back far enough, perhaps we saw an A:\>, and the monitor was gold or green and black. These were the days of running one application at a time. When you were finished with each different application or program, you exited back to the command line and started the next. Did you know you can do the same thing in Windows 2000, 2003 or XP on your server?

Of course, the obvious question arises: If we have a nice UI (user interface) in Windows for everything, why would you care about old DOS commands and a command window? The answer is, because we do not have a nice UI for everything. In Windows 9x, if you needed to check the TCP/IP settings, you could run a nice little application called WinIPCfg. Up would pop all of the TCP/IP settings for your Windows 9x system. Well, guess what? In Windows 2000, 2003, or XP where everything is better, this utility does not exist in a UI.

In fact, many of the utilities we need to use to check our server operate only within a command window. To get a command window in Windows 2000, 2003, or XP go to the Start button and go to Run. The command we want to type is "cmd." Likewise if you go to the Accessories menu on the Start button under Programs, you will find a "Command Prompt" menu option that launches a command window.

There is our old, familiar C:\>! In Windows 9x you can do the same, except the instruction for the Run command is not "cmd," but "command," which starts the DOS command.com application. In Windows 2000, 2003, or XP the "cmd" has more features that can be accessed than under the old DOS command.com. Among the new improvements include allowing a user the ability to Copy and Paste, as well as being able to scroll through previous commands and their results.

Similarly, old DOS applications can be run using the command window, and they can benefit from the copy and paste improvements. Additionally, they are now running in a virtual DOS machine so their operation is time sliced, so more then one old DOS application can be run at once.

ADMINISTRATION VIA COMMAND LINE

One command line utility administrators often use is NET. We previously discussed using NET to set system time. But look what happens when we type "NET" at the C:\>

```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\User>net
The syntax of this command is:

NET [ ACCOUNTS | COMPUTER | CONFIG | CONTINUE |
FILE | GROUP | HELP | HELPMSG | LOCALGROUP | NAME |
PAUSE | PRINT | SEND | SESSION | SHARE | START |
STATISTICS | STOP | TIME | USE | USER | VIEW ]

C:\Documents and Settings\User>
```

Most command line utilities will let you know which command line arguments are available. This is what we see here. Of course, some utilities may provide results immediately, unlike the NET utility, and getting the listing of options may require a command more along the format of "NET /?" to be typed. As you may have decided to test it out, you may now notice that the "NET /?" works just the same as the "NET" command. Anything that follows the utility name with a slash is considered an argument.

Interestingly, most of the command arguments that the NET utility provides also can be accomplished through a UI. But, unlike the NET utility, IPCONFIG, is not found elsewhere in the GUI.

IPCONFIG

So, let us take a look at IPCONFIG and see what it does for us. First we will go to a command window and type "IPCONFIG." (If you still have the previous command window open and want a "clean screen," typing the famous old "CLS" will clear the screen.) After typing "IPCONFIG" you should see something similar to this:

```
C:\Documents and Settings\User>IPCONFIG
Windows IP Configuration
Ethernet adapter Local Area Connection:
        Media State . . . . . : Media disconnected
Ethernet Adapter Wireless Network Connection 2:
        Connection-specific DNS Suffix . : corp.radio-guide.com
        IP Address. . . . . : xxx.xxx.xxx.xxx
        Subnet Mask . . . . . : 255.255.255.0
        Default Gateway . . . . . : xxx.xxx.xxx.xxx
C:\Documents and Settings\User>
```

In this case, notice IPCONFIG provides information other then command line arguments. If we want the command line arguments for IPCONFIG we must use the /?. What not try that now? (I'll wait for you!) As you type "IPCONFIG /?" notice one of the arguments is /ALL. Invoking this argument yields many more results that will tell us how well configured the TCP/IP settings are, settings such as DNS, WINS, etc. One important value that is displayed is the lease information for TCP/IP. It should look like this...

```
Lease Obtained. . . . . : Tuesday, July 14, 2003 7:45:05 AM
Lease Expires . . . . . : Tuesday, July 14, 2003 10:15:05 AM
```

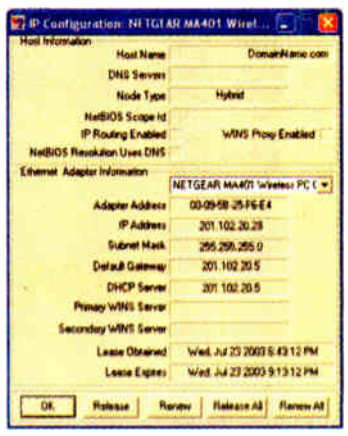
This information tells us when we received the lease and when it will expire. If we have passed the halfway point on our lease, it may be an indication that DHCP is not functioning correctly. DHCP was discussed in a previous article, along with why a lease will renew itself at "half life."

How though can we be certain that we are leasing an address correctly? Again IPCONFIG can assist us. Using the /RENEW command line argument makes a request to the DHCP server to renew the address. The response to this request should not take very long on a small network. Most of the time DHCP will return the same address as before.

Using the /RELEASE argument first guarantees we have gotten rid of old address settings. The address will turn into a 0.0.0.0 address. Now when we use /RENEW the lease we receive becomes obvious, though it may be the same.

Another useful argument for IPCONFIG is the /FLUSHDNS argument. Sometimes we may change the address of a server, yet a workstation may think that the address has not changed and still try and use the old address. This is because DNS values are cached on workstations. To expedite the process of getting valid DNS values, you can flush or clear the cache out. The /REGISTERDNS argument in turn tells the server of any new values you have obtained since an address change. These commands are valid whether or not our address has been leased.

Now, we have spent most of this article talking about IPCONFIG. As I stated earlier, WinIPCfg does not exist in Windows 2000, 2003 or XP. However the resource kit for Windows 2000 actually does contain WntIPCfg, and we can do most all that we talked about in a GUI.



So then, why all this information about IPCONFIG? Because sometimes we can do more at the command prompt. This is true with WntIPCfg – we will be limited, especially in dealing with VPN connections. So do not forget the power of a command line.

There are a number of other command line utilities an administrator may encounter or find more quickly than navigating the GUI menus, including nslookup, ping, tracert, ping, pathping, and route. A fuller list may be found in one of the various aftermarket books on Win2000, NT, or XP. A brief caution, though: Check them out carefully! While you will not likely create a problem in issuing most of these commands without any argument, before trying the various options be sure to either have a good backup, or write down the parameters before you make any changes.

I really do appreciate the continuing positive comments and questions generated by this series. Please let me know which parts have been the most useful for you, and the topics on which you would like to see more discussion.

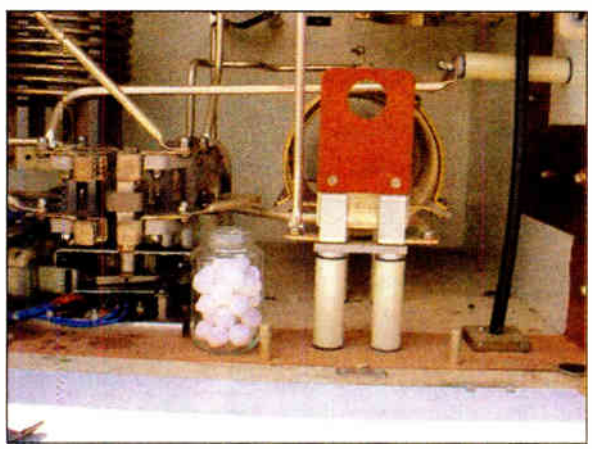
Tren Barnett is a System Administrator and Programmer in Tucson, Arizona. He welcomes your questions on solving network problems in your facility. Contact Tren at tpb@aires.org

Tips From the Field

Using Moth Balls For ...

by Gary Peterson

[RAPID CITY, South Dakota - August 2003] Have you ever opened a door at the transmitter shack, or tower base and had something unexpected fly or run out? How about finding Black Widow spiders in an equipment rack at a transmitter site? These are the sorts of surprises I have never enjoyed. A convenient solution was as close as the hall closet: moth balls. I have long used moth repellants in and around broadcast electronics. I use them in ATU cabinets and any other place I do not want something jumping out at me when I open the door.



Moth balls are usually naphthalene or para (p or 1,4) -dichlorobenzene. Both tend to sublime (turn directly from a solid to a gas) without going through the liquid phase. The rate of sublimation is a function of temperature and air circulation. Para-dichlorobenzene melts and boils at a lower temperature than naphthalene and, therefore, normally sublimes more quickly. Either will last longer in a closed area or at a lower temperature.

Neither product is directly corrosive to copper, aluminum, steel, silver-plating, insulation, electronics, etc. However, para-dichlorobenzene contains two chlorine atoms per molecule. If an ATU cabinet was filled with p-dichlorobenzene vapor and an RF arc occurred, a small amount of free chlorine gas (very corrosive) could be produced.

The amount of chlorine would be very small. However, with repeated arcs over a period of time, the corrosive effects of the chlorine could be noticeable.

On the other hand, Naphthalene contains no chlorine (just hydrogen and carbon) and, therefore, has no possibility of producing a corrosive byproduct. Plus, because it sublimes more slowly under similar conditions, naphthalene will last longer. Moth balls and snake repellant, containing naphthalene, are available at most hardware (such as Ace) and home improvement (such as Home Depot) stores. It is very reasonably priced.

To prevent naphthalene from subliming too quickly (as in an ATU cabinet where the temperature may reach well over 100 degrees F on a regular basis), place it in a glass jar and punch a small hole in the metal lid. The size and number of holes in the lid will affect the rate of vapor release.

If some critter is burrowing under your doghouse, pour some moth balls into the hole. Whatever is doing the digging will pack up and move.

It works everywhere. I maintain a translator, in a small building (outhouse size) on top of a rock outcropping. Somehow rattlesnakes were getting into the shack, likely because field mice could get in there. A couple of open boxes of moth balls every year keeps everything but me out. I love the stuff! (My heart rate still goes way up when I prepare to open the door, though.)

Gary Peterson, K0CX, is Corporate Engineer, Triad Broadcasting Co., LLC in Rapid City, SD. He can be reached at kzerocx@rapidcity.net

Email your tips to: editor@radio-guide.com

"Field Notes"

Letters From Our Readers

From: Mark Dixon, PD - WMUS, Muskegon, Michigan

Hi. I've been following the series, Networking 101 ... I'm the Program Director and do the morning show here at WMUS. I've been going for a networking degree in my spare time and I've found this series to be a nice addition to the information I've been learning in class. Tren does a nice job of getting the content across in a straight forward, easy to understand way. I hope he's planning on doing similar articles. Pass along my thanks to him.

[RG replies: We will. And, thank you for letting us know! Ed.]

From: Stu Tell - Mason, Iowa

I just wanted to let you know how much I enjoy Radio Guide. There are lots of great things I always learn from it. We need periodicals to show us and tell us how things are supposed to work and be installed at the station. Fortunately, you have noticed this and you are putting forth practical, nuts and bolts articles and features to help pull us through!

Something I would be interested in seeing is a poll. The question: What is the most unusual thing a GM has ever tried to paid you for your contract service? Me? My latest offering was one of those "discount coupon books" the radio station (with another marketing outfit) were selling over the phone. This GM calls with a "small problem" and I re-arrange my schedule to help him out. And he pays me with their latest coupon book!

He whipped it out of his pocket and said, "Here this is all I can pay you for your services!" I was so surprised someone had the gall to do that, I grabbed my VOM and tool box – and coupons – and hit the road! The kicker? I tell my wife this, as she is going through it and she laughs and tells me ... "Stu, the good coupons (eating places, movie theater discounts etc.) have already been torn out!" So it boiled down to this: a two hour job, used $10.00 of my own parts, all for a "used discount coupon book".

[RG replies: Stu, that is pretty low! Folks, what crazy compensation have you had? Let me know at editor@radio-guide.com. We will share the answers with you in the coming months. Ed.]

[Radio Guide welcomes your feedback. How can we serve you better? What do you need to know? Please let us know at editor@radio-guide.com Thanks! Ed.]

A Report on SBE Activities and Programs

SBE National View

Rule Change Raises Questions, Provides Opportunities

by David P. Otey, CSTE

[DENVER, Colorado - August 2003] In this space in the March 2003 issue, I described a set of rule changes by the FCC and how those changes are likely to affect frequency coordination in Broadcast Auxiliary Services (BAS). Since the release of the Commission's Report and Order in ET Docket 01-75, I have been receiving a lot of questions. Here is an attempt to answer some of those questions, with emphasis on the most urgent items for station engineers to understand and act upon.

***Q:** How is SBE Frequency Coordination affected by the recent changes to Part 74 rules?*

A: As a result of the recent rule changes, most new fixed BAS links will have to undergo "Part 101" coordination, requiring a formal interference analysis and a formal notification process known as Prior Coordination Notification (PCN). This is a substantial change from "local coordination," which is what the FCC calls our voluntary coordination system.

Once this change is effective, broadcasters who need new fixed links can still go to their local SBE Frequency Coordinator for help getting started, but the formal process will probably be handled by a commercial frequency coordinator, for a fee. Your local coordinator will still be the go-to person for any mobile or temporary needs, including itinerant users and anyone operating under the "720 hour rule" (74.24).

***Q:** When will this change take effect?*

A: Thanks to SBE's request for a stay, the effective date of the new coordination requirement is delayed six months, to October 16, 2003.

***Q:** What is the purpose of delaying the start of the new rules, if they are going to be implemented anyway?*

A: The FCC agreed with SBE's assertion that there is no system now available that can effectively replace local coordination databases. SBE has agreed to help the Commission improve the BAS portions of its Universal Licensing System (ULS), found on the web at wireless.fcc.gov/uls. At present, the ULS database contains far too many incomplete or erroneous entries to be considered an effective tool for coordinating Part 74 frequencies.

***Q:** How does the inaccuracy of the ULS database affect me or my station(s)?*

A: You do not want someone firing up a new STL that interferes with yours, do you? It could happen, unless you make certain your auxiliary licenses are correctly recorded in the ULS database.

***Q:** But all my auxiliary systems are already licensed – why are those licenses not sufficient to protect me?*

A: For the same reason we have frequency coordination: Your license cannot protect you from newcomers who do not know you are there! If those newcomers rely on ULS instead of the local coordination database, you could be the one receiving interference, thanks to (1) licenses that were recorded years ago using Form 313, before the FCC began collecting more complete technical data as is now done using Form 601, and (2) licenses that have "disappeared" – either they did not migrate over to ULS correctly, or they were erroneously canceled, perhaps because the parent station changed its call sign or ownership and the changes did not "ripple through" correctly under the systems previously in place.

***Q:** So how do I know if there is a problem with my auxiliary licenses, and what do I do about it?*

A: First, you need to do a little research. Fortunately, the internet makes it easy, especially if you use the web site **www.fccinfo.com**, courtesy of Cavell, Mertz & Davis, Inc. This site's powerful search engine makes it easy to find the auxiliary licenses associated with your parent station. For help in organizing your search and interpreting the results, visit the SBE web site, **www.sbe.org**, for step-by-step instructions.

***Q:** You say the rule changes affect fixed-link coordination. What auxiliary licenses should I be researching?*

A: Actually, it would be a good idea to check on all your auxiliary licenses. Your auxiliary, or Part 74, systems may include any or all of the following:

- Studio-transmitter link (STL).
- Intercity relay (ICR) [If you have a transmitter-studio link or TSL, it is considered an ICR.].
- Low-power devices like wireless microphones.
- Remote-pickup (RPU).
- 2-way radios in the 450/455 MHz band.

Of these, the first two-STL's and ICR's-are the ones for which coordination rules are about to change. Still, you will want to make sure all your BAS licenses are accurate in ULS.

***Q:** OK, I have found my licenses in ULS, and I can see that some information is incorrect or just plain missing. Now what?*

A: In the case of fixed microwave links (which, for this purpose, includes aural BAS links at 944-952 MHz), receive site coordinates and antenna data are often missing on older systems. Since that is clearly a historical problem with the way the FCC has collected data, SBE has requested a blanket fee-waiver for electronic filings to add the missing data.

As of this writing, that request is still pending. (Check the SBE web site for the latest information, including the status of the fee waiver and any special filing procedures that may be required.) For incorrect data, though, you will most likely have to file a modification application and pay the filing fee.

***Q:** But the missing data is all in the local frequency coordinator's database – why cannot SBE just roll their data into ULS and take care of it all at once?*

A: That would be nice, would it not? Unfortunately, there are both practical and legal obstacles to that approach. Still, it would be a good idea to compare your official records with the local database entries. Chances are, your SBE Frequency Coordinator (or in some cases, your local Frequency Coordination Committee) can help you by providing copies of your local database records that will clarify what is missing or incorrect in ULS.

***Q:** This license data is an alphabet soup! "ASR"... "FRN"... "FAC ID"... What are these things? Are they important?*

A: Yes, they are. "FRN" stands for "FCC Registration Number," which is assigned to any entity doing business with the FCC. For electronic filing, you need to know the FRN associated with a particular license, and its associated password. "ASR" stands for "Antenna Structure Registration," commonly referred to as the tower registration number. And "FAC ID," or Facility ID, is the number that identifies the parent broadcast call sign that an auxiliary license is associated with. This is how both the Media Bureau and ULS track broadcast stations, whose call signs often change.

If your company owns more than one station, you will need to pay careful attention to the FAC ID's on all your auxiliary licenses, and modify any that are incorrect. Some radio stations have experienced nightmarish results when they have split up a group only to find that one station moved out of a studio with the "wrong" STL.

***Q:** Speaking of STL's, I plan to upgrade mine to digital – how does that enter into all this?*

A: Changing a system's emission designator – like almost any technical change– is a "major change" according to FCC rules. If done on or after October 16, such a modification will require the new and costly PCN coordination, even though your frequency and other parameters may be unchanged. So take advantage of this window of opportunity, and file now!

***Q:** This is all very interesting, but with everything else on my plate I just cannot spend a lot of time researching licenses, much less filing modification applications. Besides, our corporate legal department is supposed to take care of licenses. How can I justify spending time on this?*

A: It is all about protecting your station from interference – is that not reason enough to make it a high priority? Once this opportunity passes, you will have a much harder time preventing interference problems– much less rectifying them– if you have not taken the time to be sure your BAS license data is complete and correct in ULS.

Even if your legal department handles the actual filings, they are completely dependent on engineers like you to identify your licenses' technical problems and to supply the information required to correct them. It may be up to you to educate your station management on the importance of this task so appropriate resources – your time included– can be allocated to it.

David Otey is the National Frequency Coordination Director for the Society of Broadcast Engineers. He can be reached at dotey@sbe.org

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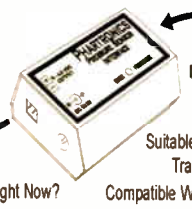

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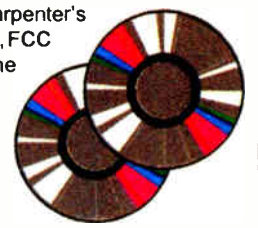

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Keynote Address
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