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February 2003
Volume 11 Issue 2

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Columns & Articles

Radio Guide

Volume 11 Issue 2
February 2003

ANTENNAS:

Radio's Connection to the World

Page 4 – Every station needs an antenna. But how much do we know about them, how are they built, and how do we maintain them?

Radio Guide begins a series designed to help stations get the most from their antennas.

Living With AM-IBOC

Page 8 – Thomas Ray III begins a new series with a "Primer on AM-IBOC." Over the next few months, he will pass on what WOR Radio has learned, during their implementation of IBOC.

Audio Processing - *Part 2*

Page 12 – In part 2 of this series, Cornelius Gould teaches us about time constants, and the attack and release times, of wideband audio processors.

Networking 101

Page 16 – Tren Barnett's series about building a computer network from the ground up.

Nighttime, 2-tower DA cover photo courtesy of Thomas R. Ray III, CRSE

Hands-On Broadcasting

Any way you look at it, broadcasting is much more than a job. Few careers have as wide a variety of experience and range as that of the broadcast engineer. From the relatively comfortable studios to transmitter sites located in some of the more "interesting" and challenging locations available, broadcasters are rarely described as bored. And, unlike some professions, we get to put our hands on the various elements that make up the broadcast chains we care for.

There are other professions that fall under the category "it's a way of life," but something about broadcasting seems to lift it above the rest of them. True, some might grumble that the 24/7 nature of broadcast engineering is more "a way of death," especially when the phone rings in the middle of the night, but even those challenges can lead to job satisfaction in many cases.

At least until computers and transmitters learn to repair themselves, and all antennas can be put somewhere where they are unaffected by weather, engineers will continue to have the joy and annoyance of diagnosing problems while anxious co-workers count the minutes.

Odd, isn't it then, that when things go well, those same anxious co-workers often complain we are "goofing off" and wonder where we go that they don't see us working?

Perhaps it is because the rest of the staff has never been to the transmitter site or never had explained how proper routine maintenance actually prevents problems. After all, they do have their own set of problems each day.

Maybe we need to find ways to get each station employee to come out and visit the transmitter site, and put their hands on the gear. Who knows, maybe it will "spark" their interest in what we do, and give them a true appreciation for our passion.

Antennas: Radio's Connection to the World

by Barry Mishkind – *Editor*

The first in a series, to help you learn about, and inspect your antenna systems.

[Tucson, Arizona - January 2003] They come in all sorts of sizes, shapes, and heights. They may, or may not be painted, lit, guyed, covered, or heated. Of course we are talking about the antenna and towers from which broadcast stations launch their signals to the listeners.

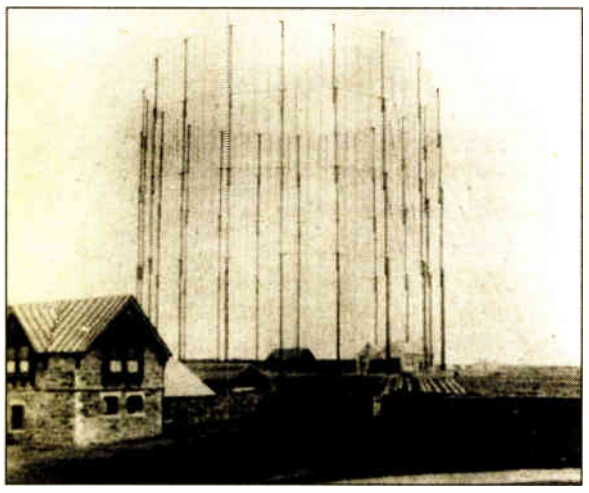
To broadcasters, they are beautiful objects, the symbols of our profession. Some of them qualify as the highest man made objects on the planet. Tall and graceful, they are built to withstand some of the most extreme weather conditions. Others are short and squat, just tall enough to get the signal off a hill top. But each one of these towers represents a considerable expense.

Not only is there an expense in designing a new tower system, and getting it approved by the local Bananas (Build Absolutely Nothing Anywhere Near Anything), but construction costs of hundreds of thousands – even more than a million dollars are possible on the taller sticks. And, then there is the issue of maintenance. It is, sadly, far too common for owners, who literally don't see the antennas, to assume they will just stand forever. FCC fines for lighting and painting violations often are harbingers of towers that have started to have structural failure.

Clearly there is a lot for a broadcast engineer to know about antennas. To help, Radio Guide well be running a series of articles to help you inspect your antenna system from all directions. And, without a doubt, antennas have changed over the years, as well as the technology and tools used on them.

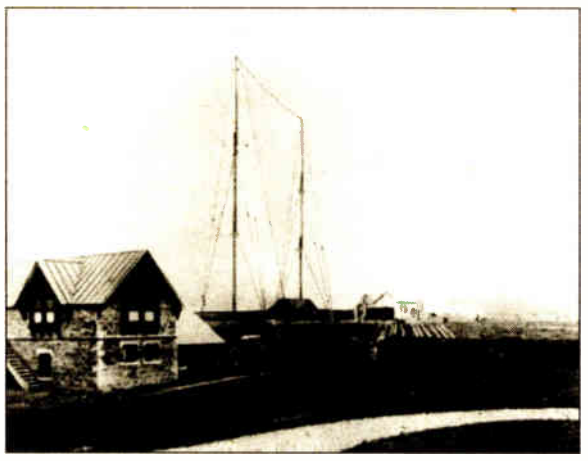
Termite Problems?

Once upon a time, it seemed that termites were more of a problem than rust. Many of the earliest antennas were constructed from wood and wire. The Marconi antenna at Poldhu, England, originally consisted of 20 such 200 foot towers.



Unfortunately for Marconi, neither termites nor rust were responsible for the loss of this array. A violent storm blew the towers down in November 1901. A shortage of time and money allowed for the restoration of only two towers of this and antenna, and use of a kite-supported receive antenna at Newfoundland for the historic trans-Atlantic transmission the next month.

Today, it is highly likely that a tower crew will arrive and install a suitable tower for emergency transmission in a matter of hours or days, should a catastrophe occur. Still, it may give you just a slight chill to daydream for a moment about how you might react if you were called to come in and attach your



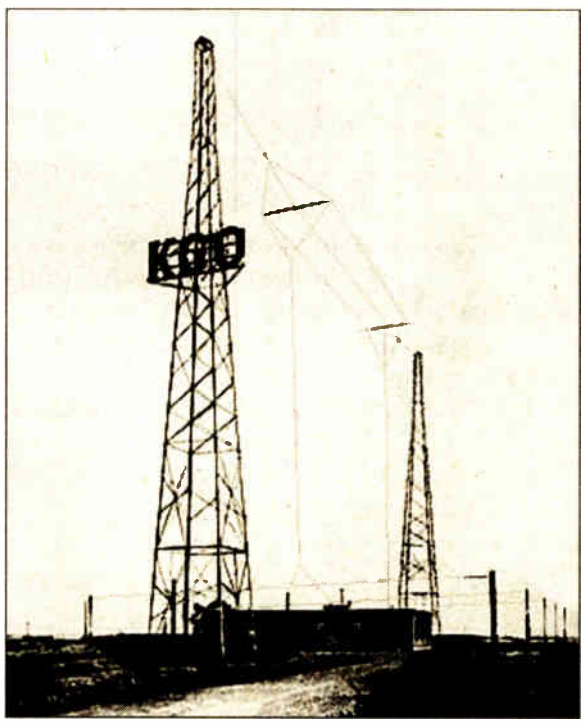
FM antenna to a kite after a storm downed the tower! Since Marconi's towers were new, it likely was not a maintenance problem. Rather, it was inexperience in designing large antennas which led to a system inadequate for the intended use.

Engineers learned the lessons from the Marconi stations. It didn't take too long for metal towers to become the norm for building antennas. All the new "broadcast" stations in the 1920's were constructed this way.

Perhaps the major difference between the 1920's technology and what came in the following decade, was the lack of suitable base insulators. Since the radiating elements of an AM antenna are only half of the antenna (the ground is the other half), it was important to isolate the radiator from ground. Without strong insulators, there was no way to hold those heavy steel antennas off the ground.

The solution for the time was to construct horizontal or "Flat Top" Antennas. In this method, the radiator was strung between two vertical antennas.

These antennas worked well for many stations, and a couple of them survived in use well into the



KGO Antenna, 1924-1947

1990s. In addition to construction in rural areas, the layout permitted installation on the tops of buildings in large cities, where land costs would be prohibitive. Often newspapers or car dealers, etc, would place these antennas on their roofs, and run the radio station from the "mother" organization.

Perhaps the major drawback was that, just like desktop radios, horizontal antennas have an inbuilt directionality, with relatively little signal off the ends. As cities grew, it was not uncommon for the population to grow in areas where the station wasn't able to serve as well. This would require a different antenna.

Vertical Antennas

Finally, by the late 1920's and early 1930's, porcelain insulators were produced that were capable of supporting antennas of sufficient height to be useful on AM. The higher power stations took special advantage of the vertical radiators, as well as relocating out to the edges of their market.

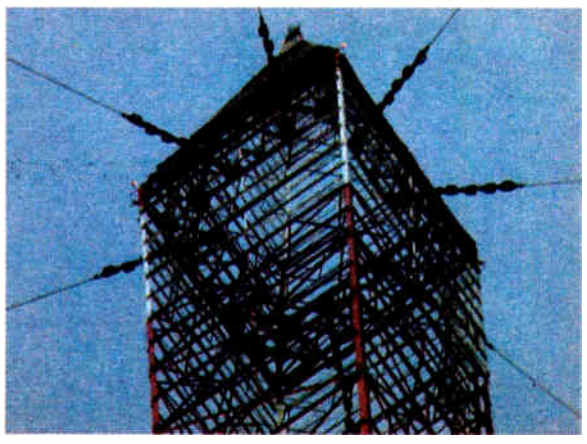
These antennas were of a variety of designs. Not only were there the now familiar uniform cross section (usually three sided) towers of various face widths, but also square (four sided) towers, self-supporting towers that started with a large base and tapered as they rose, the stacked "Franklin" antennas, and the wonderful, seemingly made-to-stare-at, Blaw-Knox Dual Cantilever design. Many were quarter wave length, but as engineers began to appreciate the higher efficiencies of the taller towers, AM antennas started to grow in height.

Vertical towers actually had two issues to overcome. The need for insulators, as mentioned, and the need to handle the various movements that are transmitted to the antenna from the wind, temperature changes, etc. A tapered bottom and pivot were designed to permit the "moment" forces to be handled without having to build gargantuan insulators.

Blaw-Knox was a well known tower manufacturer of the time, along with Truscon and others. (Unfortunately, as with many tower companies of the time, liability issues seem to have led to their demise.) Their special name recognition came from the distinctive appearance, coming from what was apparently an ad lib change during an installation in Tennessee.

When contracted to build a new antenna for WSM in Nashville, Blaw-Knox prepared two self-supporting towers for installation. Before they were erected, though, Chief Engineer Jack DeWitt had become interested in the vertical antennas of the day, and their improved radiation characteristics.

Believing the "buried counterpoise" (made up of copper radials buried just under the ground at an AM tower) would provide WSM with better coverage than the planned horizontal antenna, DeWitt talked his depression era owners into spending a lot of money to "stack" the two towers, install a base insulator of sufficient strength, and add a ground system.



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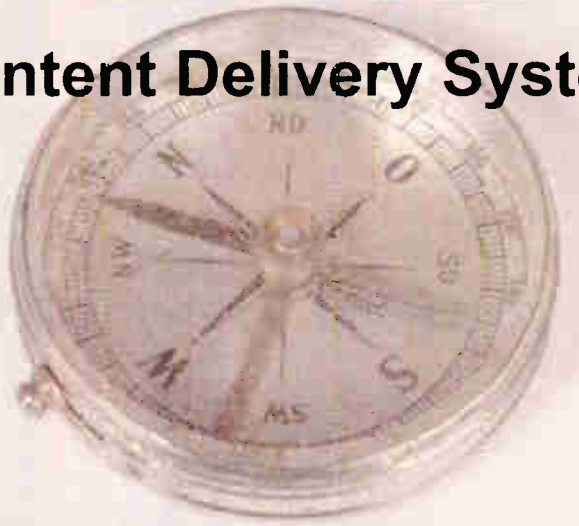

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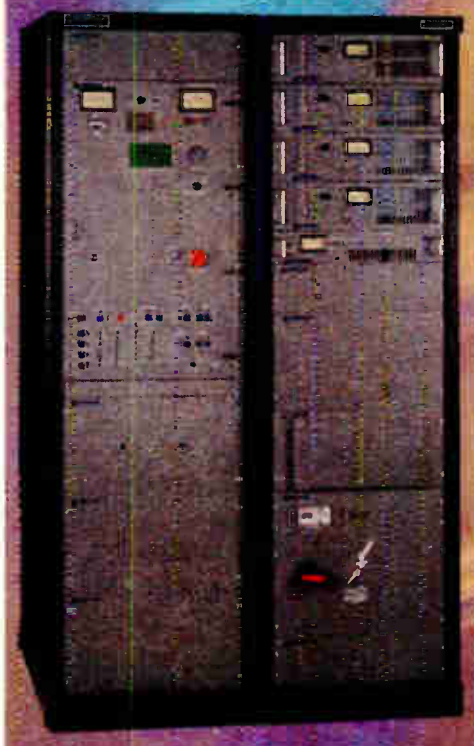

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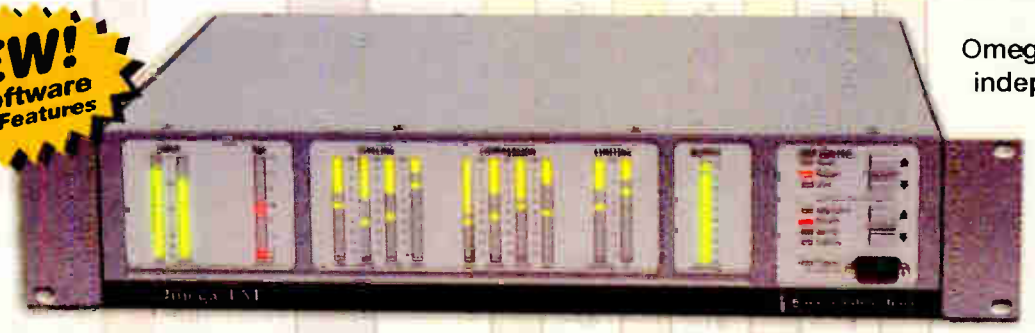

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Antennas: Radio's Connection to the World

Continued from page 4.

The WSM tower, pictured on the front page, is still in operation today. The base insulator was something like four feet tall, and capable of withstanding the weight of the combined tower, plus the force from the guy wires, estimated at approximately 300 tons. Its strength is proven, as the WSM antenna has stood for well over 70 years, aided by careful maintenance. Coverage is great, and the WSM signal really "gets out."

Interestingly, right after finishing the WSM installation, the Blaw-Knox crew built another one for another little station down the road: WLW

Watt Hairston, CE of WSM stands next to the base insulator.

The two "bottoms" come together to form the famous "diamond" shaped tower.

The WLW Blaw-Knox tower.

Soon tower companies were able to produce uniform cross section, guyed towers of sufficient height, and the Blaw-Knox Dual Cantilever was no longer necessary for constructing tall towers. Still, the ones that remain have a story to tell about conquering the physics with the technology of the time.

Starting about the same time as the vertical radiators became common, directional arrays were developed to protect co-channel stations. WSUN in St. Petersburg, Florida was built to protect WTMJ in Milwaukee. This is a very interesting story in itself, but the care necessary in construction is apparent. A four tower in-line directional array will not tune up very well if one of the towers is not exactly in line.

Higher and Higher

Starting in the 1940's, as FM radio and television gained a foothold, many AM antennas started sprouting "appendages" at the top. With their shorter wavelength, these antennas could be side mounted or top mounted on existing antennas, with suitable isolation for the RF. However, since FM and TV are much more sensitive to "line of sight issues" the antennas have increasingly moved to mountaintops or towers that run as high as 2000 feet or more. Additional concerns regarding lightning damage need to be in place, as towers soar ever higher into the sky.

Although FM antennas themselves were usually between 20 and 90 or so feet in length, installing them and maintaining them becomes an issue. This is no trivial matter, especially when you need to send someone up 2000 feet to inspect or repair an antenna. Accidents which result in death or the destruction of some towers have occurred, fortunately not too often. And, thought needs to be given so that the tower structure itself can hold, not only the antenna, but also the coax to get the power to the antenna, plus wind and ice loading that can occur during the year. One solution used in congested

areas is the antenna combiner, which takes the output of many transmitters and routes it to an antenna. If you've seen one, you know combiners can take up quite a lot of floor space!

To bring this overview to a conclusion, let us take note of the wide variety of people involved in the design, installation, and maintenance of any antenna. The level of attention and maintenance performed varies from owner to owner, even manager to manager. If you are leasing your site, you still need to know what is being done and when.

As we press ahead in the next few months, we hope to help make the various parts of the antenna system clear, and offer some maintenance tips, tricks and warnings of pitfalls to avoid. By sharing our thoughts and experiences, it should make it easier to develop effective plans to commit the right amount of money towards keeping the towers and antennas up in the air, and in good shape! – *Radio Guide* –

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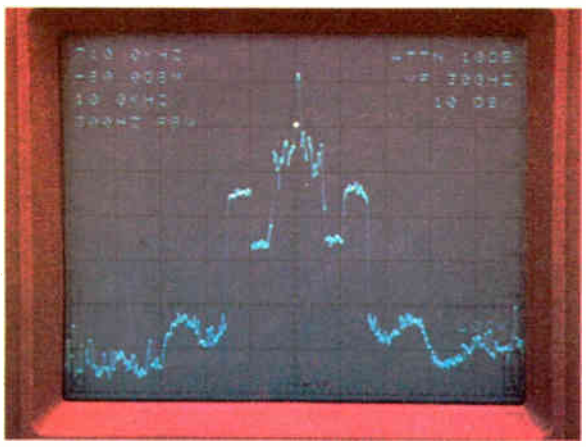
Living With AM-IBOC

by Thomas Ray, III – *CSRE, Corporate Director of Engineering for Buckley Broadcasting/WOR*

A Primer on the AM-IBOC System

The FCC approved the use of iBiquity Digital Corporation's AM In-Band On-Channel (IBOC) digital transmission system on October 10, 2002. With the magical push of a button at 9 a.m. on October 11, WOR Radio in New York City became New York's First Digital AM Radio Station, when we officially signed on IBOC.



Spectrum analyzer shot of the WOR-HD signal.

Seeing as how WOR is, arguably, the first AM radio station in the US to adopt IBOC on a full time basis (we are presently using a proprietary exciter from iBiquity), and we have been operating IBOC daytime-only since October, I guess I'm an "expert" on the topic. After all, I have been living with IBOC since then. And so far, it's been quite an adventure.

This column, over the next few months, will attempt to pass on to you what we at WOR have learned about IBOC since we turned it on. We will discuss AM theory, what the IBOC system is and how it works, and, most importantly, what is required to install IBOC on your AM station. It really is not as big a mystery as it may seem.

Getting a First Hand Look

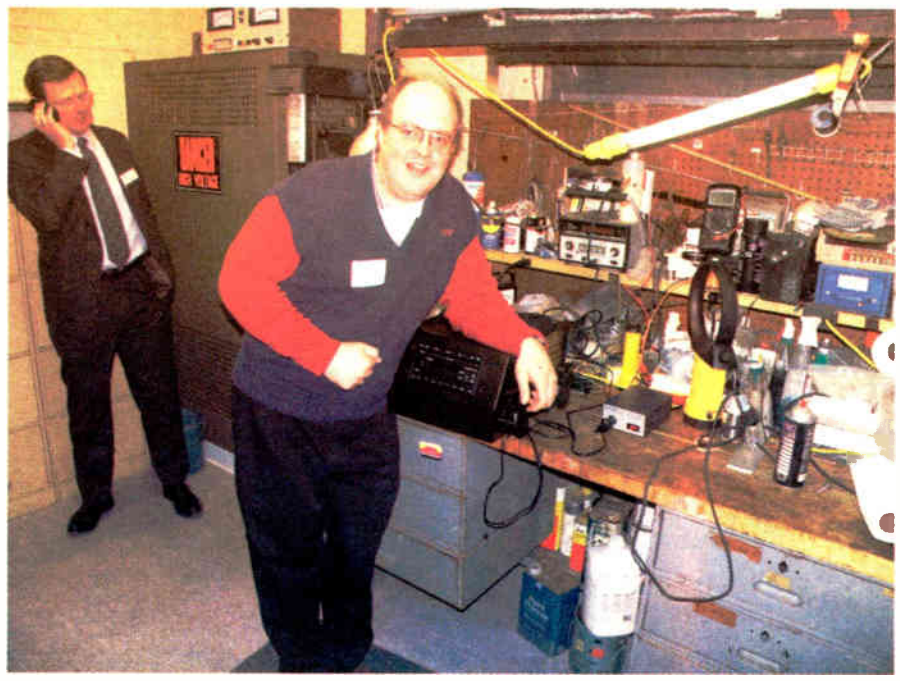
How much interest is there in IBOC? Chapter 15/New York City, of The Society of Broadcast Engineers, held their January meeting on January 23. The topic? The WOR HD Radio installation. The attendance? We had 80 people listed on the sign-in sheet. All 100 seats at the later presentation were filled, and we estimate that we had around 130 people, in all, attend the event.

The event started with an open house at the WOR transmitter facility in Lyndhurst, New Jersey, at 3 p.m. At 6:30 p.m., we adjourned to a restaurant up the street from the transmitter for corned beef and a presentation on WOR-HD and AM IBOC in general, given by yours truly.

This was followed by a presentation on the radios soon to come to market, and FM IBOC by Jeff Detweiler and Russ Mundschenk of iBiquity. The floor was then opened to questions.

The meeting was attended by Engineers and Managers alike. We had people from the New York City area, Connecticut, New Jersey, Albany, Binghamton and Syracuse, NY, and Washington DC. The Pennsylvania Broadcasters Association showed up with a bus load (literally ... a bus!) of 40, and one person flew in from Oklahoma. Quite frankly, we possibly set a record for attendance of an SBE meeting.

At the WOR facility, the attendees saw how the exciter interfaced to WOR's main transmitter, a Harris DX-50. They got to hear WOR-HD on an iBiquity test receiver. They heard WOR-HD on a real production model Visteon radio that will be appearing in Ford, Lincoln, and Mercury vehicles this summer. They also toured an iBiquity test van, which is one of the coolest things to see. (I'll bet the FCC is jealous.)



Tom Ray, Buckley Broadcasting Corporate Director of Engineering, hugs a production model Visteon HD radio. This radio will start appearing in 2004 model year Ford, Lincoln and Mercury vehicles this summer.

When you come to New York, you simply must experience the subways! Wait ... this is the WOR transmitter room during the SBE/Chapter 15 meeting on January 23.

WOR's Chief Engineer, Kerry Richards and I held nothing back. We showed all attendees what they wanted to see: connections, the individual processors, the spectrum analyzer monitoring the signal. And we answered questions about what has started as one of the great mysteries of broadcasting.

Incidentally, I have been playing with the Visteon and have driven into the station with it several times. WOR is a talk station and, while the talk programming sounds considerably better on the radio when it opens up in HD mode, we run several commercials that were locally produced in New York and were recorded "properly." It is absolutely awesome to go into a break and actually hear the cymbals and bells at the beginning of a spot.

Next time around, we will cover basic AM theory and how it applies to IBOC. With HD radios scheduled to start appearing on the market in the second quarter of 2003, the time is right to start boning up on a subject we all will be faced with very soon.

Tom Ray is the Corporate Director of Engineering for Buckley Broadcasting/WOR, New York City. You can reach him at tomray@wor710.com

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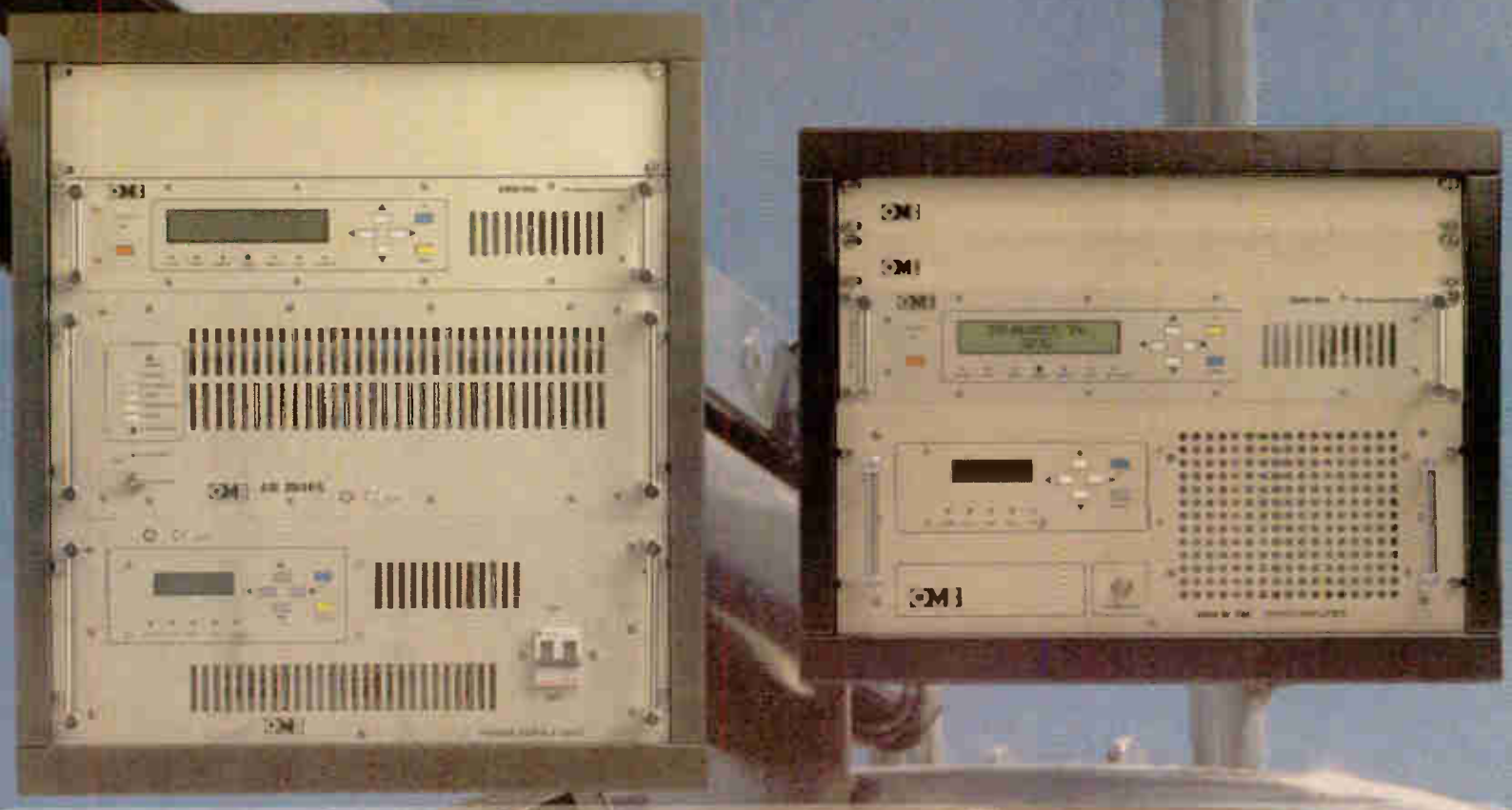

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The Business of Contract Engineering

Contract Engineer

Corporate Clients

by William Bordeaux, CBRE

Recently, I found myself working along side a cellular telephone engineer. The cellular company has antennas on an AM tower that I am responsible for. They had been experiencing high VSWR on one of their transmitters, and strangely, about the same time my nice new Harris solid state AM transmitter had gone off the air. I found that the resistors and capacitors on the audio input of the transmitter had burned up, trying to bleed off abnormally high levels of RF. The isolator feeding the cell phones signal up the tower had failed and was causing all kinds of grief. But that's another story.

It turns out the cellular engineer had gotten his start as a radio engineer in the early sixties. When the cell phone industry geared up in the early eighties he jumped ship and has been lamenting his decision ever since. His heart was still in radio but he needed the cellular industry to pay the bills. He was shocked when I told him of the changes that had happened in radio since he left.

In particular, he was amazed that so few people were engineering at so many stations. He wondered how the future might look, and what opportunities might exist in this climate of consolidation and incorporation. I told him that with the right approach, the contract engineering business could offer lots of opportunities. As with any business, it's critical to understand your customer.

Corporate Communications

Make it your job to understand the methods that your corporate clients use to communicate. Integrate their system into your communications methods. In this way, you can seamlessly integrate your operation into their daily routines.

Of course most clients use e-mail for day to day communications. E-mail works great for casual information exchange, but falls flat for urgent or complex communications. I always spend a little time with my clients, to find a system that will work best with their business structure. The importance of setting guidelines for communications was recently apparent when one of our clients hired a new program director. He did not realize that we spend most of our time in the field working and very little time in front of the computer checking e-mail.

One day I got a panic call saying that a special satellite fed program was not available. It turned out that the program director had e-mailed me a request for the program feed sometime before lunch, and the feed was required at three p.m. that same day!

I dropped what I was doing and hustled over to the station to connect the feed they needed. After the excitement was over, I sat down with the new program director and explained to him how our communication system worked. For us, we are usually able to make it to a computer first thing in the morning and that's about it. Normally we are out at job sites throughout the day and don't have access to e-mail.

To help bridge the gap between our clients that constantly communicate with e-mail, we've started using alphanumeric pagers that are e-mail capable. I encourage our clients to e-mail our pagers if they need a simple question answered promptly.

A word about cell phones. We may be bucking the trend, but we're fighting the pressure to carry a cell phone at all times. We have cell phones, and use cell phones, but we leave them in our vehicles. We carry our pagers at all times, and with the e-mail enabled pagers, find we are able to satisfy our clients need for communication without using interruption prone cell phones.

My experience has been that clients start getting lazy when they find that you can be reached immediately via cell phone. After a while, they can stop thinking for themselves and begin using the cell phone as a crutch. Why bother learning something when I can just call the engineer and have him tell me what to do? By using a pager system, I've found that clients tend to think through things when ever possible before resorting to paging me.

A forest of STL dishes marks the location of a corporate "cluster."

In lazy cell phone mode, when a transmitter would go off, the air talent would call me and say, "the transmitter is off. Can you turn it back on?"

In pager mode, they will page and say, "the transmitter is off. I've followed the instructions on the transmitter log, but it still won't come back on." When you've got twenty-some clients, and over thirty transmitters to keep track of, that's a huge help.

Billing and Payment

Corporations like to set up complex methods by which they disburse funds. Do your best to completely understand the process that your invoice goes through, on it's way to being paid. Many times, multiple people will be asked to look at it and sign off before it gets paid.

You may wish to meet or talk to the people involved and come to an understanding as to the information that they need to do their job. They are generally busy people and don't want to have to fret over your bill. Your goal is to make their job as easy as possible.

One of our corporate clients sends our bills to three people to review before they get paid. Following approval, the bill goes to the accounting department where it is entered to be paid. Early in our relationship, I met with all of the people involved in the process to be sure that I was going to be able to supply them with the information they required. It was well worth the time spent. Not only did it insure smooth sailing for our billing but I established a relationship with the people involved so problems that crop up in the future could easily be resolved.

Special Projects

With profits evermore important, many broadcast groups look to cut costs by cutting the number of engineering personnel on the payroll. This may leave a broadcast outlet understaffed, should a studio move or transmitter site construction project come up. Labor intensive projects are a perfect opportunity for a contract engineering company to work with the full time engineering staff and give them the help they need.

Our contract engineering business was able to assist a local "corporate" client when they needed to build nine new studios, a new mountain top transmitter site and move a news-talk facility – all the while keeping their existing eight stations on the air. The timetable for the project was less than eight months. With corporate engineering staffs already stretched thin, more and more engineering groups are "jobbing out" studio projects.

Don't overlook these opportunities when offering your services to a local broadcast group. If the stations have an on-site full time engineer, make sure he or she understands that you can be of great help to them when it comes to pushing these big projects over the top.

"The Powers That Be"

Knowing who is the decision-maker, and who is just filling a chair, is key to getting things done within the corporate structure. The political climate within an organization can be quite intense at times. Often the contract engineer is left out of the power struggles that may be waging within an organization. I've been surprised to find my work suddenly under microscopic scrutiny for no apparent reason.

Of course it starts me wondering if I've done something wrong or maybe some of those back burnered projects shouldn't have been back burnered? Ultimately, I find out that some bosses boss is coming down on someone within the organization that's been skating and fingers are pointing at me in an effort to deflect attention from themselves.

Such is the lot of the contract engineer. I've been fortunate in my career that most times the guilty party is found out and suddenly that person is gone and I'm working with someone else within the organization. This chain of events most often means that you've now got someone new to get up to speed on all of the projects and problems under your jurisdiction.

Understandably most corporate broadcasters need to have a central person that coordinates engineering activities. The amount of latitude that the contract engineer is given to perform his duties varies widely from organization to organization.

We've got some clients that give us free rein to keep them on the air and make them sound great, no matter what. We keep them apprised of our activities of course, but when, say, a tube fails, we put in the spare and order a new one pronto. After the fact, we let the engineering manager know, and then contact him again when the new tube is in and we're running back normally. Other clients have engineering managers that require us to consult with them before, during, and after any work is accomplished.

As painful as it is, we've had to let transmitters run themselves into the ground while we waited for the OK from above to take care of the situation. It's a strange feeling to stand there with your hands in your pockets waiting on a call back to give you the OK to save a piece of equipment from certain destruction.

If any of this sounds like madness ... well it is, and it isn't. It's part of the growing pains of an industry adjusting to a new way of doing business. As consolidation continues and more Mom and Pop's turn into Mega Stations Inc., the contract engineer's role will continue to grow. – *Radio Guide* –

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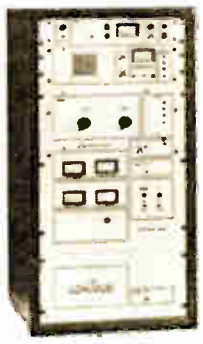

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Audio Processing From the Ground Up

by Cornelius Gould – *Senior Staff Engineer, Infinity Broadcasting Cleveland*

Part 2: The Art vs. the Science – Time Constants

(Listening to the difference between "line" and "air" makes us highly aware of the value of the audio processor in the chain. What is inside turns out to be more than some filters and combining networks. In this series, Cornelius Gould explains what goes on inside an audio processor.)

[Cleveland, OH - February 2003] Broadcast audio processing is a strange animal. It's one of the few instances where the object of the game is to take an already produced musical piece, and run it through some "black box" whose sole purpose is to intentionally distort the piece in all sorts of ways in the name of making it "sound better."

This runs counter to everything a good audio engineer is taught. You spend money making sure the studio gear is the best you can buy within your budget. You make sure that the distortion figures are all low as possible ... only to run it through a box that is essentially a big distortion unit!

It's been said many times before, but nothing is truer than the statement that audio processing is part science, and part art (or "magic," if you will). The art comes in knowing how to use the distortion tools supplied to you in the expensive distortion box, to yield acceptable results. Many times I've heard from a totally stumped engineer, who needed help getting their black box to play as good as Joe Engineer at the radio station across the street.

This is even with the exact same unit. If you understand the parts of your black box, you will more likely be able to yield acceptable results from it. That is what this installment will start to explain.

To begin, we need to look at this from the designer's point of view – the nuts and bolts of an Automatic Level Control device. I'll interject with my own parallels to this road, very well traveled by those before me, as I tried to get my little "neighborhood blaster" to be as loud sounding as the big time stations.

The Audio Compressor

The application: In modern broadcasting, there is a need to keep audio levels consistent. When this objective is met, the rest of the broadcast chain can be accurately "fine tuned" since you are now dealing with "known operating levels." Another benefit is that the end-user (your listener) doesn't have to keep reaching for his or her volume control to try to compensate for sloppy levels back in the studio.

Ideally, the device for ensuring consistent levels is the board operator (or DJ). In reality, this is not the case as the board operator rarely looks at VU meters anymore ... and that is assuming there is a body there to watch them in the first place.

The "scientific" solution to this problem: To create an electronic device to automatically maintain program levels for you. The raw program audio will leave the studio and go through this device. This device will watch for any levels that are either too far above, or too far below a pre-determined program level threshold. If program levels exceed the "upper" limit of the threshold, the device will make a gain correction to decrease its output gain. If it is too far below this threshold, it will do the opposite. This is the concept of the "Automatic Level Control" device (ALC).

At the heart of such an ALC device is the Voltage Controlled Amplifier (VCA). How much gain this amplifier has depends on the amount of voltage applied to its control port. Generally speaking, as the voltage on the control port changes from zero volts, the gain of the amplifier changes proportionately.

The automatic level control is realized by sampling the output of the Voltage Controlled Amplifier, filtering it to DC, and comparing this DC signal to a static reference. When the audio from the output of the VCA exceeds the threshold of the reference, the DC output is applied to the VCA's control port, which causes a decrease in gain. The speed at which this happens is determined by a timing network between the raw rectified DC and the VCA control port.

The Artistic part: How fast should the ALC operate? When a condition requiring a level correction occurs, the ALC must "act on" (or "attack") this situation within some acceptable period of time. When the level problem has either been corrected, or no longer exists, the ALC must go back to "normal" operation ("recover") at some defined length of time as well.

The speed of the level changing transitions of the ALC can either be fast enough for this automatic correction to be audible in some obvious way, or slow enough to not be noticed at all by the casual listener. To decide what approach is the appropriate one, depends on the designers' "artistic mission."

Faster is Louder

The main side effect of these transition times being set faster, is greater "perceived loudness." This is due to the fact that the ALC can be configured to "average out" loud and quiet passages to one uniform level. This can happen so fast that quiet sounds in between loud percussive beats can be brought up considerably, and when the beat occurs again, the unit can very quickly reduce (attack) the level to be closer to the levels of the quiet material, and quickly "recover" to bring the quiet passages up again.

If the percussive beat is mostly of bass energy (which is the case for most music), then the effect can become quite annoying, in that you will hear high frequency material drop down in level whenever the percussion beat happens, and quickly "recover" to normal level. This particular side effect is commonly described by engineers as "pumping."

An additional aspect comes into play. Not only does the speed at which the ALC operates affect loudness, but it's also how much you drive the unit! This is because the more you "overdrive" the ALC, the more often program levels exceed the "upper limit" threshold. When this happens, the ALC is normalizing average levels across a wider audio level range. Operating in this "overdrive state" can even bring the noise floor of the studio to a "normal" level (if you overdrive drive it hard enough).

When you "overdrive" the ALC unit hard, there is practically no change in audio level, despite how the source material is recorded (or where the operator sets his or her board levels). This means that all audio, from the loudest sound down to the air traveling down the DJ's throat between his spoken words, can be at one level. This can cause the station to sound LOUDER than everyone else, but at the cost of taking the concept of "pumping" to ridiculous extremes.

The Classic "Programming vs. Engineering Department" Struggles

Radio programmers were so highly pleased with the increased loudness demonstrated by ALCs, they asked for more – happily living with this "pumping" if they could be the loudest sounding station on the dial! This aspect of the art has been deeply established in the broadcast community over the years

Engineers, on the other hand, have a tendency to be purists, so the pumping effect drove them insane. This set up interesting battles that play out to this day between programmers and the engineers (who generally hold the magic keys to the processing equipment). "Can't we be just a little bit louder than 'them'?" they ask. Eventually, the engineer gives in, and dials in more obnoxious side effects. Now the programming department is happy, for only as long as it takes their counterpart across the street to notice, and do the same.

There are many arguments out there suggesting this type of "overdriven" processed audio causes listeners to subconsciously become tired of this "really busy" audio. This condition has become commonly known as "listener fatigue". This theory states that when listeners become fatigued of the "sound" they hear, they will tune away, after a short period of time, for relief. They will do this is in spite of the fact that the extreme loudness of the station may have been one of the factors causing them to stop and check it out in the first place.

The designers of these ALC units, generally siding with the broadcast engineers, had to come up with clever solutions to make both parties happy. In solving that problem, they can also address solutions to the larger problem of "listener fatigue" – since the desire to have loud sounding radio isn't going to go away anytime soon.

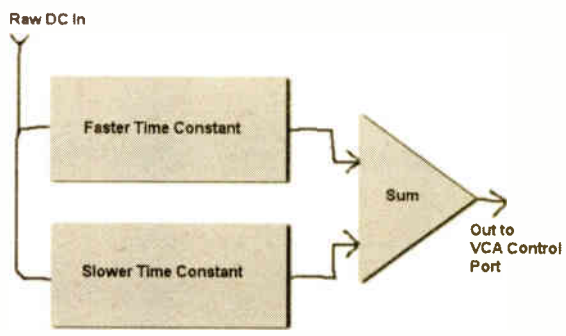
This was also the dilemma facing me, as I built the successor to my first "successful" processor, the AC-302. The engineer in me was glad to have level control. The PD in me wanted it to sound louder, because every one was louder than my station!

The problem that I quickly discovered, with this approach, were those momentary LOUD sounds in my program audio: sometimes percussion, sometimes a "p" pop on a microphone, or a nice loud pop or click during the quiet passage of a musical piece. Signals like these caused a *huge* decrease in the output level of the processor, which would require a longer recovery time for the single time constant compressor.

This is because the noise "spike" can be as much as 15 dB louder than the rest of the programming, but it only lasts for a fraction of a second. Setting the attack time shorter, to keep the compressor from reacting to such a short transient, just moved the problem downstream for the single time constant limiter to catch.

You can set the limiter to recover very fast, but you still would get an obvious "hole" punched into the audio by a very short duration "tick". (Yes, modern processors combine AGC and limiting, but we want to talk mostly AGC in this article.) In the journey to find a solution, I stumbled onto the concept of "multiple time constants," after brainstorming for several weeks on a way to minimize the "pumping" effect of the processor.

The idea I came up with was to have a "secondary" timing network that is somehow triggered by such short duration event.



I schemed up the design, tried it, and thus was born the AC-302A. After a couple of refinements, I settled on the AC-302C, which was shown in last month's installment. (Little did I know in 1986, while I was making "revolutionary discoveries" in my mom's basement, the basic technique was already in use in thousands of radio stations across the country in one form or another in the growing number of Optimods, and Audio Prisms.)

How Multiple Time Constants Work

In the classic implementation of an audio compressor, the time constant is created through the use of a simple timing network, consisting of a resistor and

(Continued on page 14)

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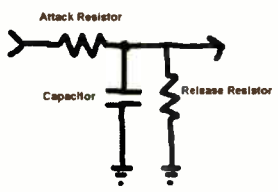
Audio Processing

Continued from page 12.

capacitor. The (raw) DC control voltage is fed into one leg of the resistor, and the other leg is connected to a capacitor, which also goes to a DC amplifier. The capacitor has one leg to the resistor, and the other to ground. There is another resistor in parallel with the capacitor, which sets the discharge rate of the capacitor.

The way this DC integrator works is like this: The input resistor value sets how quickly the capacitor charges up, the value of the resistor in parallel with the capacitor to ground sets how quickly it discharges. The charge rate is called "attack," and the discharge rate is called "release." These two resistors are usually made user-adjustable so that you can custom tailor the characteristics of this integrator to better suit your programming.



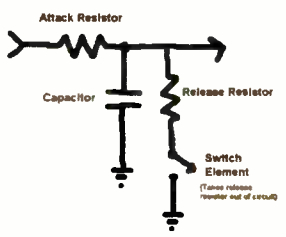
The average program source has lots of transients that are not unlike the "momentary glitch in the audio" scenario I described earlier. They occur all the time, mostly in the form of the percussion section. Handling these intentional transients, by switching in the appropriate timing network at the right time to prevent the disruption of the overall average audio level, goes a long way toward minimizing listener fatigue.

The "hole punching effect" is minimized because of the way the faster time constant would "envelope" the transient at an extremely fast rate. After the faster time constant recovers, the processor would then be back at its "normal" gain reduction, previously set by the slower time constant.

I should point out that multiple time constants take many forms. They can be derived by switching in various networks (as I described for simplicity), or by adding the outputs of different timing networks, in various ways, to create a "composite" control signal. Each method has its advantages, and disadvantages. Using a combination of both approaches is pretty typical these days. The Aphex Compellor is an example of the combination of both schemes in one unit.

The most basic form of a multiple time constant network is the infamous "freeze" gate. This is probably one of the best audio processing ideas to ever come out of someone's head. Let's return to the diagram of a simple time constant network.

A freeze gate works by monitoring the audio coming into the VCA. When the audio at the input falls below a user-determined threshold, the freeze gate circuit 'removes' the recovery resistor from the timing network. Doing this causes the capacitor to discharge at a much slower rate. When the audio exceeds the threshold, the resistor is placed back into the circuit, allowing the normal user determined mode of operation to continue.



This is a great tool for eliminating the noise buildup that would normally happen as the integrator is being discharged by the recovery resistor during quiet moments in the studio.

Another great idea is the use of a "quiescent gain state". With this approach, it is assumed that your processor would preferably operate at "unity gain" during silence. This gate watches for audio at low levels at the *input* of the VCA. When low level audio meets the threshold value of this gate, it causes a change in the resting voltage of the VCA to cause it to "turn up" the quiet signal to a more audible level.

When the signal goes away, it returns (turns down) to unity gain state. When the signals on the *output* of the VCA exceeds unity gain threshold, the control and timing network we described earlier kicks in and keeps the output level constant.

Some audio processors use a combination of those two concepts, as well as composite control signals derived from the adding of various time constants, for even more intelligent control of your audio.

As a side note, some people don't like the "quiescent gain" approach as it can have a state where the "smarts" in the processor fails to recognize some low signals as legitimate audio, and can cause a change back to unity gain. When this happens, you will be very quiet on the dial unless the audio is turned up higher on the console by the studio operator.

Almost Every Station in Overdrive

Using multiple time constants to form a very complex composite control voltage for the VCA also allows the use of *lots* of "overdrive" for maximum loudness, with only minimal side effects. As a result, to this day, *almost* every station in the world operates their audio processing units in "overdrive" all the time.

The ALC unit I have described is what's known as a wideband audio compressor. It is given this name because the entire audio spectrum is controlled by one VCA device. This was the standard unit for broadcasting, from the inception of automatic level control sometime back when cars were made out of 100% steel ... till about the early to mid 70's.

By the mid 70's the broadcasting world pushed that wideband concept to the limit, and with that, engineers were back at the drawing board, and had to scheme up something better. That's where I was in late 1986. I needed to go to the next step. That step was to go MULTIBAND ... we'll get there next month.

Questions? Comments? Sure. Let's hear your thoughts, too. I love audio processing, and am always on the prowl for new ideas to try.

Cornelius Gould has had a life long interest in the insides of audio processors. He is the Senior Staff Engineer for Infinity Broadcasting in Cleveland, Ohio as well as Chief Engineer for WJCU 88.7 FM in Cleveland. Reach him at: cg@radiocleveland.com

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Larger Than Life Radio

It was HUGE. There is no other way to describe it. Even today, as you enter the room with the remnants of the largest transmitter ever used for regular operation in the US, the first word that comes to mind is Huge. Then come massive, giant, stunning, powerhouse.

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Everything about WLW was HUGE. It required its own pond to provide over a million gallons of water a day to cool the power tubes, and one and a third million cubic feet of air each hour. The tower was one of the tallest structures on the planet in the early 1930's, at 831 feet high. The modulator transformers towered over people, ten feet tall, and 37,000 pounds of metal. The power tubes were the largest of their kind, costing $34,000 in 1934 dollars.

And the people! WLW had some huge stars in their studios, as they broadcast to 1930s America: Fred Allen, Red Barber, Eddie Albert, Red Skelton, Fats Waller, Andy Williams and more.

And then there was the reach. It was HUGE. WLW was heard coast to coast. Engineers estimated the service contour at 5,000 miles. Except to the NE, where to protect a Canadian station, WLW was cut back to a mere 50,000 watts. Teams were sent out to record the station's audio from hundreds and thousands of miles away.

Mike Martini and Mark Magistrelli

WLW was built to sell radios. And, in an effort to make those radios as inexpensive as possible, Powel Crosley sought permission from the government for greater and greater power for his station, 20, 500, 5,000, 50,000, and eventually achieving 500,000 watts, making it a legendary powerhouse, never repeated here in the US. Unlike a certain fictional radio station in Cincinnati, WLW sold a huge pile of radios.

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Thanks to the folks at WVXU, it is now possible to read, view, and listen to the voices and music that made WLW an icon among radio stations. Cincinnati Radio: The Nation's Station (1921-1941) is now available to the public. Produced as an incentive for station members, this set contains two CD's, a 40 page booklet, and a reproduction of a WLW tour guide.

This documentary represents several man-years of effort on the part of Mike Martini, Mark Magistrelli and George Zahn, under the direction of Dr. James King, GM of WVXU Radio at Xavier University. As one of several such documentaries from WVXU, it was produced with the utmost care and with a budget designed to save history, rather than merely make money.

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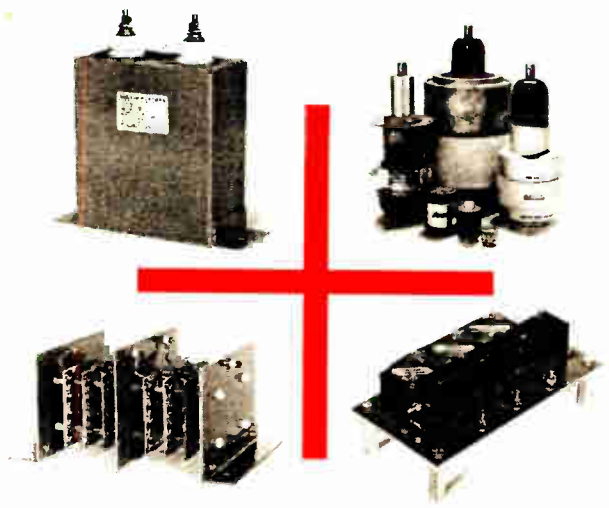

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	5/10 kW	1982	Continental 316F
	5/10 kW	1982	Harris MW10A
	25 kW	1991	Nautel ND25
	50 kW	1982	Continental 317C-2
	50 kW	1986	Nautel Ampfet 50

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Networking 101

by Tren P. Barnett – *Tuscon, Arizona*

Any business quickly realizes the need for more than a peer-to-peer network when it expands beyond a few employees. For this series of articles, we are going to create from the ground up, a network for a small to medium sized facility. Good planning requires consideration of software needs along with security needs. We are going to skip the planning stage, and assume our needs go beyond sharing a file or a printer between a few computers.

In our scenario, our small radio station has a sales department, an accounting department, a management group, and if sales continue at the present rate we will need a remote district office. Windows 2000 server and Windows XP Pro workstations will be the systems of choice for these next few articles.The Internet is playing an ever bigger role in successful business every day. Thus, we will have an Internet connection with five static TCP/IP addresses, a web presence hosted on a Windows 2000 server running IIS, Internet -mail using Microsoft Exchange, and Microsoft Internet Acceleration Server (ISA Server) as a firewall. Our accounting department, along with the sales department will be using Microsoft SQL Server 2000. We can and will discuss other operating systems, but let's start with this configuration.

We need to achieve a reasonable level of security, between sales, accounting and management, and protection from external network attacks. All our employees need to access the Internet, and have internal and external e-mail, yet these must not be abused. Sales and accounting need to have access to client and vendor information. Beyond that, Accounting needs access to payroll information, employee's addresses, and Social Security Numbers along with tax records, and also account information for clients and vendors, which must be kept secure. (The issue of how secure any Operating System [OS] can be made always leads to strong opinions. The purpose of this article isn't to get into that, but instead we'll explore how we can use the products mentioned to our advantage.)

The best way to secure the system is to prevent anyone from ever touching a computer. However, reality is somewhat more demanding, so we need to limit access to the network, both physically and virtually. Fortunately, the more limiting the settings and location are, the less likely an administrative failure will happen. This is where our Windows 2000 domain starts to work for us.

Identifying the Domain, Computer & User

Every Windows 2000 network consists of a domain or domains. In brief, a network domain is the sum of all the computers and users over which a dominant server exercises its authority to control security. Each computer therefore must have a computer account in our network domain, as does each user. User and computer accounts are controlled through the "Active Directory Users and Computers" management console. Within our domain, users can be placed into groups. Groups can be given access to necessary network resources, such as printers, files, e-mail, and the Internet. Individuals can likewise be assigned access to such resources.

Notice, though, both computers and users have accounts in the domain. Because computers have accounts, one administrator can control all computers in the domain, and access them and the software installation on them. The domain, not the workstation, validates users of the workstation or computer. Information shared on these workstations, can be limited to specific members of the domain. Users using the computers or workstations can also be limited to specific users or groups in the domain.

With Windows XP Pro for our workstations, we can limit the access each user has to the workstation. Since the workstation is part of the domain, it inherits default domain security settings. Multiple users can use the same workstation without being able to access private documents saved on that computer by other users. Data stored on the network is still secured because security settings are based on user accounts or user groups and is dependant, not on the computer, but the domains security model. Because the workstation is dependant on the domain for its security model, access can be denied to a specific user, or groups. This means we can deny the accounting department the right to log onto and use the sales computers on the network, and visa versa.

Another security plus to this scenario is network passwords. They are controlled, as stated, by the domain server. Settings requiring different levels of complexity, lifespan, and lifetime can be set. Levels of complexity can range from a blank password to a password that has to be a specific length. We can stipulate the user must use a capital letter, a number, a lowercase letter, and that his/her password be no part of his user name or domain name. Lifespan can be set to require a new password every so many days. While these requirements may be inconvenient, they can do a lot to beef up security (and alienate the IT department from the rest of the office).

The lifetime of a user account can also be set. A temp may be hired to help with some additional sales during the busy season, yet the account the temp's access can be set to expire at a specific time in the future. Also, failed attempts at a network logon on can be tracked to a specific computer or workstation, and can be set to lock the account out after so many attempts. While all of this may seem extreme for a small to medium sized business, and may not be needed, it can still be worthwhile in ease of network management and use.

Adding Computers and Users

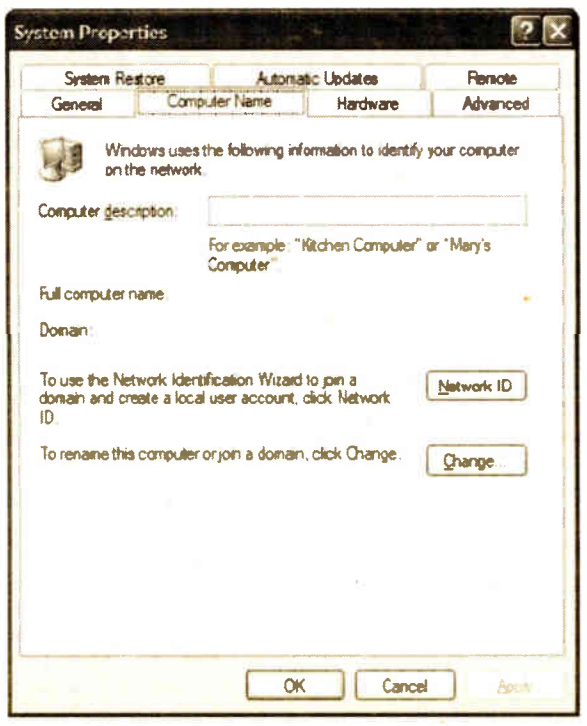
Now let's start assembling our network. We'll assume, for a moment, the needed settings for network communication are in place, as we will discuss these in depth later. DHCP and DNS are running, and all the needed wiring is complete on our network. Our server is configured as a Domain Server, and waiting for users and computers to be added. We sit down at our first workstation, and it is time to add it to the domain.

Since it is a Windows XP Pro workstation, we need to log onto the computer. If it has not ever been added to a domain, it is possible, depending on how it was set up, that all that will be required to logon on is to turn it on and wait. More may be required though, depending on how it is set up. If you are prompted for a logon name, it must be a name that is in the workstation's administrative group, in order to add it to the domain.

Every workstation will have a local administrator account, and local user accounts. A workstation that is not part of the domain can be set to default without a logon screen to the workstation's local administrator's account. Local workstation accounts allow access to the local computer workstation. They do not allow access to any other resources, only their own resources. Accounts specific to the workstation can remain active even after joining the workstation to the domain, and must be considered in the final security settings of the network.

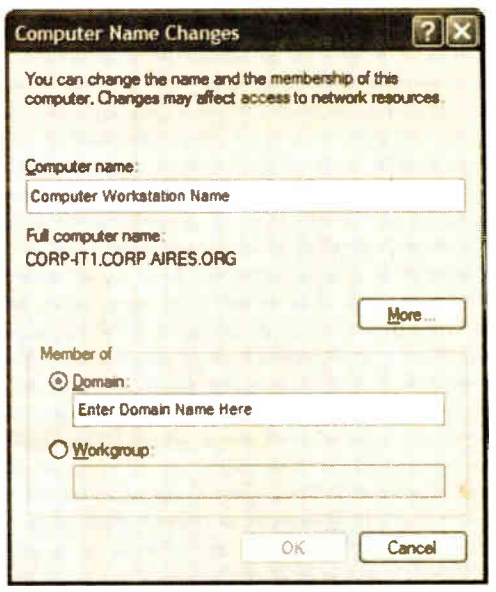
At the computer's desktop, select My Computer, right click and choose properties. A window entitled "System Properties" will open.

Select the "Computer Name" tab, and choose the "Change" button. Another window entitled "Computer Name Change" will open.



In this window, the settings to join a domain are made. The workstation computer must be placed in the domain to use the domain's resources.

Setting the workgroup to the domain name, will allow browsing of network resources, and those that are open to everyone can be accessed by workstations in the domain workgroup. Workstations must be assigned to the domain, to be a part of the domain.



A valid computer name is needed to begin with. Names that identify the purpose of the workstation are beneficial, and fall into best practice guidelines. They can be named anything within reason. To join the domain, in the "Member of" group box, select the "Domain:" radio button, and enter the domain name in the text box.

Since security is important, our domain server isn't going to say OK, and we are done. In order to join the domain, the server is going to ask us who we are. We will be prompted for a user name and password that have the needed authority to OK the request. Once the process is started, it will take a little time.

In order to complete the request, notice that proper authority was required both by the workstation and the domain server. Not just any local workstation account or any domain user account can do this.

Now the domain and the server start to join together as a team, and the local workstation will be informed of additional security settings that the domain requires. These settings can be quite stringent, and may take a while to complete, depending on how the domain's security model is set up. One of the steps being accomplished during this process is adding the domain administrator group to the local workstations administrator group. The domain users group will be likewise added to the workstation users group. When this is completed, any domain user will be able to logon onto and use the workstation. The domain security policies will become the workstation's policies, overriding the workstation's original security policies. The users and administrators who have access to the workstation can be set differently then the domain workstation defaults.

Security policies have a definite hierarchy. Similar to federal laws, states can have additional laws, but cannot supercede federal law. The same is true of workstation policies. Workstations can have additional policies, but they cannot supercede domain policies. If the domain says all users will be forced off the network at 12:00 a.m., the workstation cannot change that, no matter how badly the user wants to.

When the workstation informs us we have successfully joined the domain, we will be done. The workstation must be restarted before it can be used. Depending upon how our domain is now configured, this workstation can now actively participate as a member of the domain, taking advantage of all the domain resources.

Obviously, several things had to happen before we were able to get this far in our network setup. So, in the next article, we will take a new computer system, and build it out as a domain controller for our network. We will then briefly touch on how to tie in an ISA server, Exchange server, and a SQL server. These will require TCP/IP, DHCP, DNS, IIS. Those are lots of definitions, but once we see their relationship, it gets easier. And, once these servers and services are in place, we are ready to address user accounts, groups and security settings.

Tren Barnett is a System Administrator and Programmer in Tucson, Arizona. He welcomes your questions on solving network problems in your facility.

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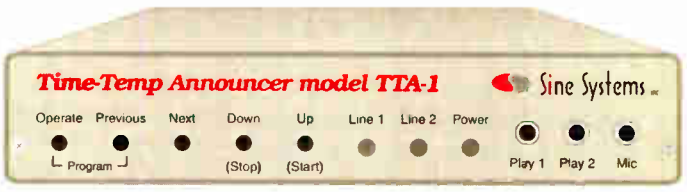

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Answers to the EAS *by Clay Freinwald with Barry Mishkind*

EAS Q&A

[February 2003] One of the misunderstood aspects of EAS is the designation LP, or Local Primary, what that means, and what the station is expected to do for the EAS community.

Barry: Exactly what is an LP station?

Clay: It is important to understand what differentiates an LP station from other participating EAS stations, and what the role of the LP station should be. The primary mission for the LP stations is to be the 'Local Entry Point' for NATIONAL EAS messages. This role requires the LP facilities be connected to sources of those messages, i.e., the region's PEP (National Primary Entry Point) station and/or a participating NPR facility.

In turn, the SECCs setting up state and regional plans need to make sure these communications circuits are in place. Preferably each LP facility will have a redundant connection to those sources. And this is what differentiates LP facilities from other participating stations in the local areas that, in turn, monitor the LP's. It is through such redundancy that we make EAS robust.

Barry: That does present a better pathway. Does an LP facility have to be an AM Station?

Clay: No it does not. It can well be an FM or TV station, or can be a communications system that is *not* a broadcast station. Anything that can do the job can qualify. A VHF or UHF radio system that can monitor the sources of National EAS (PEP or NPR) and automatically relay to stations in the Local EAS Area can work fine.

Barry: Clay, it sure seems being an LP-1 or LP-2 is like being 'in the line of fire' these days. Have you noticed a growing trend toward stations trying to shed the LP designation?

Clay: From time to time, I do hear about this. Most of the time it is based on the notion that an LP station is the relay point for *all* EAS messages for that area. And, this is where the problems begin. Owners and operators of Broadcast Stations may rightly feel their programming should not be cluttered with EAS Data Bursts so their station might act as a relay device for the benefit of other stations 'down-stream' who could be receiving the official word directly.

For example, if all the stations in a local area can receive NWR there is no point for an LP station to relay weather messages. In this case, these stations should deploy NWR receivers connected to their own decoders.

Barry: Are you suggesting that LP stations should only relay national level messages?

Clay: I never advocate that a broadcast facility be relied upon to relay any EAS message where there is no FCC requirement that they do so. EAS plans based on the notion that LP stations can be counted on to relay State, Weather and Local EAS messages are, being blunt, not well thought out. The owner, manager, or program director of any LP station can opt out of this at any time, leaving the area's EAS plan dysfunctional.

Barry: If an LP station only relays National EAS Messages, how to the other types of EAS messages get out to the stations in the area?

Clay: Broadcast Stations are meant to reach the general public. What many have been doing is asking Broadcasters to turn their equipment into repeaters. In my view, this is wrong. Take a look at NWR. This government entity (NOAA) has a number of distribution devices or repeaters of their own with which they distribute their emergency messages (162.55 etc). It should be similar for State and Local governments.

These government entities need to establish background or non-broadcast channels for distribution of messages that can be received by Broadcasters and relayed to the general public. This is what State Relay Networks (SRN) and Local Relay Networks (LRN) are all about.

Barry: Are there areas where this is the case?

Clay: Yes, many, including ours here in Washington State.

Barry: With the political pressure to run AMBER, on top of the rest, are LP stations becoming overloaded?

Clay: If an area is requesting an LP station relay a ton of EAS messages, including AMBER, they could well feel they are overloaded. When the 'competitive / entertainment value' of the property is compromised by the amount of EAS message relaying going on, this is a danger sign. Again, this is why EAS messages need their *own* distribution systems. I call them Relay Networks (a term taken from the old EBS rules that called for State Relay Networks).

Barry: That's a good idea, but right now, in many markets, issuing alerts usually falls on the LP stations.

Clay: In these cases it appears we have not fully learned the lessons of EBS. With EBS, a government entity called the local primary station and asked them to relay an emergency message. One of the major reasons for the change to EAS was to permit unattended operation of *all* Broadcast facilities.

What is a government entity going to do when they call the station and get a recorded message that the office will be closed until 8 a.m. on Monday? EAS plans written on this basis are shaky at best. The state and local EAS Committees need to re-commit themselves to EAS plans that do not rely on something that cannot be counted on. This work should be done *before* their local LP station changes their mind.

Barry: What about the markets where LP stations want to opt out of the obligation, what should be done?

Clay: I would urge those LP stations to re-focus on the primary role of an LP station, i.e., being the Local Entry Points for *National* EAS Messages and to work with their LECC's (Local EAS Committee's) to shift the responsibility of relaying local EAS messages away from their 'air ' to background channels.

The FCC requires that *all* stations relay EAN's and RMT's. If the local EAS system is set up correctly, these LP stations will not be singled out to perform a task that makes them sound bad (airing data bursts for the benefit of competing stations in the same market, etc.) and the playing field will be leveled. Once that takes place, the role of LP station will not be a burden.

Barry: Can NWS function as an LP station?

Clay: Yes, under certain circumstances they can. But remember, in this case they must be connected to a source of National EAS Messages, either by monitoring a PEP or a participating NPR station or both.

Barry: Of course, one of the hardest things to accomplish is changing the LP stations. No one wants the designation.

Clay: Again, this requires *participation*. The Local EAS Committee's responsibility is to bring together all the various factions of EAS, to not just talk about EAS, but to develop solutions and implement them. These committees can make or break an EAS system.

Barry: Who should be on the LECC?

Clay: The whole EAS community should be represented on this committee. Here are some recommendations:

On the 'input' side: Representatives from all government entities within the local area, counties, cites etc. Emergency Managers, 911 Facilities, Law Enforcement, Communications experts, Industrial Plants, Schools. NOAA, FEMA, Amber, etc.

On the 'output' side: Representatives from as many Radio and TV stations and Cable Companies as possible.

Facilitators: Volunteers, ARES, REACT, etc.

Barry: In some areas, that is a *lot* of people!

Clay: It is *vital* for all to understand that EAS at either the State or Local level is *not* a job for *one* person. No one person can do the work (and hold down another job), nor can they speak for the various factions it takes to make a system work.

Barry: Who should lead these committees?

Clay: These organizations require strong leadership – leaders who completely understand the EAS, how to make it work and can inspire others. I recommend a Broadcaster be the leader. Another point: EAS is *not* an Engineering thing. Broadcasters who have the leadership ability should be considered first.

Barry: I understand that you travel around the country teaching about EAS, how does this work?

Clay: Over the past few years, I have been conducting a series of EAS workshops. I do this on a voluntary basis and only ask that my expenses be paid by whomever invites me. With the recent inclusion of material about AMBER, these sessions take the better part of a full day. Contact me via email or phone and I will be happy to explain the details.

Barry: We have received a number of pieces of email from our readers, let me share a few of their questions.

From Cliff Mikkelson, Colorado Springs, CO:

Cliff: How long should we keep our EAS Logs? I save them for two years.

Clay: The length of time that you keep them should be a recommendation from your company's communications attorney. I definitely would say two years at least. Some stations hold them through license renewal. I would recommend you keep your EAS logs with your Operating (transmitter) logs.

Cliff: Should your log show 3 RMT entries?

Clay: Right you are. Two should be from the facilities you monitor (each one of them will transmit one RMT each) and the third will be an entry of the RMT sent by your station. My recommendation is simply this: you can't have too much logging of EAS activity, but can certainly have not enough.

Cliff: What about using computers for the logging? I use a program called EAScriber.

Clay: I have not evaluated the various offerings of EAS logging software so cannot comment on any particular product. There is certainly nothing wrong with logging to disc, and it does save a lot of trees. Locally we use a rather simple, DOS-based, capture file for this purpose. Our LECC Chair then dumps this out on our local EAS remailer as a means of cross checking.

From Bruce Kinde in Window Rock, AZ:

Bruce: I am responsible for two stations near the AZ/NM border. Where can I find out who I am supposed to be monitoring?

Clay: Bruce you are not unique in this situation. There are many cases where political boundaries tend to confuse matters. I would suggest that you contact the AZ and NM SECCs, and ask that they assist you with this issue. They might want to consider moving the 'EAS Border' East or West so as to make your area within one state or the other.

A quick look at the map tells me that perhaps you could be in the same Local EAS area as Gallup, to the East. EAS boundaries need not be the same as state or other political lines. In any case, this is a situation where your local LECC should be working with both SECCs to quickly resolve this matter.

As to what you should monitor, this is, again, usually a function of the SECC as they see the 'big picture' and understand the monitoring architecture of the LP's etc.

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. Please feel free to address your questions about EAS to Clay at radio@broadcast.net.

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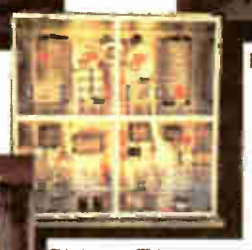

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Useful Tech Tips From Our Readers

Tips From the Field

The Kill-A-Watt

from John Stortz, CE Moody St. Petersburg

(John Stortz, CE for Moody's stations in St. Petersburg, FL, recent came upon a gem in a local Radio Shack. As many of us know, Radio Shack is slowly eliminating the slower moving and less popular items. Thanks to John for showing how being alert at the "closeout" sales can uncover some real gems. - Ed.)

Radio Shack is currently liquidating a device called Kill-A-Watt (Cat #63-1152, I think). This "toy" was overpriced at $59, IMO, but I allowed myself to be suckered into buying one at $29.25. I bought the first Kill-A-Watt because I went thru a lot of trouble trying to make a plug-in ammeter, for home use. I built one, but the results were only so-so. Kill-A-Watt does so much more, I bought one on impulse.

The idea is to plug this meter into a wall outlet & then plug any appliance into the Kill-A-Watt. It measures line voltage, frequency, current, watts, Volt-Amps, and power factor. It claims 2% accuracy.

Theoretically, one can find energy "drains" in the house, or even appliances that are getting ready to die. For example, some folks have fans that stay on all the time in the kitchen, living room, etc. If you think of all fans as "cheap air movers," you might be surprised to learn that some run about 300 watts. At average rates, one such fan could be as much as $15 a month on the power bill! It almost pays for the device right there.

The Kill-A-Watt uses the short shunt method of a current sensor connected just ahead of the voltage sensor. A couple of little circuit cards provide calculations and display in true RMS voltage, current, frequency, and of course, wattage.

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From Home to Work

Three times in the past two weeks, I was wishing I had my Kill-A-Watt at work. For example, Modulation Sciences tech-support told me I should try a test, then place my Mod-Minder on an isolation transformer to prevent the unit from losing configuration info. On the way to the transmitter, I got to wondering what size transformer might I need? Kill-A-Watt would have told me, but I didn't have it with me.

Another situation was when several small UPS units refused to switch over to generator power, during a power failure. I suspect it was a frequency problem that night because outdoor temperatures were unusually low. Kill-A-Watt would have been able to tell me instantly the line voltage & frequency.

Question: How can you know how many volt-amps you can get from a small, un-marked transformer? This question came up recently. An easy way to check would be to load the transformer until the power factor was above 90%. A lightly-loaded transformer will have a low power factor reading. At full rated power, it should be close to 90-95%. Test time, maybe one minute.

Without a Kill-A-Watt it might take a couple of hours – load the transformer with a bunch of light bulbs or resistors and see how hot the core gets. If it gets too hot, well, you over-guesstimated. Let it cool down & try again another day.

I do expect that the tools I have at work should at least be as good as what I have at home. Yes, I do bring in some of my tools, but when something is needed frequently, it's time for the company to buy one for work use. My closest RS still had three of them in stock. So, I bought one for work.

When I got home, I told my son. He immediately said, "You should have brought it home so we can plug the two of them together and see how well they agree." Oooh! Wish I had thought of that! Later on I did so, and found most readings were within one LSD [least significant digit] of the other. (Since VA is a calculation of volts times amps, that error ran about 3 in the LSD.)

The Kill-A-Watt I have is model P4400, marketed by P3 International Corp. www.p3international.com. Perhaps the product will still be available after Radio Shack drops it. I think they're not selling at RS due to bad advertising. I only discovered the product in a sale brochure. During the purchase of each of the units I picked up, the salesman wanted to know why I wanted it and what would I do with it – they had no idea why anyone would want it.

If there is still one around , grab it. Of course, you will have to ration your time, you can't just spend the rest of the month measuring every device in the station!

John Stortz is CE of WKES and Lakeland, and WKZM, Sarasota, FL.

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Version 1.2 of the BDR Now Available

At last year's NAB, Version 1.0 of the Oldradio.com CD was released. **Broadcaster's Desktop Reference** (BDR) is now is available to everyone. A work in progress – it seems something new is added almost every month.

Among the resources already available, you'll find: Barry's Radio Utilities-2002, The Continental Electronics E-Slide, RF Specialties Toolkit, Tom Osenkowsky's Toolkit, Bob Carpenter's AM and FM/TV database viewer, Top Ten Lists, EAS paper sources, some project schematics, and some nice historical files.

To make the CD even more valuable, when you are at the transmitter site, we have added the FCC and EAS checklists, and some equipment manuals. And this is not the end ... more is planned.

You will find most of the CD contents are listed at: www.oldradio.com/latest.htm

The proceeds from this CD are going to be put into improving the next edition of the CD, and supporting Oldradio.com and its efforts to document and display the history of our industry.

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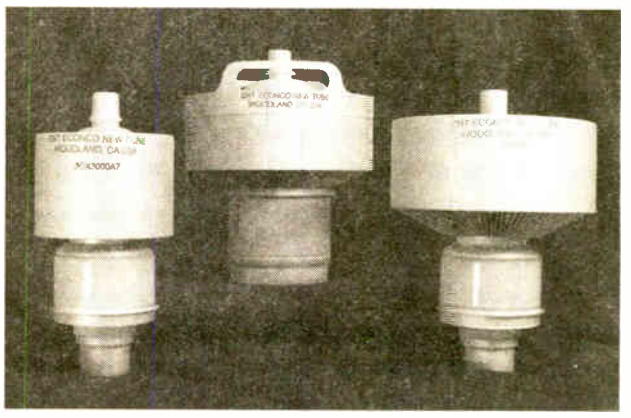

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Radio History

Radio Reaches Out: WJAZ, the Zenith Station

by Harold Cones, PHd and John Bryant, FAIA

(In the 1920's, companies sought to take advantage of the new wireless medium. Some built stations to sell radios, others to promote their businesses. Chicago was home to Zenith, whose receivers brought fame. But Zenith's entrance into broadcasting itself was for a very unusual purpose - Ed.)

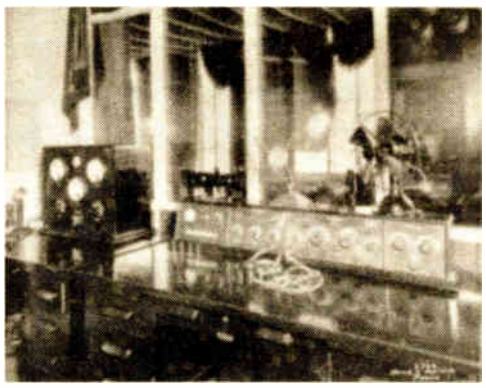
[Newport News, VA, February 2003] In 1923, communication between the US and the Arctic Circle was difficult. Despite public fascination with reports from expeditions at the top of the earth, getting those news reports back home was virtually impossible. Indeed, polar explorers were often completely out of touch for months or years as they explored the remote north.

Throughout his life, Eugene F. McDonald, Jr. explored the outer limits of what was possible. A flamboyant businessman with an uncanny ability to see the future, McDonald made a fortune in the emerging automobile industry as the originator of selling cars on time. His various promotional activities developed a reputation that would grow and be enhanced throughout his career. Beyond his personal creativity and leadership, he was fascinated by the unknown, and had a life-long commitment to geographic and archeological exploration.

So, in 1923, as Admiral Donald Baxter MacMillan was organizing his 15-month-long expedition to the Arctic region, it got quite a technological boost when McDonald offered to provide radio equipment to his friend. After a very successful period of growth for Zenith Radio Corporation, being the official radio receiver of the MacMillan expedition was just the sort of publicity Zenith desired.

Founding Zenith

McDonald had only been introduced to radio two years before. Finding radios were expensive and difficult to obtain, he decided to go into the radio business. He discovered an Armstrong license was necessary to manufacturer radios, but Armstrong had temporarily suspended issuing licenses. Needing a license led McDonald to Chicago Radio Laboratory, run by two Navy radiomen, Ralph H. G. Mathews and Karl Hassel. CRL had begun manufacturing amateur radio equipment, enhancing its sales with the national reputation of Mathews' amateur station, 9ZN.



The WJAZ Edgewater Beach Hotel control room. Photo courtesey of Dale Goodwin and Zenith.

CRL had orders and no capital; McDonald had capital, and a partnership was formed with McDonald as General Manager. Zenith Radio Corporation would be the marketing arm for CRL's Z-nith radios (the name came 9ZN). McDonald's drive for new and better products lifted the corporation above its less successful competitors. A period of rapid growth followed.

By early 1921, Chicago Radio Laboratory was sharing a 14' x 18' garage on Chicago's lake-front with station 9ZN. A large antenna was erected, and with its big synchronous rotary spark-gap transmitter, 9ZN became one of the most well known amateur stations in the world, taking part in the first transcontinental and transoceanic amateur radio transmissions.

In mid-1922, McDonald decided to build a broadcast station at the Edgewater Beach Hotel, near the 9ZN, to help entice radio sales. Although intended to operate as any other commercial broadcast station, McDonald was especially interested in designing and completing WJAZ in time for MacMillan's 1923 Arctic Expedition.

Beyond that, WJAZ was to serve as a voice for Zenith and the Chicago Radio Laboratory and as such, began McDonald's long-standing commitment to broadcast only "high quality programming."

WJAZ Opens for Business

The station formally went on the air at 833 kHz on Saturday night, May 12, 1923 (changing to 740 kHz two days later), with a "20 watt" license – but actually running closer to a 600 watt transmitter, running into the same fan antenna, on 175 foot steel towers, used for Mathews' and Hassel's amateur station 9ZN. The transmitter and antenna were located 300 yards north of the Edgewater Beach Hotel, immediately on the shore of Lake Michigan.

Powerfully built, to get a signal to MacMillan in the North, the station set a number of distance records. On December 19, 1923, while engaged in a broadcast to MacMillan frozen in the Arctic ice, WJAZ was heard by YMG in the Samoan Islands, more than 7,300 miles from Chicago. Unfortunately, the powerful station also began interfering with broadcast reception throughout the Chicago area.

The Edgewater Beach Hotel received many complaints and requested WJAZ to decrease its power; WJAZ, in order to get maximum range for the MacMillan expedition broadcasts (as well as maximum advertising potential), desired to keep power high. However, in April 1924, McDonald decided to close the station and it was sold, first briefly to the Chicago Tribune, and then to the Edgewater Beach Hotel, who operated it as WEBH.

A 1924 Zenith press release explaining the demise of WJAZ stated, "... Because of the uncontrollable interference caused by this station throughout the entire North Shore of Chicago, the company decided to erect a new station far enough away from the city and its environs so as to be no longer an interference to the three millions of people who make up the second largest city in the United States."

In a future article, we'll follow WJAZ, now mobile, as it seeks a new home.

This article was adapted from Zenith Radio, The Early Years, 1919-1935; Zenith Radio, The Glory Years, 1936-1945 is due out this summer. Harold Cones is a Professor and Department Chairman at Christopher Newport University in Newport News, Virginia. Dr. Cones and his research partner, John H. Bryant, FAIA, Oklahoma State University, have been researching and writing on radio topics for 20 years. More information is available at www.cnu.edu/bces/ConesHome.html

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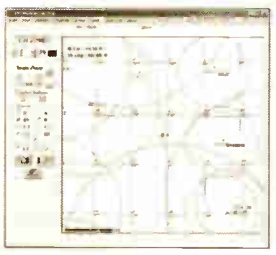

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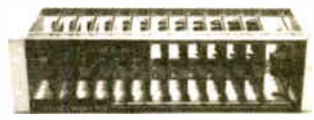

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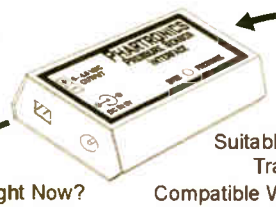

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