

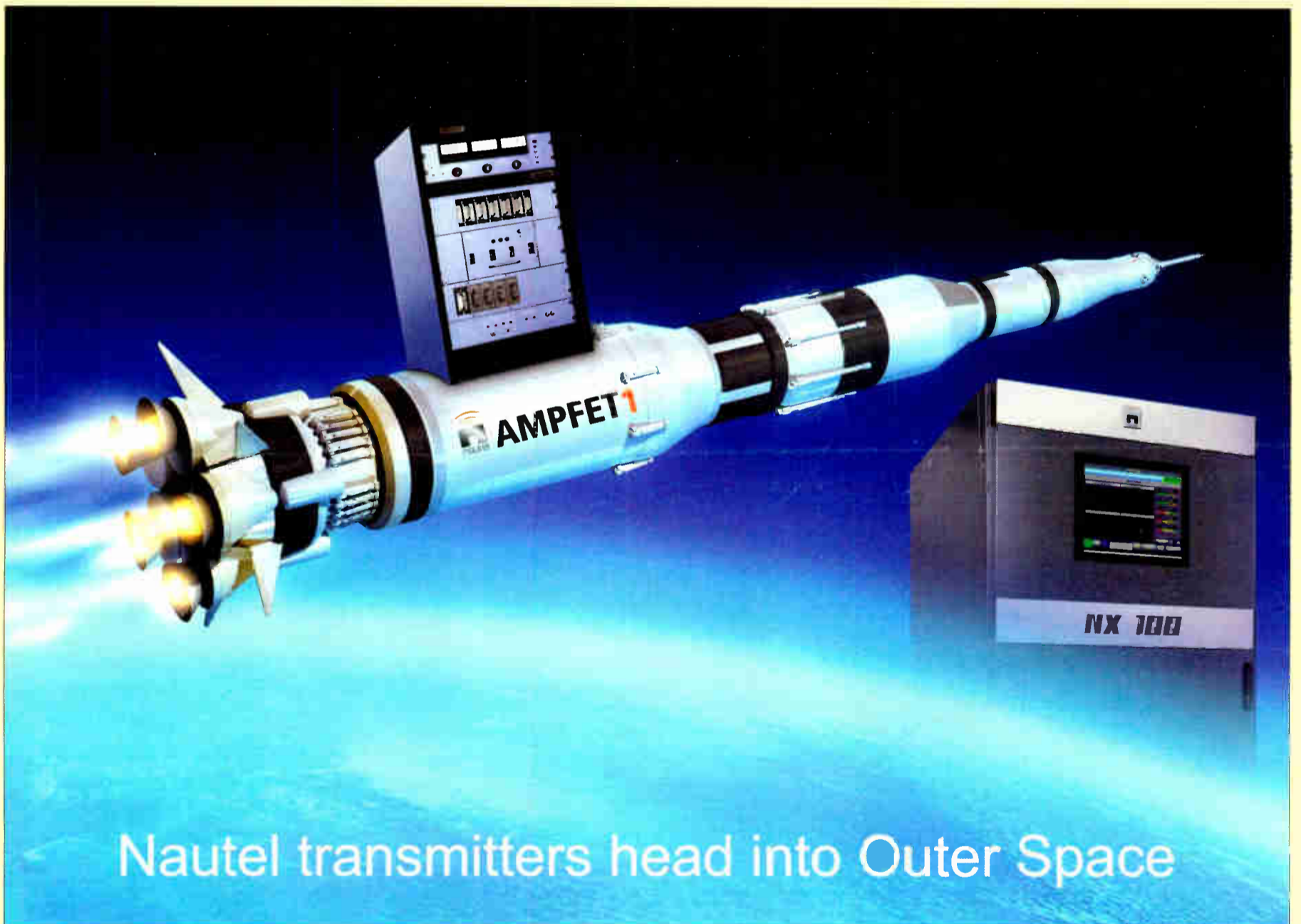
Radio Technology for Engineers and Managers

Radio Guide

www.radio-guide.com

March-April 2008 – Vol. 16, No. 2

Reaching New Heights With Solid State Tech



Nautel transmitters head into Outer Space

Inside

Radio Guide

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Recognizing those who have made real contributions to the broadcast profession.
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FROM THE FIELD.
SEE PAGE 5

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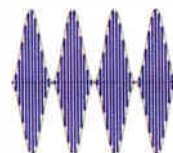
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Radio Guide

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March-April 2008

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by Barry Mishkind – Editor



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Radio Guide

Volume 16 – Issue 2

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Radio Guide: www.radio-guide.com
Tech Manuals: www.radiogearguide.com
Classified Ads: www.radio-classifieds.com
White Papers: www.radiopapers.net
Radio History: www.olderadio.com

Radio Guide, ISSN 1061-7027, is published bi-monthly, six times a year, by Media Magazines Inc., PO Box 20975, Sedona, AZ 86341. Radio Guide is copyright 2008, Media Magazines Inc., and may not be copied, reproduced, or stored in any format, without the written permission of the publisher.

As April opens, the 2008 NAB Spring Convention is just ahead. Many engineers from around the country are getting ready to meet, confer and otherwise hob-nob with their fellow tech wizards. We hope you have made plans to be there. (There are still some cheap “packages” available in many markets, airfare and hotel at very affordable prices.)

Some suggest it is not worth the trip for radio engineers this year. It will not be a radio year, they say. With Digital Conversion for TV nearly upon us, many broadcasting companies are putting their money there. In fact, a few manufacturers are giving up, saying “radio is not happening” and cutting their marketing and product development.

On the other hand, you will find a lot of companies are coming to Las Vegas with new and/or improved gear. From new transmitter designs to improved automation software (and everything in-between), the NAB show is where to see products that will make your station – and you personally – more effective and efficient.

A number of these products are showcased in articles in this month's *Radio Guide*, with more to come in the months ahead. We will show you what is important, but getting to NAB and making contact with the manufacturers, actually touching products and seeing them in action, is really worth the effort.

The bottom line is that you will be more valuable to your employer. Not only will you be better able to maximize your budget, but you will save some money by implementing many of the things learned at the show. Unquestionably the information, education, contacts, and ability to see products and talk to the manufacturers will make you a better broadcaster.

We hope to see you in Las Vegas. Stop by our booth, N8829, and say “Hi!” And, if you can make it, do not forget our 16th Annual Lunch Gathering on Tuesday at Noon. For a map and directions see: www.olderadio.com/nab.htm

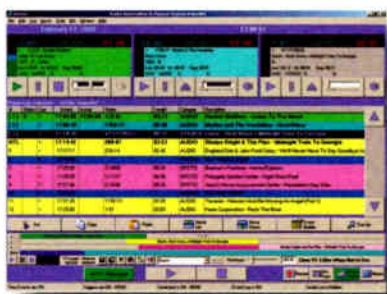
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Above: Rays broadcasters **Andy Freed** (left) and **Dave Willis** (right) interview Rays' star third base prospect **Evan Longoria** on the "The Hot Stove Radio Show."

Top: **Larry McCabe**, Tampa Bay Rays Senior Director of Broadcasting and **Rich Herrera**, broadcaster and Director of Radio Operations are shown on the field during spring training.

Impossible Remote? Nah...You've Got ACCESS!

Tampa Bay Rays' Real-World Super Hero Saves the Day!

Fans of the Tampa Bay Rays baseball team are intimately familiar with Dave Willis and Andy Freed, play-by-play announcers and hosts of "The Hot Stove Radio Show." Offering the inside track on all things Rays, the show kicked off its 2008 season with the "Countdown to Opening Day" series. While at a remote from a well-known sports bar, ACCESS showed its true worth. Two minutes before the broadcast, the ISDN line that was supposed to be used for the broadcast failed to connect. Luckily, they had the ACCESS running on Wi-Fi provided by the restaurant. The broadcast got on the air and was flawless for the entire one hour show.

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Nautel Rides the Technology Wave into the Future

– Continued from Page 6 –

include not only the fundamentals of broadcast transmitter design but also key new technologies such as communications theory, digital signal processing and data communications. The latest generation of products being introduced this year demonstrate this: very simple, robust and efficient transmitters that have been enhanced through the use of the latest generation digital technology rather than be handicapped by it," Hardy said.

"INSOURCING"

As the "outsourcing" trend raged in the 1980's and '90's, Nautel held a contrarian view, keeping in-house the processes necessary in the construction of transmitters, such as metal work, painting, cable harness assembly and circuit board stuffing.

This philosophy continues today as Nautel ships in raw materials such as sheet aluminum and components and ships out completed transmitter systems. Having all these processes in-house not only maintains high quality but nurtures in-house expertise and allows fast prototyping with the same tools and processes that will be used in production.

Holly Hubley has been involved with building transmitters at Nautel for 23 years. She oversees the light and final assembly manufacturing process. "We've looked hard at outsourcing for many years and granted, there are some areas where it makes sense to go outside such as surface mounting and power supplies. But really, to build a transmitter that our customers can depend on we need to control quality down to the smallest details.

"Having such a high level of control also lets us be fast-moving to introduce new products and models quickly. When we do outsource components we tend to favor other custom, high-craftsmanship suppliers for the same quality reasons," Hubley says.

FROM THE GROUND UP

I quickly gained an understanding of Nautel's approach to transmitter manufacturing when my tour began via the factory's back door. This path took me past the paint shop and the area where they wind their own copper coils. After that, I entered the main building where I saw massive inventories of heat sink extrusions, metal stock and high stacks of sheet aluminum indicating that Nautel even builds their own cabinets from scratch.



Nautel builds its product from the ground up.

Does it make sense? Absolutely, says Mike Woods, Nautel's head of development: "We tried outsourcing cabinets many years ago but really weren't happy with the results. Our equipment ends up all over the world: in arctic areas, hot and humid environments, deserts, and rain forests. These products need to be absolutely rust resistant and capable of being shipped by every conceivable method of transport from air to ship to horse cart."

Woods says the light, tough aluminum cabinets used by Nautel are specifically built for transmitters, not gen-

eral purpose applications. "Building items in-house also lets us address the specific serviceability needs of transmitters like doors and access panels," Woods says.

THE TEAM APPROACH

Nautel uses a manufacturing cell process to build transmitters. "It's the same approach that you'd usually associate with the building of a high-end luxury car," says Woods.

"CNC punches, lathes, and mills give us state-of-the-art fabrication abilities, while hand construction of many of the sub-assemblies allows us to pay attention to the fine details and produce superior product," he noted.



Building the sub assemblies and wiring harnesses.

Woods says that everyone involved in the design, production and support of the product is well versed in the entire process from idea to product, giving Nautel a clear advantage in providing complete solutions to its customers: "Having the designers work literally next to the production facility and customer service means that expert support is only a few steps away for both internal and external customers."

Nautel's tradition of innovation has carried forward over the years. The company holds numerous patents on combining and signal correction techniques as well as more recent digital synthesis patents.

(Continued on Page 10)

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the signal down the phone line to provide that "how'd you get it to sound THAT good over POTS lines" nudge. There are convenient 3.5 mm send and receive jacks for recording the show or mixing in your MP3 player.

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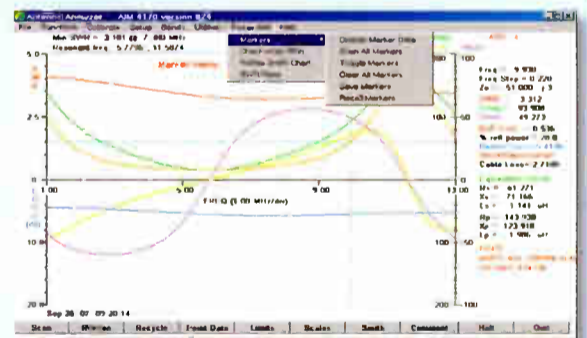
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Nautel Rides the Technology Wave into the Future

by Elaine Jones

– Continued from Page 8 –



Checking out a finished transmitter.

TECH SUPPORT

Even the best products require some service, and Nautel has made a commitment to provide the best service in the industry. "Support is an area of pride for Nautel. We offer telephone customer support 24 hours per day, 7 days a week, 365 days a year," says Conlon.

Replacement parts, modules, and sub-assemblies are readily available for shipment world wide. Repairs of modules are accomplished with quick turn-around times.



Module repair and testing.

On-site commissioning of transmitters, including complete installation, is available, and extensive training programs for customers are also available at the Nautel factory or at the customer's facility. Conlon says the company is in the process of establishing parts depots in strategic locations throughout the world for even speedier parts deliveries to customers everywhere.

In addition to telephone, e-mail and fax support, the company recently added "live chat" capabilities on-line. One customer who recently used this service commented: "This morning I used Nautel's on-line tech support for the first time. It worked great, chatted with Nautel support, got the information I needed, and they emailed me a transcript of our chat. No need to madly scribble down various needed information during the conversation."

Nautel tells me that it is their standard practice to include component manufacturer name and part numbers in their manuals so that customers can know where to source parts cost effectively.

"That has always seemed like a natural approach to us," says Jeff Welton, who last year crossed over from support into sales. "Some companies would try to hide that kind of info but if we can provide information to our customers that may someday help them then that's what we'll do."

CONTINUITY AND FAMILY

By the way, Welton's shift from one area to another is not unique. During my visit, I got the sense that there is a great deal of shared knowledge that gets passed forward to each generation of designers, manufacturing, and support personnel. It seems to be a sense of tradition and even of family.

Employees value the long term commitment that has been made for the company's success and that commitment has meant not only job satisfaction, but also job

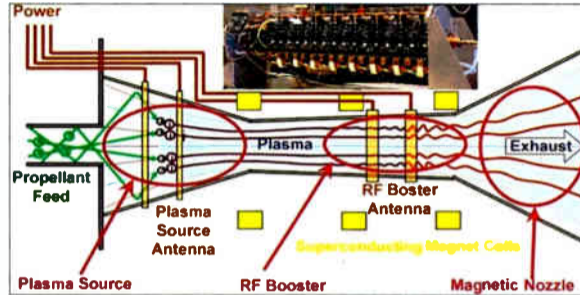
security. Conlon says, "When times get lean we've made decisions that favor our employees. That's the way you would treat family and it's helped us maintain our unique culture and continuity."

The result is each employee shows pride in each step of the manufacturing process, and equal pride in helping customers get the answers and support they need.

FROM BROADCAST TO ROCKET SCIENCE

Around the world there are now over 7,500 Nautel transmitters, totaling over 158 Megawatts of RF on line. Expanding its AM broadcast transmitter line, Nautel recently introduced a line of high power, medium wave transmitters for the international market which can operate at up to 2,000 kW. These transmitters, as with the other broadcast transmitters designed by Nautel, come standard with built-in HD Radio or DRM capability.

Nautel's innovations also extend outside the broadcast industry. The company recently began collaborating with the Ad Astra Rocket Company of Texas to develop a high power RF amplifier for space travel applications.



Nautel RF antennas and amplifiers are being used in rocket engine development.

The amplifier will be used for plasma generation and subsequent acceleration in an electric spacecraft propulsion system. Nautel has set up a website relating to rocket science should readers wish to learn more: www.nautel.com/rocketscience

LOOKING AHEAD

Nautel is heading to NAB 2008 with the theme "Expect More." Marketing manager John Whyte comments: "We are a company that is truly committed to radio. We're able to roll up our sleeves and just focus on what we do best: building innovative but extremely reliable transmitters." As an example, Whyte pointed to the new NX series of transmitters to be shown in Las Vegas.

Whyte likes to point to a particular strength of the Nautel approach: "I don't think people realize the size of our design team. That means our customers are going to see a continuing slate of introductions and innovations. We think customers should expect more and we plan to be the one company that delivers more."



The Nautel design team surrounds the new NX transmitter.

"From nautical beacons to rocket science, Nautel's long history of innovation has led to some important and valuable technological contributions to a number of markets," says Conlon. "That creative fire has been rekindled in the company and is evident in our latest generation of products, which will be showcased at NAB '08. Nautel will become the 'go to' place for creative product solutions for challenging applications."

From beeps in the cove to beeps in space, Nautel definitely wants to be there.

Elaine Jones operates a PR agency in Salt Lake City Utah. She has been involved in the Radio Broadcast industry for over 30 years. Contact her at elaine@ejonespr.com

Riding a Different Kind of Wave in Nova Scotia

By Barry Mishkind

Taking a trip Nautel's factory brings one to a very scenic part of North America: Nova Scotia. From Halifax to Peggy's Cove to the Bay of Fundy, there is much to see and do, in addition to the fine folks and transmitters at Nautel.

During my visit last year, I mentioned to Nautel's John Whyte that I was thinking about visiting the Bay of Fundy, site of what is perhaps the largest tidal range in the world – over 50 feet. Whyte raised the stakes by inviting me on a rafting trip while the tide came in. It proved to be interesting, exciting, and wet!

ON THE SHUBENACADIE

The Bay of Fundy runs along the north side of Nova Scotia. Toward the eastern end, where the Shubenacadie River (the longest river in NS) normally empties into the bay, several river-running companies offer guided trips in 16-foot Zodiac rafts that follow the tide.

It is fascinating to see the river bed and much of the bay exposed at low tide. While waiting for the tidal bore, you can walk around in places that will soon be covered by more than 45 feet of water.

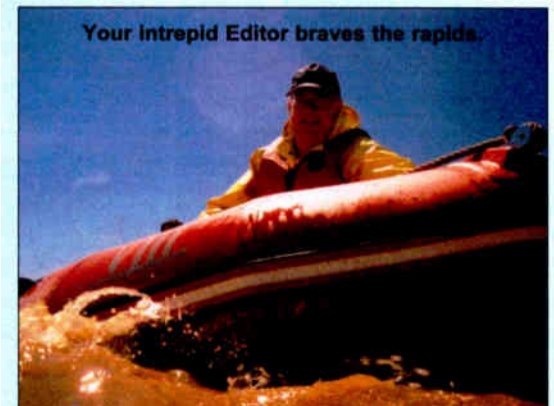


The tidal bore comes in virtually as a wall of water, from one to ten feet high, depending upon the tide's cycle. The rafts pick up on the flow and start heading upriver on the leading edge of the tidal bore.



The force of the tide literally pushes the river backwards, creating rapids with crests as high as ten feet. Using strong outboard motors, the rafts zip back and forth through the rapids, staying with the tidal bore.

The guide mixed in interesting information on the natural wonders that created the bay and its tide, the local wildlife, along with the general history of the area.



All in all a beautiful day, but the process did get us quite wet. Fortunately, when we got back to the base, the company had plenty of hot chocolate for us to enjoy, as we reflected on the day's experience!

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World Radio History

What You Don't Know About Your Tower Can Cost You

Any time you buy something from someone else, a critical part of the transaction is knowing that what you are buying is in good condition – and meets regulatory requirements. Accepting the seller's word that everything is "all right" can potentially lead to a costly experience, as Ron Crider explains.

Sometimes you just never give a second thought to broadcast towers. Nevertheless, you should have a list of questions about any tower you have – and more importantly, the answers to those questions.

For example, for an existing station: Are all those towers where the coordinates on file with the FCC say they are?

Or, let us consider new construction: You contract to have a new 1,049-foot tower built. When completed is it the proper height? Is it where it is supposed to be? Does your tower really need lights? Does your new tower about to be constructed meet the proper building codes and wind load specifications?

LOCATION, LOCATION, LOCATION

Sure, we have heard that expression used and over used regarding the purchase of real estate. But suppose you are the owner or engineer of a station and an FCC Field Inspector calls, wanting to know why your tower is in the wrong location.

Perhaps your first reaction is: "Just what is she talking about?" Your company may have owned the station for years. It was already on the air for 20 years prior to that. And to the best of your knowledge, there never has been a tower move.

However, that is exactly what happened to me. In 2000, we bought a small AM station in Buena Vista, Colorado. Then, in 2004, the Field Inspector shows up with her little GPS and guess what? "This tower is 2,600 feet from where the coordinates on file with the FCC say it should be located."

Who would have ever thought to check the coordinates? Wow, did I look like a fool to my partners! They asked: "You mean to say you never checked the coordinates of that tower?"

TRUST, BUT VERIFY

Well, I believed the closing documents certifying everything to be where it was supposed to be was good enough. Sorry, Charlie, *not* good enough.

After much digging I was able to determine that the actual tower location was changed during construction to a more suitable building location. The then owners said "it was just a small change we didn't think would matter." Unfortunately, we are talking about a half mile – and we are near an airport!

The end of the story is that we were required to file a complete "Modification of License," as well as significant paper work and re-filing with the FAA. Now, the FAA re-negotiating could have been a real problem. Fortunately in this case it was not.

The day after this incident I took my trusty GPS to every one of our towers (including the STL towers) to make sure we were close. As you know, most GPS systems are good to an accuracy of about 30 feet. Several towers were questionable, so I called in a professional surveyor in order to be certain – and sure enough, some of those towers were not really dead-on as they should have been.

So here is the deal: If you are not sure about your tower location, *it is time to get sure*. Today is not too

soon. You may not be inspected with the eagle eye of my inspector, but when you go to sell a station, try to be correct. Otherwise you may find yourself scrambling at closing or, worse, leaving money on the table. As of that day I now check every tower with which I have any relationship. It only takes 60 seconds to get the results.

TALLER MAY NOT BE BETTER

In the 80's, when I was President of Lodestar Tower, I found myself in another serious and potentially very expensive mistake.

Our company was engaged in the building, owning and leasing of tall towers to meet the new FCC 80-90 Rules for FM stations. One of the tall towers for which I was responsible was located in Jacksonville, Florida. I was quite proud of myself to have conceptually engineered a 20% guy radius, 1,049-foot tower on a very small plot of land owned by Metroplex Communications and one of our tenants.

Allan Dick of the Allen Dick antenna company in England and I created a special FM Panel Antenna to be mounted on a cantilevered tower section on the tower top, above the last guy layer – it was directional for one of the Jacksonville stations, but non-directional for the other stations. The great news was that the tower was completed on time and within budget – including the panel antenna, building, combiner and generators.

Then came the most embarrassing news of my tower career. About six months after the tower was completed I received a call from Metroplex and their Washington attorney. They informed me that the tower was 50 feet too high. Instead of the tower being 1,049 feet, it was 1,099 feet – and the FAA was demanding that we remove the top 50 feet of the tower.

WHEN YOU HAVE NO FRIENDS

At first I thought the telephone call was a practical joke, since this type of phone call had been used at a roast, and the Metroplex guys themselves had been the brunt of the joke.

Unfortunately this was no joke. These guys were not happy or friendly. What happened to my nice-guy buddies? Well, when it comes to a possible \$500,000 mistake and you are the President of the company that made the mistake, as well as the executive overall project manager, it was a real big dilemma – as well as a potentially big problem for the stations.

What happened was that no one took into consideration the ground elevation above mean sea level (AMSL) where the tower was constructed. It was 50 feet! The tower had 1,049 feet of steel and antenna, but should have been 1,049 feet AMSL. *It was fifty feet too high!*

DODGING THE BULLET

This should have never happened. Neither the Canadian tower fabricators nor the tower crew were keenly aware of the stringent FAA and FCC requirements. *I* should have been aware of the problem and caught it early on.

You can be sure that never happened again with me in charge. I went over all the new towers plans we built with a fine tooth comb, as well as having surveyors on the job more than any of the other companies like ours in the industry.

What happens now? Ask the FAA to raise their minimums? Well that was a start. You can imagine their first response.

Finally we were able to convince the FAA this was not an intentional mistake and that just cutting off the top 50 feet – although not impossible – was a huge problem, since the antenna occupied the top 50 feet. This was an expensive process to solve with many meetings, lots of consultants, lawyers and experts.

Fortunately the government really does try to work with you when approached in a gentle, humble way. In the end, the FAA raised the aviation minimums, and we had the stations all re-file with the FCC to reflect their new height. Here was another lesson learned: Even if you are just the station engineer and you contracted the project – *always be vigilant*. Even the most obvious sometimes gets over looked.

THE NEED FOR APPROVAL

My last assignment as President and co-owner of Global American Broadcasting in Longmont, Colorado was to increase the power on a 10 kW Longmont station on 1060. The goal: to get the station to 50 kW and find a new tower site that we could get FAA, FCC and County approvals. This tower was to be located near a new suburban up-scale neighborhood, so it needed to present the least possible visual impact.

I started by finding a local consulting company that was headed by a lady that had recently written the new tower regulations for Weld County. This gal knew all the hot spots, the ins and outs, what to apply for, and how to go about it in the county we wanted to build.

First, she wanted to see our FAA permit, the "Determination of No Hazard," so I immediately applied for one. The real estate I tentatively selected was more than five miles from any airport and more than two miles from any major power line or highway system.

TRYING TO KEEP A LOW PROFILE

I applied for 199 feet as I did not want to deal with lighting of any kind – not because I am opposed to tower lights. I have been to many public hearings regarding towers – and lights were often a major issue. Without the lighting system, I believed we could overcome at least one hurdle early on.

I also chose a free-standing 199-foot monopole as the proposed structure. A quarter-wave on 1060 would have been 232 feet, but I felt the sacrifice of the efficiency was worth it, considering there were almost no options.

So, here is what it took: designing a less efficient tower system, spending 40% more for the shorter tower than a normal guyed, series feed structure and installing a 5-wire skirt system.

MONKEY WRENCH

Our consulting engineer suggested a two-step application process for the location change. First, the move and a power increase to 30 kW. Once that was approved and licensed, we would apply for the full 50 kW using measurements. Perhaps this could have been accomplished in one step, but we followed his conservative advice.

The FAA came back with their "Determination of No Hazard" (DONH), with one little hitch – a requirement for a "medium intensity strobe light" on the tower top. Where did this come from? I was under the impression that a tower under 200 feet, more than five miles from any airport or major highway, would get us home free, with no light.

By this time I had already presented my case to the county. Based on our renderings and assurance that we would receive FAA approval – without lights – and an FCC CP, they conditionally granted a special exception to move ahead.

Meanwhile the new tower site was surveyed and staked. I purchased a pivot section of property and entered into a long-term lease for additional adjacent land for part of the ground system. The condition of the additional land was that the ground system was to be buried 18 inches below ground level, so the land owners could farm it.

(Continued on Page 14)



Yeah, we're gonna be GROUNDED, for sure.

Uh oh, the boss is steamed... guess that means no more playing around, eh big guy?

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Operations Guide

by Gary Cavell

Successfully Adding a Tenant on an AM Tower

"Vertical real estate," as radio towers might be called, can provide a tidy income for the tower's owner. Of course, it is not always as simple as just "hanging something up there" – especially when an AM tower is involved. Gary Cavell offers some sage advice and tips for those who might be considering a new "profit center" for the company.

A question was raised on one of the engineering mailing lists recently about complications that could be encountered if a station owner decides to rent tower space on their AM tower to a non-broadcaster. This non-broadcaster may be a cellular telephone company, but other "land mobile" entities, such as local government and commercial interests are also candidates for renting an AM station's "vertical real estate."

Having been in the consulting business for more years than I would care to remember, I have seen many of these proposals and have advised both sides in not only the negotiations but also the initial implementation. On occasion, I have also been called in to help sort things out when things "seemed to be going badly." Fortunately, most arrangements work out just fine providing the station owner had a nice, stable stream of extra income.

However, I am afraid some do become true horror stories. As with any relationship involving financial interests, there are some cautions that should be reviewed well before a deal is signed.

MORE THAN A HANDSHAKE

First, a properly executed, *balanced* contract, which spells out responsibilities and remedies for all parties is a real necessity. A simple handshake is *not* enough.

Everyone's responsibilities should be clearly spelled out so that a non-technical third party (judge or jury) could understand the intent. For instance, if the tenant causes your station harm (and define what this means – like off-air time, shifted parameters, FCC filing events), then it should be clear that *they* are on the hook for the costs of resolution – and *within a specified time frame*.

You should also think about whether you want to ensure that the lease is transferable, in case the station is sold, and whether you want the obligation of the tenant to be transferable, should *they* be sold or merged.

INVOLVE COMPETENT ADVISORS

Furthermore, these contracts should not be signed until an experienced communications lawyer has reviewed the document, *as well as a local lawyer* conversant in your state's laws.

Finally, the station owner really needs a technical person's input. In particular, the lease should have a technical review *before* the lease is signed, either from the station engineer or some other AM-savvy technical person (such as your consulting engineer).

Unfortunately, all this advance caution and diligence cost money. We all have witnessed the "save money no matter how much it costs" mentality – and all too often we techie types are blown off as being "negative" or "getting in the way" of a "great deal." But it is far cheaper to spend a few bucks up front than to wish you had done so when things go sour.

The problem is that it is always *after* the fact that complications seem to become apparent and the "money making opportunity" becomes a serious headache – or even a money loser. And then you hear: "why didn't you warn me?" It is enough to make an engineer grumble.

12 STEPS TO SUCCESS

While anticipating every possible problem and contingency is impossible for anyone (that is why you need two lawyers and an engineer, as well as the owner/

manager to review everything), here is a list of key issues that require careful thought and attention. Success or failure may hinge on any of them.

1. Pay attention to the details. Any proposed lease should specifically address the number of transmitters, number of antennas, and number of coax runs, as well as the height (aperture range) being leased on the tower.

I have seen companies negotiate "just one antenna" on a tower, only to have multiple transmitters plumbed into a multiplexer. Why is it a big deal? Because it is a matter of leaving money on the table. If you negotiate a deal to install one antenna on the tower, and the tenant multiplexes a boatload of transmitters, putting 10 pounds of stuff in a 5 pound bag, your boss might feel cheated.

Your vertical real estate has worth, so thoughtfully charge for it! Think about a per-transmitter/per-antenna or feed line/per-foot arrangement, if possible.

2. Zoning. Even though you have an existing use permit, some jurisdictions have zoning laws that might prohibit adding things to your tower. The station and tenant should check this out and secure all proper permits.

Also, be watchful for anything that can trigger an electrical inspection in your building. Most broadcast equipment and installations do not pass inspection because, among other things, broadcast gear does not have a UL label! But that is fodder for another discussion.

3. Be on site. While careful advance planning and attention to detail is required, having an experienced AM radio engineer *on site* during *all* the installation festivities is *essential*. Many of these deals get into trouble early on because a station engineer is not available at the site when the cell company does their installation, or the manager/owner will not back the engineer up if he/she sees a developing problem and is trying to get the installers to do things properly.

Sure, you do not want to make the tenant angry, but bad installations are much harder – and far more expensive – to fix after the fact!

4. Do not give away the electricity or floor space. As pointed out above, some folks will make one assertion as to their usage – and then install a ton of equipment in your transmitter room, eating up floor space, cooling load, and electricity.

One tower owner "threw in" the electrical costs, trying to be nice. Then a dozen transmitters were installed (since the lease was silent in this regard) and – you guessed it – the utility bill ran more than the lease payment. Furthermore, *get a separate power company meter* for the tenants; they need to pay for their own power.

5. Access can be (or will become) an issue.

a) It is my personal opinion that you should not let anyone on the tower(s) when hot, even with a few Watts. This also goes for towers where you have a skirt feed (folded monopole/folded unipole) or a slant wire (shunt) feed.

b) The issues include RF burns, RF exposure, and consequential downstream liability if someone decides that the 10 Watts (or whatever) of power you had feeding the tower while they worked on it caused them some illness or problem years later. Cold towers are essential to shield you and the station from liability. I know I am being overly cautious here, but it is much safer to err on the side of caution.

c) The cell system will want access to the tower for any number of reasons (to change/add/decommission/maintain their coax lines and antennas). When they do so, *you will have to be off the air* (or operate at reduced power if you do not feel like sticking to the above

cautions). Of course they want to work during daytime hours – and the work could take hours.

Is this something management would tolerate given the format, spot load, programming or sponsor contract requirements? Cover this clearly in the lease!

d) There should be a clause in the lease that access is only permitted with advance coordination and permission. Otherwise some guy will run out to your site, try to climb the tower not knowing it is hot, and get burned.

Or they could come out unannounced and shut down your transmitter in the middle of your prime time, without any foreknowledge or permission. Do not think you are safe because your transmitter is in a separate locked building. Battery jumper cables across the tower base do a great job of "cooling off" a tower.

e) You *really need* to have a written "Site Policy" regarding RF exposure. The FCC wants this and your lawyer will want it, too. Basically, the document should state that access to the tower is limited and coordinated, and that none of the signatories or their agents/employees will enter into RF hot area or climb/contact the tower or its associated components without mutual notification and adhering to the safety measures adopted within the agreement, etc.

f) Section 73.49 of the FCC Rules requires that the antenna base(s) be enclosed by a protective fence. I have seen stations fined for violating this Rule while the fence was breached for the construction effort (being left unattended compounded things). More logistics, but it is a perfect example of why you need to be there when all this is going on.

6. Do not forget about RFI. Your RF may get into their gear and, although less likely, their RF can get into yours, especially the STL. Make sure the contract addresses mitigation of any interference to one another – and who pays for what. You may also want a provision for giving/receiving due notice of an issue and a drop-dead schedule for resolution; perhaps even consider writing in a third-party engineering arbitrator clause.

7. Grounding issues.

a) If the tenant's grounding practices are not proper, then your equipment grounding will become primary. Every piece of gear (both theirs and yours) should be at the same ground reference point.

In worst case instances, I have seen the radio station's equipment placed across a difference in potential (during lightning strikes) which made the transmitter or equipment rack gear act as a big alternative path for the discharge. Cleaning up the grounding situation solved the problem. Advance planning and mutual agreement in this area is critical.

b) If they plan on putting their own equipment shelter at your site, where will it be placed? There is a real possibility that they could damage a portion of the ground system. Furthermore, their grounding systems should be tied into the station's radial ground system. (Several publications illustrate how to properly "ring" a building and tie the station and building grounds together, to ensure that the station ground has continuity beyond the new enclosure.)

c) Delivery vehicles, trucks, etc driving over the ground system can be an issue. It is easier than you think to tear up your station's ground. Establish some basic rules beforehand about what can be driven, and where. If they need a crane or heavy truck to deliver their equipment enclosure – *be there* and watch carefully. Be prepared to confront the driver who has only one mission in mind.

d) How are their transmission lines getting to the tower? Do they want to trench their lines? Will they "fly" the cables to the tower? Will they be using poles/trestles with an ice bridge? All this has the potential to impact or tear up the station's ground system. Again, proper grounding and bonding techniques must be followed.

e) It is essential that their antenna system(s) and coax line(s) be electrically bonded to the tower using grounding kits, at tenth-wavelength intervals – and especially where the lines depart the tower to travel to their building. Otherwise, you are setting yourself up for all kinds of troubles.

(Continued on Page 26)



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Tower Guide

by Ron Crider

– Continued from Page 12 –

CHECK AGAIN!

Remember: always double check *everything*. It will pay off every time.

The tower location had been surveyed and staked for construction. However several months passed prior to actual construction getting under way. So when the tower crew arrived to commence the foundation construction, I had the fortuitous idea to order a verification of survey.

It was good that I did because the tower center stake had been moved almost 150 feet from its original location, the one specified on our FCC application. Once the site location was corrected, the foundation was installed at the proper spot. Then tower and skirt system were erected in one day with the assistance of a crane.

MORE THINGS TO CHECK

Another excellent idea is make *sure* that you check for buried wires or pipes when digging. During the ground system installation the trencher cut a major three-phase, 440 feeder cable to our landlord's pivot watering system. To say the least, he was *not* a happy farmer.

There would be no cable splicing for this farmer; he required us to replace the entire 600-foot run. Even though the ground system was contracted, the contractor did not have proper insurance to cover this type of problem. Whoops! There went the budget!

As with other items that should be on a checklist, always carefully check the fine print on a contractor's insurance documents. Since this job went to the lowest bidder, I basically was back to square one. Had I hired the company I originally wanted, I suspect this may have never happened. There just never seems to be a savings when you really think you were a good negotiator.

The project slowed down to an almost dead stop due to winter snow and mud. It took forever to get the primary 440 power pulled into the building from the road.

SOLVING THE COUNTY PROBLEM

Meanwhile, we still had the lighting issue. The bad news arrived: The County said "great job but no Certificate of Occupancy would be granted unless that light goes away!" Tension was building.

Everyone wanted the project done – and done *now* – regardless of the problems. Even my business partner, a preacher, threatened to take over the project himself. I knew going back to the Seattle FAA office would get me nowhere, as I already had that conversation. They were firm, "the light was staying." Talk about pressure; this entire site, building and tower were instantly rendered totally useless unless I was able to make that strobe light go away. I needed a little good luck.

Then, I remembered an aviation consultant I had used in Florida with great success: John Allen. I called only to find out he had passed away, but was greeted by a gal who had taken over for John and was totally sympathetic to my cause. Finally, someone seemed to be on my side.

She decided to take a different tack and petition the Dallas FAA office for the removal of the light requirement. Hurray, they came through and the light was removed. The station finally got on the air at 30 kW, with a great signal.

Another lesson learned: you do not always have to use the same FAA office that issued the original DONH.

AND UP TO 50 KW

The final chapter was the last step: the power increase from 30 to 50 kW. The reason we wanted the full 50 was to provide us with a stronger signal in the Denver metro area, 30 miles from our tower site, to

better penetrate buildings and overcome the city noise level. Off we went to make the measurements.

Plan one was to measure our station operating at 30 kW. Wow! The field measurements showed the ground conductivity was much better than we anticipated based on the FCC ground conductivity charts. This was great news for the signal but bad news for our power increase to 50 kW.

Fortunately, we had a backup plan, which called for us to measure the station with which we potentially would be causing interference. That worked with room to spare! The application was filed and approved with a transmitter power output level of 52 kW to compensate for the reduced tower height.

From these examples, you can see why I cannot stress too much how important it is to check, check – and check again – every detail of a project.

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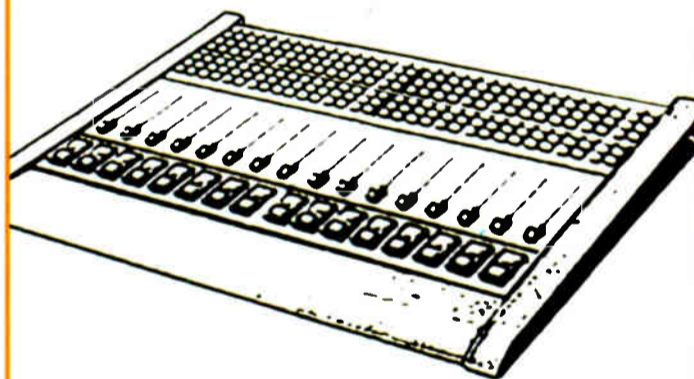
Comdial Executech® PBX phone, ca. 1996. Comdial was one of the leading PBX companies in both sales and technology, with a million-square-foot assembly facility and over \$7,000,000 in reported earnings. Comdial continued with traditional PBX tech and declining sales until filing for Chapter 11 bankruptcy protection in 2005, when all assets were acquired by **Vertical Communications**, a VoIP company.¹



Cisco® 7970 IP Phone, ca. 2006. Founded in 1984 as a manufacturer of multi-protocol routers, Cisco began, in 1998, to promote VoIP technology to Fortune 500 companies as a more cost-efficient, feature-rich alternative to PBX phone systems. In just 10 years, VoIP effectively killed the traditional PBX; VoIP revenue is projected to reach \$48 billion by the end of 2010.² Cisco annual revenue reached \$35 billion in 2007.³



Axia Element broadcast console, ca. 2008. Founded in 2003, Axia is a division of Telos Systems, worldwide leaders in broadcast audio equipment. Axia was launched with the mission of bringing proven technology from the computer world – switched Ethernet, audio routing via IP, distributed network architecture – to radio. Using open standards and bulletproof Cisco routing technology, nearly 1000 Axia consoles have been built in just 5 years, making Axia the fastest-growing console brand in radio.



Generic TDM console, ca. 200x. Some radio consoles and routing systems are still based on Time-Division Multiplexing, developed in 1962. TDM was once the basis of most (if not all) digital PBX telephone systems. Consoles and routers based on TDM employ centralized "card cages" that require all inputs and outputs to be wired to a single location. Like traditional PBXs, TDMs typically rely on closed, proprietary code, and cannot be easily or economically changed or expanded when new operating criteria arise.

Santayana famously noted "Those who cannot learn from history are doomed to repeat it." Some people change when they feel the heat; others when they see the light. With that in mind, a quick comparison of telecom and broadcast technology reveals some common trends that broadcasters are finding hard to ignore.

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Audio Over IP - Part 2

Last time I introduced the Barix codec to you as the "Swiss Army Knife" of IP audio. In this article we will show how to set them up for use as an STL or point-to-point Hi-Fi link.

BUILDING BLOCKS

The two units most popular for audio-over-IP usage are the Instreamer 100 and the Exstreamer 100. Other models include the Exstreamer 200 (which has a built-in 25-Watt per channel audio amplifier) and the Exstreamer Digital, which adds a coaxial digital output to the analog outputs.

Since there has to be a static (non-changing) IP address on at least one end of a basic point-to-point IP line, the static Internet or LAN IP address is usually placed on the send end. This way, the Exstreamers can "tune" to the Instreamer using its IP address.

CONFIGURING THE INSTREAMER

Configuring the Instreamer is much easier if you use the built-in software and the "Sonic IP" feature, which announces the default IP address to you.

Start by plugging the Instreamer into your DHCP network or router, plug in a pair of headphones, and power up. Use the announced address in the web browser of a computer connected to the same network and you will see the Instreamer's web configuration screen.

Click on the configuration button on the left side just under the picture. The network settings screen will appear.

The screenshot shows a web browser window with the title "SETTINGS". There are several tabs: NETWORK, AUDIO, STREAMING, IP, CONTROL, SERIAL, and SECURITY. The NETWORK tab is selected. The form contains the following fields:

- IP Address: [0] [.] [0] [.] [0] [.] [0]
- Netmask: [0] [.] [0] [.] [0] [.] [0]
- Gateway IP Address: [0] [.] [0] [.] [0] [.] [0]
- Use SonicIP: Yes No

At the bottom of the form are "Apply" and "Cancel" buttons.

The Barix configuration panel.

This is where you put in the static IP address information, but *do not* do anything here, yet. The zeros in the windows are there to tell the unit to find a dynamic IP address.

Next, click on the STREAMING link. This is where the streaming protocols are selected, except for one setting. The area we need is in the middle of the page.

STREAMING SETTINGS

First, set the "Streaming Mode" (second item from the top) drop down box to "send always." Then, where it says: "Radio Path," you can put the name you want to give your stream. Many stations use their call signs here. The default name is */xstream*. You *must* have a forward slash (/) before the name, but it is perfectly okay to leave the default as it is: (*/xstream*).

Next we set up the streaming protocols. There are eight boxes to enter these, but you should change the drop down in boxes 4-8 to "Not Used." This is done so we will not waste upload bandwidth. Next, change the drop down box for #1 to "BRTP," and put the port number 4040 into the port box. Leave zeros in the IP boxes. Boxes 2 and 3 are set to "Internet Radio" with no IP or port numbers. Finally, click on the "Apply" button at the bottom of the page. The unit will reset and return to this page, with all your settings saved.

(Barix Real Time Protocol (BRTP) is recommended for an STL or other point-to-point link. This protocol offers several advantages over HTTP or RTP streaming – specifically more reliable streaming, a bit lower latency and the ability to stream to multiple locations simultaneously.)

AUDIO SETTINGS

As we move to the audio settings, things get somewhat subjective.

There are several perceptual, bit-rate reduced protocols: G.711 (telephone quality), MPEG 1 layer 3 (MP3) or MPEG layer 2 (Do *not* confuse this with MPEG 1, layer 2 or MP2). In addition to the protocol selection, there are also several sampling rates and quality levels. These settings affect both the audio quality sent and the upload streaming bandwidth required.

As of this writing, the best quality/bandwidth tradeoff is MPEG-2, the protocol also used for DVD and satellite TV audio. Click on the AUDIO link at the top of the screen to access the audio settings.

LEVEL AND QUALITY

Set the input source: either analog "line" (Left and Right RCA jacks), "optical" digital, or consumer level "coax" S/P DIF. Take care, consumer level runs at a lower level than pro coax S/P DIF. If you select "coaxial" with a pro level source, the audio will be very distorted. For our generic set up purposes, select "Line."

Channel mode is self-explanatory; mono will use less (slightly more than half) bandwidth per a given stream than stereo. Encoding and frequency should be set according to what you want – for our purposes (a better than FM and near CD quality stereo stream, suitable for use as a high quality STL) we are going to use "MPEG-2/24 kHz." For the quality level, we need a setting of "5" for the quality we want. This equates to a bandwidth requirement of about 80 kbps per stream sent out.

The A/D amplifier gain is basically a transmit level control for the analog input; leave it on "-3" unless your input audio is very low – I will show you how I check the audio levels in a moment.

- Leave MP3 Frame CRC on "Disable."
- MP3 Bitreservoir mode *must* be set to "Kept Empty" when using the BRTP protocol.
- If running L/R stereo, leave MP3 Channel Mode Extension setting on "Enable," otherwise set it to "Disable" Stereo Encoding (Although this is not a documented feature, these units have good enough separation to run a separate mono audio feed on each channel, but if you want to use the unit in this mode, then this setting *must* be set to "Disable").

- Leave MP3 Copyright protection as "Enabled."
- Leave Stream type as "Copy."
- Leave MP3 emphasis set to "None."

SETTING SECURITY

To set a password on the Instreamer, click the Apply button at the bottom; the unit will reboot. After rebooting, click on SECURITY at the top-right of the page. The security page will open. For simplicity's sake, I suggest you use the same password in *all* the following positions: Save Configuration, View Configuration, and Control/Command.

Click the Apply button. The unit will reboot and ask you for a username and password. There is *no* username – put the password you just used into the password line and click OK.

FINAL SETTINGS

The last thing we need to do is set the static IP address for the unit. Click on the Network link. We have seen this screen before.

All that is necessary to do is put in the unit's static IP address, Netmask, and Gateway – information that should have been provided by your network administrator or Internet Service Provider (ISP). Put in your password, click Apply and you are done. (Remember,

you will no longer be able to see the Instreamer's configuration screens with the original IP address, because you have changed it. You need to put its static IP address into your browser.)

One more thing – if you have been given a static LAN IP address from your Network Administrator for the Instreamer, *make sure* he has opened port 4040 in the firewall. If this is not done, the stream will *not* be available outside your studio!

EXSTREAMER

Fortunately, setting up the Exstreamer is not nearly as hard, though a firmware update is probably necessary (only www.datanab.com ships the units with the firmware we are going to be using – and then only upon request).

First, we need to download and unzip the Barix Streaming Client Firmware here: www.barix.com/RG Unzip this file to your desktop or other place. There will be one main folder (streaming_client_updatekit) with several sub-folders inside this main one.

The file we are looking for is called Compound. It is a .bin file (Compound.bin), located in the Update_Rescue sub-folder. Plug the Exstreamer (100, 200 digital) into a DHCP enabled network (just like you did with the Instreamer above). Plug in headphones to the unit and power it up; it will read you its IP address. Put this address into your web browser and you will see the Exstreamer's configuration page.

EXSTREAMER SETUP

- Click on the Config link at the top center of the page. The configuration screen will open.
- Click on the Update link in the center of the page. The Exstreamer will reboot and go into Bootloader mode.
- Click the Browse button and browse to the Compound.bin file
- Then click the Upload button. *Do not touch anything* during this update process!
- Once the update is done, a screen will come on telling you to unplug power supply from the Exstreamer to reboot it. Do so now.
- The unit will reboot and a message will come on that says: "Click here to reload the main page." Click on the word "here" and the Streaming Client Firmware Configuration page will load.

Once the new firmware is installed, configuring the unit is as simple as going to the STREAMING section and putting the proper URL into line 1. Type the following in: "BRTP://(static IP address of Instreamer):4040." (If we assume the static IP address of the Instreamer is 123.456.789.10, the address would look like this: BRTP://123.456.789.10:4040

Click on the Apply button at the bottom of the page. You are done configuring the Exstreamer.

MAKING IT PLAY

I usually set Instreamer levels with Winamp (www.winamp.com). Click on the sine wave in the left top corner. Move down to the Play tab and then the URL sub-tab. A window will open. Put the following into the window: HTTP://(static IP address of Instreamer):80/(stream name)

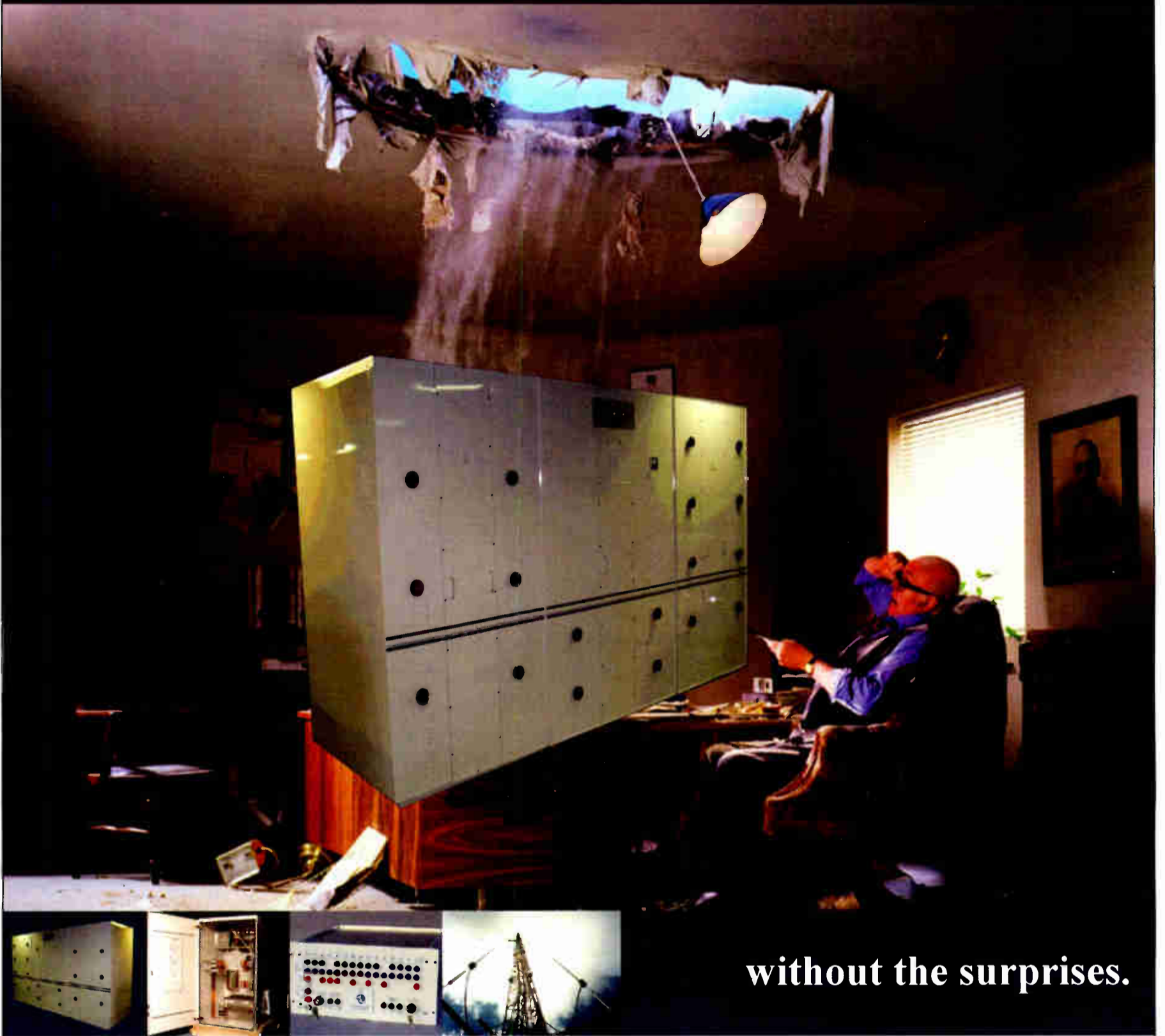
Again, if using the address above, things would look like: <http://123.456.789.10:80/xstream>

Winamp will then open and begin playing the stream after a short buffering time. You set the level by looking at the bar graph in the Winamp screen. It is fairly obvious when a band is clipping. If you click on the sine wave, then the options tab, there is a setting that says "Double Size." Using this will make the Winamp graphic twice as large. I find this handy for reading levels. If you click on the bargraph, it will also toggle to an oscilloscope like-screen – another way to set levels.

Next time we will go over some of the special features these units have. Until then, or for more background reading, try the following link: www.barix.com/RG In the meantime, have fun with your Barix units.

Dana Puopolo is a long-time radio and television engineer who recently has taken on North American Technical Support for Barix. Contact him at dana@barix.com

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James Boyd

Helping Keep Oregon Broadcasters On the Air

One does not have to be a national figure to have a major impact on one's fellow broadcasters. As we shall see, James Boyd's reputation has made him the "go-to" choice for many broadcasters in the Northwest. Scott Fybush profiles this dedicated broadcaster with over forty years experience.

Bend, Oregon is a long way from just about anywhere. It is nearly four hours to Portland, the nearest big city. And if it seems like a small town today, with some 80,000 people, it was truly a small town when James Boyd was growing up there in the fifties and sixties.

"When I graduated high school, it was only about 11,000 people," recalls Boyd, proprietor of Boyd Broadcast Technical Services and



James Boyd

Radio Guide's latest inductee into the **Hall of Achievement**. Back then, even in a small town, it was easy for a young boy to develop an interest in radio.

AN EARLY START

Boyd remembers, "I started messing around with electronics when I was eight or nine years old. I had two uncles who were radio guys and two cousins who worked at Tektronix up in Portland. I remember visiting a radio station one of my uncles built when I was five years old. I can remember it like it was yesterday – and today I take care of that place," Boyd says.

But while Boyd knew as early as junior high school that he wanted to follow his uncles into the radio business, it was a long road that led from a youth in Bend to a contract engineering practice that does business all over the West.

THE WINDING ROAD TO RADIO

Boyd's first paying jobs were in the newspaper business, working as a carrier and distribution supervisor for the *Bend Bulletin*. While the *Bulletin* had partial ownership of a radio station, KGRL(AM), Boyd's first radio job was across town at KBND(AM), a competing station. It only lasted for about a year when a draft notice from Uncle Sam sent Boyd across the Pacific to Vietnam.

He spent a year in South Vietnam as a Broadcast Specialist in the U.S. Army, recording interviews with soldiers to be sent back to their hometown stations and pulling occasional airshifts on a satellite station of the American Forces Vietnam Network. Returning to the U.S. in 1967, Boyd finished out his Army career at Fort Benning, Georgia, working part-time at WRBL in nearby Columbus, Georgia until he was honorably discharged in 1969.

Returning home to Oregon, Boyd worked first for KBND and then for Capps Broadcast Group, which had bought KGRL. In October 1969, he moved to Capps' station in Pendleton, Oregon, KTIX(AM).

COMBO JOCK TO CORPORATE CHIEF

"Those were fun days," Boyd says. "I enjoyed those times. I was the program director, chief engineer, news director, did the news in the morning and then pulled a midday airshift plus some production."

Boyd's career soon began to turn toward engineering. By the mid-seventies, he was Corporate Chief Engineer for Capps, responsible for seven stations in six markets and supervising five other full-time engineers.

After a decade with Capps, Boyd relocated to Portland in 1984, spending a year as Chief Engineer of public radio station KBPS. He returned to Capps in 1986, this time based in Portland at KMJK(FM) and KVAN(AM), but with responsibility for the company's other stations as well.

BUILDING AN INDEPENDENT BUSINESS

When the Portland stations were sold to Fairmont Communications in 1989, Boyd came along as Chief Engineer, but he was already thinking about going to work for himself. "You started to see the writing on the wall, with consolidation and all that," he said.

After another year back with KBPS as chief engineer, Boyd finally took the leap, founding Boyd Broadcast Technical Services in October 1991. Over more than 16 years in business as a contract engineer, Boyd has built a loyal following among other engineers and managers in the region.

"He can do everything – literally – and does," said Kent Randles, engineer at Entercom's Portland stations. "He's got an amazing amount of test equipment. We always make fun of him for his truck because he's like the hermit crab that carries everything with him on his back."



The Boyd Broadcast Technical Services truck is fully stocked, ready to tackle virtually anything a station might need handled.

For Entercom, Boyd handles all the transmitter work at the company's multiple AM and FM sites in the Portland market. That includes the market's first FM HD Radio installation, at KGON(FM), as well as another HD FM installation now underway at KWJJ(FM). "James is an old dog who likes to learn new tricks well," says Gary Hilliard, Entercom's director of engineering for the Portland market. "As a contract engineer, he still has this pride of ownership for the stations he contracts with."

MULTIFACTED SERVICES

In addition to contract work for Entercom, CBS Radio, and smaller stations scattered across the region, Boyd is a regional contract engineer for Harris Corp., traveling widely across the West to handle service calls and installations for the company. He also serves as an Alternative FCC Inspector for radio stations in Oregon, and as site manager for two major multiple-user towers in Portland, the Sylvan (KOIN-TV) and Skyline (KGW-TV) towers.

"One of the things that makes my job so terrific is that it's so varied," Boyd said.

He has also worked with consulting engineering firms Hatfield and Dawson and DuTreil, Lundin & Rackley on a project to evaluate public radio stations' AM transmitter facilities for suitability for HD Radio conversion. "The most interesting (of all my work) is the HD stuff, and I've done a lot of that," he said.

Boyd's long-term outlook for HD Radio is optimistic. "I'm still doing a lot of installs," he said. "I'm concerned about AM, but not discouraged. The FM system is here to stay."

GIVING SOMETHING BACK

In addition to his hands-on engineering work, Boyd is active with the Oregon Association of Broadcasters, serving on the association's Board of Directors, and implementing a scholarship program that supports training for young people interested in broadcast engineering.

In what passes for his spare time, Boyd also serves as a volunteer firefighter. "It's amazing, the parallels between being an engineer and a volunteer fireman," he says.

At 61, Boyd says he expects to keep going for many years to come. "I don't have any desire to quit. If I won the lottery, I'd still work. I like what I do, and I'm not going to stop. Where else can you play all day?"

Radio Guide welcomes your suggestions for honoring broadcasters who have built a reputation not only for excellence and dedication to their radio careers, but for their desire to help others with their knowledge and experience. Honorees may be station engineers, group engineers, manufacturers, consultants, etc. Let us know who really helped you make your career successful. Email your comments to: Editor@radio-guide.com

While **Radio Guide** is pleased to acknowledge the contributions to the industry of people such as James Boyd, we are not alone.

It is gratifying to hear the many comments from readers who are also happy to see attention and honor given to folks whose careers have benefited us all in one way or another.

However, we also feel that while naming the individual or giving them a plaque or certificate is nice, we should do more. And so, with the kind help from some broadcast industry manufacturers and other companies, it gives us pleasure to announce that each person honored in our **Hall of Achievement** will receive a number of gifts, giving some tangible evidence of how we feel about those whose concern is to exhibit technical excellence in all they do.

For example, Kevin Webb from Tieline Technology plans to give each of our awardees a DVD copy *Empire of the Air*. Other gifts already have been offered by Kintronics Labs, RCS, Shively Labs, Nautel Ltd., and Comrex. In future updates we will tell you more about these gifts and the companies that provide them. We welcome any others who would like to participate. Just send us a note or give us a call.

Nevertheless, the focus will stay on the honorees and their stories. We just thought you would like to know that there is more to the **Hall of Achievement** than the article and a handshake.

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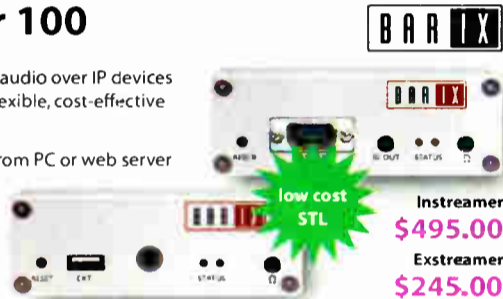
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The Barix Instreamer and Exstreamer 100 are versatile network audio over IP devices offering a variety of applications. They enables users to create flexible, cost-effective distributed audio systems using standard IP technology.

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STL

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The encoder is able to transmit basic RDS information such as the program service name(PS). Program identification(PI) and program type (PTY). Decoder information and music/speech flag are also supported.



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FM Band Spectrum Analyzer and RDS Decoder

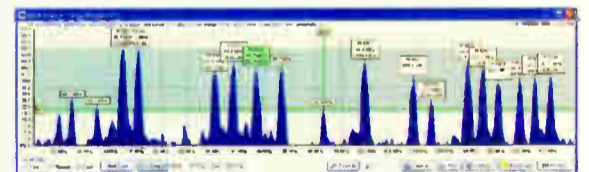
A simple, low cost scanning receiver for FM measurement & market analysis



Every radio station NEEDS one!!

The Band Scanner Pro can be used to evaluate FM broadcast band congestion and to log station identification parameters. The "Band Scanner Pro" can measure RF level, MPX deviation, Left & Right Audio levels, RDS and Pilot injection levels.

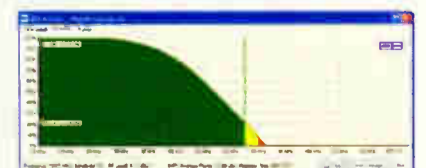
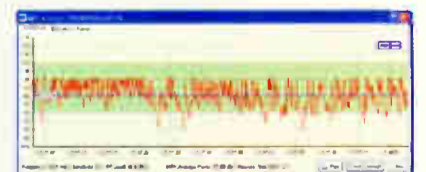
The system is powered by the USB port of any Windows PC. Supplied free of charge Windows software sweeps the receiver across the FM band, logging every carrier and generating a



spectrum display of carrier level vs. frequency. It then analyzes each carrier and creates a station list.

Stations with an RDS presence are further refined to show all the radio data groups being transmitted. Its interface is like a portable radio: It may be tuned manually through the receiver screen or by double-clicking a point on the spectrum plot or an entry on the station list.

Spectrum plots may be saved as jpg or bmp files. The RDS data error level is graphed in a separate window on the receiver screen. The program can be monitored with headphones plugged into a standard 1/8" jack.



low price



by J.S. Sellmeyer, P.E.

A New Tool For AM Network Measurements

Within the past year new instrumentation for making RF impedance measurements in the broadcast range has become available at modest cost. In this article, we take a look at the PowerAIM 120 from Array Solutions of Sunnyvale, Texas.

VECTOR IMPEDANCE ANALYZER

The PowerAIM 120 is a single port vector impedance analyzer. It has a useful frequency range from 100 kilohertz to 120 megahertz making it an excellent tool for AM and FM transmission line and network measurements. The relatively high immunity to incoming RF energy makes it possible to make accurate, reliable measurements in areas where other nearby broadcast stations are operating.

The instrument can make measurements on a broadcast antenna with an RF voltage up to 25 Volts peak at its terminals. This is roughly equivalent to a 1.5 Volt/meter field for a 190 degree tower, a level well beyond the range of the GR-916, 1606 and Delta OIB series RF Bridges when used with the Potomac Instruments or Delta Electronics frequency synthesizers and detectors.

The instrument is used with a companion laptop computer. Both may be operated on battery power. The instrument weighs less than one pound!

SOFTWARE CORE

The "brains" of the instrument are contained in the software used with the laptop to extract vector quantities representing the voltage across the measurement port and the current into the port. The magnitudes and angles of the two quantities are manipulated mathematically in the associated computer to extract the impedance and associated angle of the measured impedance.

From this information several parameters may be calculated and displayed graphically as a function of frequency or in the form of a Smith Chart. Among the parameters are: series resistance and reactance, parallel equivalent impedance and its associated angle, VSWR, reflection coefficient, and return loss. All or any combination of the parameters may be displayed on the graphical presentations.

Multiple, user-selected markers are available for storage and retrieval of spot frequency data. This data may be exported to spreadsheet files for use in reports and analytical work.

DISPLAY OPTIONS

The data may be displayed in Smith Chart form along with the marker data. A second Smith chart is available for visualization of the load orientation at any specified rotation angle. This is a very useful feature for evaluating adjustment of antenna coupling networks when preparing a system for digital transmission.

The sum of the transmitter output network delay and the transmission line delay between the network input and the transmitter output may be added together and used for the rotation value of the second Smith Chart. The second chart will then display the orientation of the system at the RF Power Amplifier terminals within the transmitter.

It is possible to zoom in on the plotted area of the data by factors up to 5:1 for clarity. Reviewing the marker data for this orientation will immediately confirm the orientation and symmetry of the load presented to the RF power amplifier. This is a very nice feature to have when working under pressure in the middle of the night!

ANTENNA SYSTEM IMPEDANCE MEASUREMENTS

For IBOC digital transmission, symmetry and low VSWR are required at the radio frequency amplifier output terminals within the transmitter to support the digital transmission system. This is also desirable for conventional AM transmission as it assures maximum sideband energy with minimum distortion in the transmitted waveform.

In most cases, the property may not be directly measured, but may be readily modeled using the transmitter manufacturer's stated phase shift across the RF output network in the transmitter. The stated phase shift may be entered into the software and the resulting impedance orientation, VSWR and symmetry may be readily displayed.

Figure 1 is a block diagram of a transmission system operating on 1040 kilohertz. The system uses a 134 feet long transmission line with a propagation velocity of 88 percent, resulting in a phase delay of 58 degrees at the operating frequency.

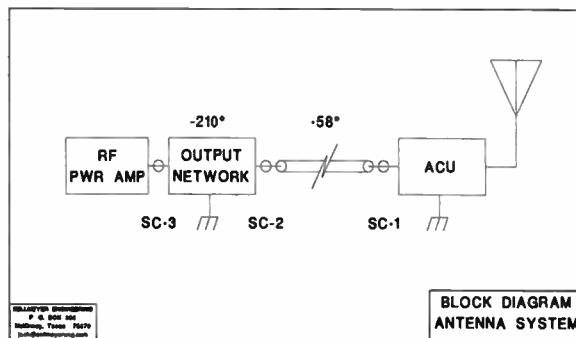


Figure 1

The transmitter used in these tests is a BE AM-1A having a phase shift in its output network of 210 degrees. Thus the total phase shift from the RF power amplifier output to the antenna coupler input is -268 degrees.

PLOTTING THE RESULTS

Figure 2 is a plot of the impedance and VSWR versus frequency of the input to the antenna coupler for a +/- 20 kilohertz sweep about the operating frequency. The resistance is very nearly flat across the passband, having been adjusted to be so with relatively low reactance in the antenna coupler design.

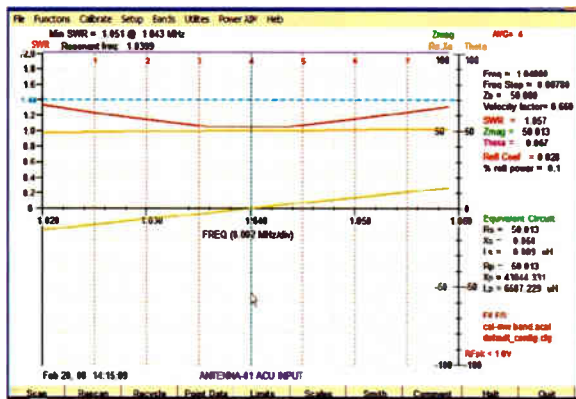


Figure 2

The resistance is shown as a solid orange curve. Reactance is plotted as a lime-green curve (very nearly a straight line). The VSWR curve is plotted as a solid red line. The dashed line appearing above the VSWR curve is the recommended limiting VSWR of 1.40:1. The numbered dashed red vertical lines are the seven markers at five kilohertz intervals.

Figure 3 is a Smith chart plot of the graphical data from Figure 2.

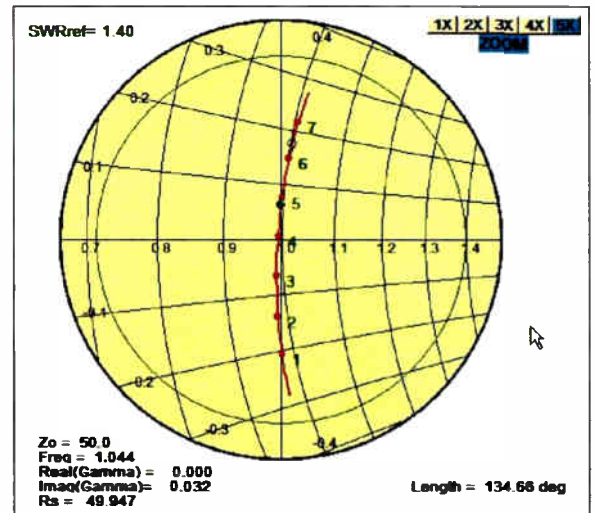


Figure 3

The presentation has been zoomed-in by a factor of 5 for clarity. The markers are shown each five kilohertz and the maximum VSWR of 1.4:1 is shown as a green circle. It can be readily seen that all sideband frequencies are well within the maximum limit of 1.4:1.

Figure 4 shows the table of data at the marker frequencies in terms of resistance, reactance and VSWR. The parallel equivalent impedance and angle are also shown.

02-28-2008 11:28:43				Save	Recall	Print	Exit
Marker	Freq	SWR	SWR_Ratio	Rs	Xs	Zmag	Theta
[1]	1.025	1.2318	1.0080 (1:7)	49.01	-10.29	50.08	-11.86
[2]	1.030	1.1488	1.0091 (2:6)	49.25	-6.85	49.72	-7.91
[3]	1.035	1.0606	1.0093 (3:5)	49.47	-3.26	49.57	-3.77
[4]	1.040	1.0075		49.75	0.28	49.75	0.32
[5]	1.045	1.0786		49.95	3.78	50.09	4.33
[6]	1.050	1.1593		50.17	7.41	50.71	8.40
[7]	1.055	1.2417		50.43	10.88	51.59	12.18

Figure 4

OPTIMIZING FOR IBOC

The IBOC digital system requires excellent symmetry and low VSWR at the radio frequency power amplifier terminals within the transmitter. The symmetry is readily expressed as a ratio of the VSWR of the sideband pairs.

A ratio of 1.035 is the recommended maximum value within +/-5 kilohertz of the carrier frequency and is desirable for the entire passband. As noted in the chart, the worst case deviation is less than 1.01 for the entire sweep. This is the result of proper design of the antenna coupling network.

For proper operation of the system we must now rotate the values obtained at this point to present the proper load to the RF PA output terminals. The total required phase shift may be readily determined by rotating the Smith Chart by the specified phase shift value of the transmitter output network and viewing the resultant display.

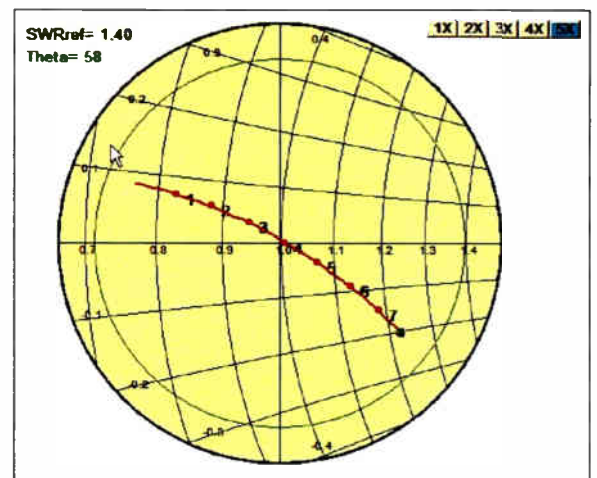


Figure 5

Those experienced with the Smith Chart will readily see that an additional fifty to sixty degrees of delay is required to place the final curve squarely on the parallel resonance circle in the R-X plane. Figure 5 illustrates this orientation. It should be present at the transmitter output terminals.

(Continued on Page 22)

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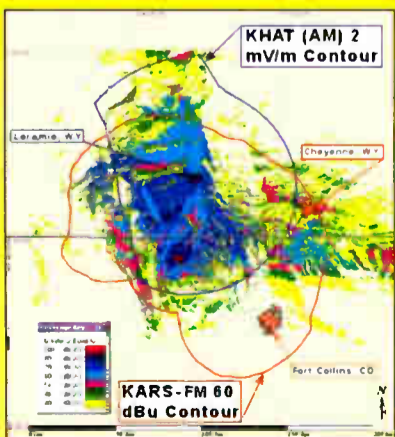
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A New Tool For AM Network Measurements

03-03-2008 16:40:58
*** Marker Data Is Rotated by 50 deg ***

Marker	Freq	SWR	SWR Ratio	Rs	Xs	Zmag	Theta
[1]	1.025	1.2373	1.0030 (1:7)	41.09	3.52	41.24	4.90
[2]	1.030	1.1511	1.0026 (2:6)	43.99	2.59	44.07	3.37
[3]	1.035	1.0731	1.0028 (3:5)	46.98	1.55	47.01	1.89
[4]	1.040	1.0566		50.05	-0.04	50.05	-0.04
[5]	1.045	1.0760		53.12	-7.02	53.16	-7.10
[6]	1.050	1.1541		56.03	-4.54	56.21	-4.63
[7]	1.055	1.2411		58.79	-7.61	59.20	-7.37

Figure 6

The marker data shown in Figure 6 should be obtained at this point with an RF bridge, or the plot may be verified by simply moving the PowerAIM 120 to the transmitter output terminals and viewing the resultant Smith Chart and marker data package.

From this point, an additional 210 degrees of rotation will result in the Smith Chart display of Figure 7.

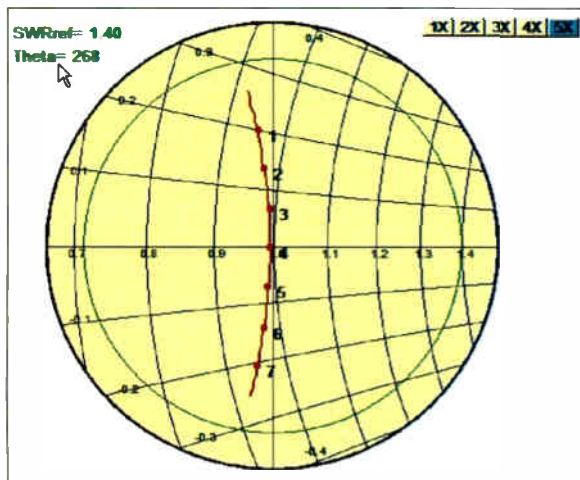


Figure 7

This display has a total phase shift from the antenna coupler input of 258 degrees. It has nearly perfect symmetry about the resistance axis and very nearly equal and opposite reactances in the sideband pairs as shown in the marker chart of Figure 8.

03-03-2008 16:47:05
*** Marker Data Is Rotated by 268 deg ***

Marker	Freq	SWR	SWR Ratio	Rs	Xs	Zmag	Theta
[1]	1.025	1.2373	1.0030 (1:7)	47.83	10.11	48.88	11.94
[2]	1.030	1.1511	1.0026 (2:6)	48.92	6.81	49.39	7.93
[3]	1.035	1.0731	1.0028 (3:5)	49.76	3.49	49.89	4.01
[4]	1.040	1.0566		49.99	-0.06	49.99	-0.07
[5]	1.045	1.0760		49.75	-3.59	49.88	-4.13
[6]	1.050	1.1541		48.95	-6.97	49.44	-8.11
[7]	1.055	1.2411		47.68	-10.21	48.76	-12.09

Figure 8

This system should perform very well with the IBOC system.

TRANSMISSION LINE MEASUREMENTS

Installation and adjustment of directional antenna systems require accurate knowledge of the characteristics of the transmission lines which carry the information obtained from the current sampling apparatus to the antenna monitor. Both the electrical length and the impedance of the line are needed for proper adjustment of the system.

The PowerAIM 120 may be used to obtain these measurements quickly and accurately. When the approximate length of the line is known, a sweep of the first pair of open circuit resonant frequencies may be calculated. When the length is unknown, a "scattershot" may be made by starting at the lowest frequency of the instrument (100 kilohertz) and sweeping to a couple of Megahertz. The sweep may be refined based on the resulting plot.

Figure 9 shows a graphical presentation of the input impedance of a length of 3/8-inch low density foam transmission line commonly used for sampling systems in directional antenna systems. It shows the first three quarter-wave open circuit frequencies.

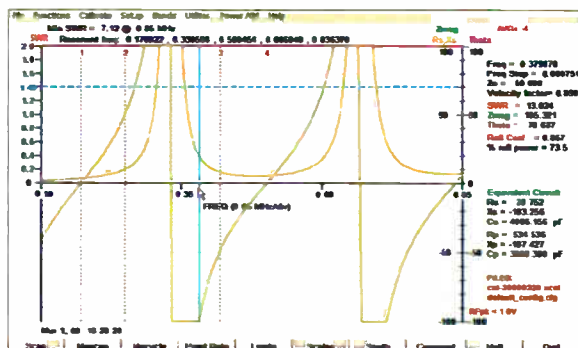


Figure 9

The markers numbered 1 and 4 are located at these points as shown on the Smith Chart plot of Figure 10, where markers 1 and 4 may be seen on the resistance line near the short circuit point. Markers 2 and 3 are located +/- 45 degrees from this point with marker 3 being midway between the first open circuit resonance point and the second short circuit resonance point.

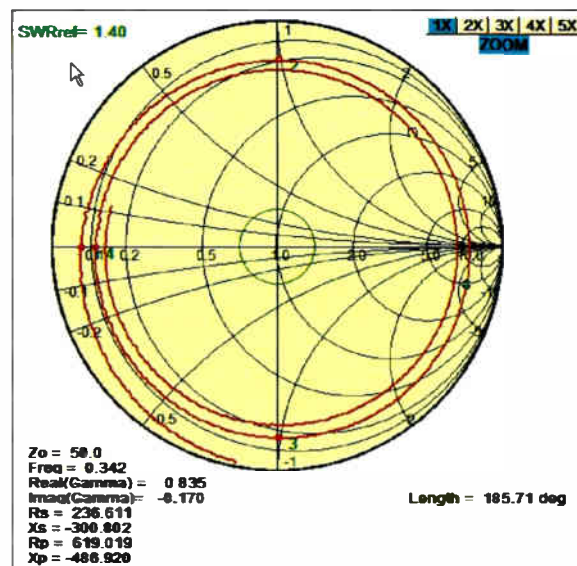


Figure 10

Figure 11 is the marker data tabulation for this Smith Chart. The frequencies where the reactance is very low (close to zero) allow the electrical and physical lengths of the line to be calculated. The markers for the frequency pair 45 electrical degrees from the resonance point show the measured impedance of the line, in this case very near the specified impedance of 50 ohms.

03-01-2008 10:59:07

Marker	Freq	SWR	SWR Ratio	Rs	Xs	Zmag	Theta
[1]	0.170	14.0988	1.5404 (1:4)	3.55	-0.01	3.55	-0.21
[2]	0.248	10.2589	1.1957 (2:3)	9.77	49.65	50.60	78.87
[3]	0.417	12.2663		8.13	-49.53	50.19	-80.68
[4]	0.500	9.1529		5.47	-0.21	5.47	-2.20

Figure 11

DESIGNED FOR MOM MODELING

There is presently a Rulemaking proposal before the Federal Communications Commission seeking to simplify the initial adjustment of directional antenna systems by use of Method of Moments modeling of the array.

One of the proposed requirements for implementation of this procedure is an accurate characterization of the antenna monitoring system, particularly with regard to the sampling system installation.

The proposal also requires periodic recertification of the sampling system. As part of the proposed commissioning and periodic recertification, measurements of the sample lines, both the electrical lengths and impedance of the lines, would be required.

As we have seen, the PowerAIM 120 is well-suited to perform such measurements.

More information on the PowerAIM 120 can be found at: http://www.arraysolutions.com/Products/poweraim_120.htm

Jack Sellmeyer has been designing, constructing and maintaining broadcast equipment and stations for five decades. Jack can be contacted at jack@sellmeyereng.com

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Successfully Adding a Tenant on an AM Tower

“Vertical real estate,” as radio towers might be called, can provide a tidy income for the tower’s owner. Of course, it is not always as simple as just “hanging something up there”—especially when an AM tower is involved. Gary Cavell offers some sage advice and tips for those who might be considering a new “profit center” for the company.

A question was raised on one of the engineering mailing lists recently about complications that could be encountered if a station owner decides to rent tower space on their AM tower to a non-broadcaster. This non-broadcaster may be a cellular telephone company, but other “land mobile” entities, such as local government and commercial interests are also candidates for renting an AM station’s “vertical real estate.”

Having been in the consulting business for more years than I would care to remember, I have seen many of these proposals and have advised both sides in not only the negotiations but also the initial implementation. On occasion, I have also been called in to help sort things out when things “seemed to be going badly.” Fortunately, most arrangements work out just fine providing the station owner had a nice, stable stream of extra income.

However, I am afraid some do become true horror stories. As with any relationship involving financial interests, there are some cautions that should be reviewed well before a deal is signed.

MORE THAN A HANDSHAKE

First, a properly executed, *balanced* contract, which spells out responsibilities and remedies for all parties is a real necessity. A simple handshake is *not* enough.

Everyone’s responsibilities should be clearly spelled out so that a non-technical third party (judge or jury) could understand the intent. For instance, if the tenant causes your station harm (and define what this means – like off-air time, shifted parameters, FCC filing events), then it should be clear that *they* are on the hook for the costs of resolution – and *within a specified time frame*.

You should also think about whether you want to ensure that the lease is transferable, in case the station is sold, and whether you want the obligation of the tenant to be transferable, should *they* be sold or merged.

INVOLVE COMPETENT ADVISORS

Furthermore, these contracts should not be signed until an experienced communications lawyer has reviewed the document, *as well as a local lawyer* conversant in your state’s laws.

Finally, the station owner really needs a technical person’s input. In particular, the lease should have a technical review *before* the lease is signed, either from the station engineer or some other AM-savvy technical person (such as your consulting engineer).

Unfortunately, all this advance caution and diligence cost money. We all have witnessed the “save money no matter how much it costs” mentality – and all too often we techie types are blown off as being “negative” or “getting in the way” of a “great deal.” But it is far cheaper to spend a few bucks up front than to wish you had done so when things go sour.

The problem is that it is always *after* the fact that complications seem to become apparent and the “money making opportunity” becomes a serious headache – or even a money loser. And then you hear: “why didn’t you warn me?” It is enough to make an engineer grumble.

12 STEPS TO SUCCESS

While anticipating every possible problem and contingency is impossible for anyone (that is why you need two lawyers and an engineer, as well as the owner/

manager to review everything), here is a list of key issues that require careful thought and attention. Success or failure may hinge on any of them.

1. Pay attention to the details. Any proposed lease should specifically address the number of transmitters, number of antennas, and number of coax runs, as well as the height (aperture range) being leased on the tower.

I have seen companies negotiate “just one antenna” on a tower, only to have multiple transmitters plumbed into a multiplexer. Why is it a big deal? Because it is a matter of leaving money on the table. If you negotiate a deal to install one antenna on the tower, and the tenant multiplexes a boatload of transmitters, putting 10 pounds of stuff in a 5 pound bag, your boss might feel cheated.

Your vertical real estate has worth, so thoughtfully charge for it! Think about a per-transmitter/per-antenna or feed line/per-foot arrangement, if possible.

2. Zoning. Even though you have an existing use permit, some jurisdictions have zoning laws that might prohibit adding things to your tower. The station and tenant should check this out and secure all proper permits.

Also, be watchful for anything that can trigger an electrical inspection in your building. Most broadcast equipment and installations do not pass inspection because, among other things, broadcast gear does not have a UL label! But that is fodder for another discussion.

3. Be on site. While careful advance planning and attention to detail is required, having an experienced AM radio engineer *on site* during *all* the installation festivities is *essential*. Many of these deals get into trouble early on because a station engineer is not available at the site when the cell company does their installation, or the manager/owner will not back the engineer up if he/she sees a developing problem and is trying to get the installers to do things properly.

Sure, you do not want to make the tenant angry, but bad installations are much harder – and far more expensive – to fix after the fact!

4. Do not give away the electricity or floor space. As pointed out above, some folks will make one assertion as to their usage – and then install a ton of equipment in your transmitter room, eating up floor space, cooling load, and electricity.

One tower owner “threw in” the electrical costs, trying to be nice. Then a dozen transmitters were installed (since the lease was silent in this regard) and – you guessed it – the utility bill ran more than the lease payment. Furthermore, *get a separate power company meter* for the tenants; they need to pay for their own power.

5. Access can be (or will become) an issue.

a) It is my personal opinion that you should not let anyone on the tower(s) when hot, even with a few Watts. This also goes for towers where you have a skirt feed (folded monopole/folded unipole) or a slant wire (shunt) feed.

b) The issues include RF burns, RF exposure, and consequential downstream liability if someone decides that the 10 Watts (or whatever) of power you had feeding the tower while they worked on it caused them some illness or problem years later. Cold towers are essential to shield you and the station from liability. I know I am being overly cautious here, but it is much safer to err on the side of caution.

c) The cell system will want access to the tower for any number of reasons (to change/add/decommission/maintain their coax lines and antennas). When they do so, *you will have to be off the air* (or operate at reduced power if you do not feel like sticking to the above

cautions). Of course they want to work during daytime hours – and the work could take hours.

Is this something management would tolerate given the format, spot load, programming or sponsor contract requirements? Cover this clearly in the lease!

d) There should be a clause in the lease that access is only permitted with advance coordination and permission. Otherwise some guy will run out to your site, try to climb the tower not knowing it is hot, and get burned.

Or they could come out unannounced and shut down your transmitter in the middle of your prime time, without any foreknowledge or permission. Do not think you are safe because your transmitter is in a separate locked building. Battery jumper cables across the tower base do a great job of “cooling off” a tower.

e) You *really need* to have a written “Site Policy” regarding RF exposure. The FCC wants this and your lawyer will want it, too. Basically, the document should state that access to the tower is limited and coordinated, and that none of the signatories or their agents/employees will enter into RF hot area or climb/contact the tower or its associated components without mutual notification and adhering to the safety measures adopted within the agreement, etc.

f) Section 73.49 of the FCC Rules requires that the antenna base(s) be enclosed by a protective fence. I have seen stations fined for violating this Rule while the fence was breached for the construction effort (being left unattended compounded things). More logistics, but it is a perfect example of why you need to be there when all this is going on.

6. Do not forget about RFI. Your RF may get into their gear and, although less likely, their RF can get into yours, especially the STL. Make sure the contract addresses mitigation of any interference to one another – and who pays for what. You may also want a provision for giving/receiving due notice of an issue and a drop-dead schedule for resolution; perhaps even consider writing in a third-party engineering arbitrator clause.

7. Grounding issues.

a) If the tenant’s grounding practices are not proper, then your equipment grounding will become primary. Every piece of gear (both theirs and yours) should be at the same ground reference point.

In worst case instances, I have seen the radio station’s equipment placed across a difference in potential (during lightning strikes) which made the transmitter or equipment rack gear act as a big alternative path for the discharge. Cleaning up the grounding situation solved the problem. Advance planning and mutual agreement in this area is critical.

b) If they plan on putting their own equipment shelter at your site, where will it be placed? There is a real possibility that they could damage a portion of the ground system. Furthermore, their grounding systems should be tied into the stations radial ground system. (Several publications illustrate how to properly “ring” a building and tie the station and building grounds together, to ensure that the station ground has continuity beyond the new enclosure.)

c) Delivery vehicles, trucks, etc driving over the ground system can be an issue. It is easier than you think to tear up your station’s ground. Establish some basic rules beforehand about what can be driven, and where. If they need a crane or heavy truck to deliver their equipment enclosure – *be there* and watch carefully. Be prepared to confront the driver who has only one mission in mind.

d) How are their transmission lines getting to the tower? Do they want to trench their lines? Will they “fly” the cables to the tower? Will they be using poles/trestles with an ice bridge? All this has the potential to impact or tear up the station’s ground system. Again, proper grounding and bonding techniques must be followed.

e) It is essential that their antenna system(s) and coax line(s) be electrically bonded to the tower using grounding kits, at tenth-wavelength intervals – and especially where the lines depart the tower to travel to their building. Otherwise, you are setting yourself up for all kinds of troubles.

(Continued on Page 26)

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– Continued from Page 24 –

There should be something in the contract about this. Also, make sure that line replacement, maintenance, and new lines/antenna installations are subject to the same requirement.

8. Wind and ice loading. Adding more antennas can upset the wind loading calculation for the tower. A bigger factor will likely be the addition of the coax lines.

Be sure that a qualified structural engineer (experienced with broadcast tower issues) runs a structural study. Your AM tower was most likely designed to support itself – and not much more. Most cell companies will run these studies to protect themselves, but you should insist upon it – and insist on seeing the results of any study they independently run. This is a cost the proposed tenant should bear.

My good friend John Reiser reminded me about the possible issue of ice loading in areas where freezing rain is common. This impacts the structural study and introduces liability questions when ice is shed from their antennas – or your tower – and damages someone's equipment, vehicles, or persons. Get your lawyer's advice about this, perhaps to address this in the lease, or in an insurance policy.

9. General Liability. Speaking of liability, John and others also mentioned the issues of "third-party" injury and damages, changes in (or inadvertent voiding of) the station's insurance coverage caused by the additional loading on the tower, subletting space on your property, additional building occupancy, site use, etc.

This is the province of lawyers and insurance professionals, so get them involved as part of the due diligence team. You may be surprised how this issue impacts the cost/profit equation.

10. FCC stuff, especially tower impedance changes and directional antenna parameter shifts.

Anything going across a tower base, even a grounded one, has the potential to shift things – and particularly so with a highly reactive tower. While isocouplers are used to achieve isolation between the installed antenna/line and your AM tower, they still have inherent capacitive values that you will be shunting across the base. This means there still may be a change in your antenna system's base impedance.

Adding a large amount of stuff near the top of a tower sometimes makes the tower think it is top loaded (increasing its electrical length). This will reflect itself in a base impedance shift and (for a DA) a parameter shift. For towers that are roughly 180 degrees tall, changes can occur with self-interference.

Although skirt-fed towers handle these types of projects best (and typically are a non-event), you should still be careful. The important thing is to use proper installation (and maintenance) techniques, document as you go, and keep an eye on the place after the dust settles (for unauthorized and/or improper changes).

a) Non-directional station considerations:

You should record transmitter parameters, base current, and base resistance and reactance *before and after* an event.

A change in base resistance will trigger the need for you to place the station on the "indirect method" until you establish the new reference impedance and report it to the FCC on a Form 302. A new license will eventually show up. (See Section 73.45(b), 73.45(c), 73.51, and 73.54 of the FCC's Rules for more details.)

My interpretation of the Rules and FCC Staff unwritten policies is "any change above the tower base triggers an FCC Form 302 filing," even if there is no material change. Others may argue differently, of course. Charles "Norm" Miller of the FCC Staff here in DC is a good guy and can be a real help, so think about calling or emailing him with specific questions. Frankly, you can do a lot of this stuff without hiring a consultant. (Did I really say that?)

Any change in base resistance/reactance can be compensated for by making adjustments in the tuning unit – unless the change is huge for some reason, requiring a redesign. Note that, if the change is material enough that your transmitter objects, you will be at

reduced power or off the air until someone can tweak the tuning unit. Older AM transmitters are much more forgiving of these things than new ones, so if you have an old iron-bound auxiliary tranny available, it can save your bacon.

Remember, the contract should put the cell company on the hook for making things right and covering the expenses for accommodating their use, which includes costs for filing FCC documents, renting equipment, hiring engineers or consultants, etc.

b) Directional arrays:

Under the present AM Rules, you should record transmitter parameters, base currents, antenna monitor parameters, and monitor point values *before and after* the event. (If you have the equipment and the confidence, getting the driving point impedance values would be a good idea, but this exercise can be tedious.) A "Partial Proof" will be required afterwards (see 73.154).

(Continued on Page 28)

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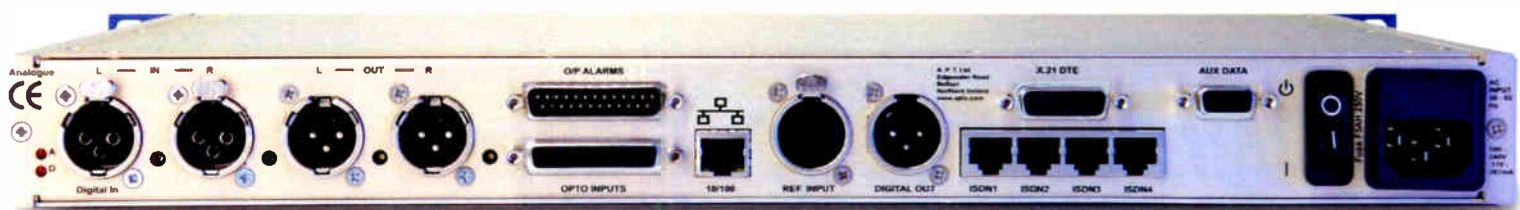
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You – and the cell company – also would be wise to do a “Partial” beforehand to establish the array condition before it was touched.

The preceding point cuts both ways. The cell company has to pay for mitigating any change they cause. If no one establishes the array condition beforehand, and your array is a sinner already, you could assert that they caused the issue (if you are being less than honest), and they would technically be on the hook for fixing things for you.

On the other hand, if they are smart, they will insist upon establishing the station’s technical condition before they touch it. If it is established that the array is out of tune before they get there – all they have to demonstrate is that no material change was caused by their activities. *You* (the station) will still be on the hook for correcting the station condition, now that it is a matter of public record.

As mentioned previously, any change above a base insulator requires a 302 and, potentially, the submission of a Partial Proof, demonstrating continued compliance. If any of the licensed parameters falls out of tolerance (Section 73.62) after the construction, you will have to request Special Temporary Authority (STA) requesting permission to operate the antenna system at variance to the Rules, pending repairs/resolution. Note that this may require reduced power operation in the worst instance.

You will then have to reestablish that the array is operating within its “standard pattern” “as is” (through the Proof test), even with the parameters changed – or you will have to readjust the array until the parameters are in, or the Partial says the array is in, or both. I would also run a radial through the main lobe, just to spot-check array efficiency.

Do keep in mind that field strength measurements can trick you if they are taken over a change of season – winter to summer readings can differ significantly in many parts of the country, as can wet/dry (drought/monsoon) differences. So try to plan the before/after measurements during similar climate conditions if at all possible – otherwise it is difficult to clearly establish what is going on.

Dealing with this need not be difficult, as long as you document things and take your time. Changes at one tower base can often be fixed in the tuning unit. Just mark where everything is beforehand with a marker/sharpie or even “white-out” and take notes about each change as you go along so you can go back to where you were if needed.

While sometimes you can fix things by just “tweaking the phasor,” I feel this might be a band-aid approach. Since the involved base impedance change (and any ensuing phase shifts) is better addressed at the base – you may be creating, or worsening, a line mismatch.

11. Resurvey your tower. Most cell companies will insist on this. If the coordinates and height information are different from your FAA approval (and your station’s FCC Antenna Structure Regis-

tration (ASR)), the prospective tenant will often file corrective paperwork on your antenna – or compel you to do so. This is another cost/hassle factor that should be considered. In the worst instance, you may find that the array/antenna location/heights are way different from what the license shows.

Small changes involve FAA Form 7460-1 filings, ASR filings, and an FCC Form 302 filing. Bigger changes will involve FCC Form 301 filings – and substantial changes may require even more sweat, especially if you suddenly look as if you are causing interference to someone.

I am not trying to scare you, but sometimes these things can become quite the can of worms. So be sure the potential tenant is on the hook for as much of the costs as is reasonable.

12. Ensure you can terminate the lease for cause. Finally, be sure any contract has a way for the station to terminate the lease quickly in the case of non-payment, nuisance behavior, or other issues.

Have the station’s lawyer think about what happens if the cell company changes hands – which is indeed possible – or if the station changes hands. Does the management want an “heirs and assigns” clause or should the arrangement terminate upon a change of situation?

SHARE YOUR EXPERIENCE

Many of you have gone through these situations yourselves and have had to live with them long after a deal has been struck. I encourage you to write Barry and this publication about your own experiences – particularly with respect to what happens as these installations age and the involved owners change. The more knowledge we share, the easier to avoid unwanted “gotchas.”

Gary Cavell is President of Cavell, Mertz & Associates, Inc., Consulting Engineers, located in Manassas, Virginia. Gary’s email address for comments and input is gcavell@cavellmertz.com

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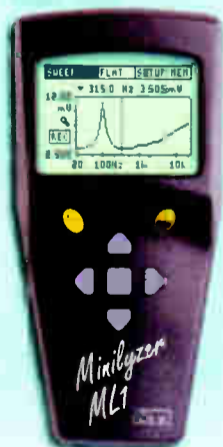
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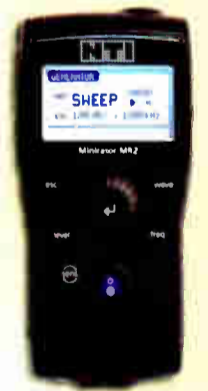
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Station Stories

by Scott Fybush

WBBM – On the Move in Chicago for 85 Years

Taking off from Chicago's O'Hare airport heading west, one of the first sights you might see, if your plane is on the right takeoff path, is the dramatic view of two tall AM towers in close proximity just a few miles west of the airport.

One of those tower sites leaves air travelers in no doubt of its identity, thanks to big letters spelled out in white-painted rocks on the ground: "WGN." There is plenty of history behind the radio station of the "World's Greatest Newspaper," to be sure. But its neighbor just down Rohlwing Road – WBBM – has plenty of tales to tell, too, from its long history.

FROM HAM TO BROADCAST

Today, WBBM (780) is one of Chicago's major radio stations, CBS' 50,000-Watt all-news flagship for the Midwest. But its story began almost a century ago



Four and a half miles west of O'Hare Airport, WBBM reaches out to listeners.

under much more humble circumstances, as a homebrew experiment by a teenage radio buff in the small town of Lincoln, Illinois, 150 miles southwest of Chicago.

The year was 1911. H. Leslie Atlass was just 17 when he and his eight-year-old brother Ralph fired up his first spark-gap transmitter in the family basement. "Les" was assigned the calls 9DFC. The station – along with the rest of amateur radio in the US – went on hold for World War I, while Atlass served in the Army Signal Corps, but was revived in 1921.

Like many amateurs of the era, Atlass was eager to try his hand at full-fledged broadcasting; in 1923 he exchanged his ham license for a broadcasting license. For all the many meanings that would later be attached to the calls, "WBBM" was a purely sequential assignment when it was handed out by the Commerce Department on November 14, 1923.

A 150-MILE MOVE-IN

WBBM's days as a downstate broadcaster were brief. The Atlass family moved to Chicago in 1924, and WBBM came with them, initially operating with 500 Watts from the basement of the new family home at 7421 Sheridan Road on Chicago's North Shore.

WBBM's first Chicago broadcasts were limited to Tuesday, Thursday and Saturday nights at 8:00 PM, as they were sharing the 1330 kHz frequency with another station – WIBO.

The station moved again, in 1925, from the family basement to the Broadmoor Hotel, where those sequential calls were soon reinterpreted as "We Broadcast Broadmoor Music." Two 75-foot towers on the hotel's roof supported an inverted-L antenna, and the station's programming was heavy on dance music, from the Broadmoor's own ballroom and from remote locations around town.

A MOVE TO PROFITABILITY

WBBM was the first station in Chicago to carry radio advertising – and the first to enter into what later broadcasters would call an LMA (Local Marketing Agreement).

In 1926, the Atlass brothers leased their signal to the Stewart-Warner Speedometer Company, which operated the station for a year. The "Stewart-Warner Air Theatre" came to a close in 1927, in the midst of some big technical changes for WBBM.

MOVING ON DOWN THE DIAL

The rearrangement of the dial shifted WBBM from 1330 to 770 kHz and gave it a new share-time partner – WJBT. With the new frequency came a big power increase to 5,000 Watts, a new transmitter site in suburban Glenview (20 miles north of downtown Chicago), and new state-of-the-art studios on three floors of the prestigious Wrigley Building on North Michigan Avenue.

WBBM specialized in local, live programming, including a station promotion called the "Nutty Club." With over a million listeners in the US and Canada wiring, phoning or writing in for membership, it was clear that Program Director Charlie Garland, aka "Colonel Nut," and his crew had something good going.

An accomplished pianist, Garland often did improvisations on the piano, to the delight of the audience. Cards, letters, even cartoons came in from listeners.



Charlie Garland ("Colonel Nut") presided over the "Nutty Club."



From a station newsletter in February, 1928

Recorded music was not well regarded in the 1920s, so many stations had house orchestras to play for the artists who came and during the times between programs – occasionally even filling in for an artist that did not show up. Some well-known groups performed in this way, including Guy Lombardo and the Royal Canadians, who were named as the official "Nutty Club" orchestra.



Guy Lombardo and the Royal Canadians in 1928.

WBBM became a secondary affiliate of the new CBS network in 1928, sharing its programs with rival WMAQ. However, when WMAQ switched to the

NBC Red Network in 1931, CBS made WBBM their primary station, and then bought the station from the Atlass brothers.

Les Atlass remained with CBS and would become a key executive with the company for more than a quarter-century. His brother Ralph bought an interest in a new station in Gary, Indiana, WJKS, later to be known as WIND. (As for WJBT, it operated only a few hours a week and was eventually merged into the WBBM operation, with a brief period during which the station operated as "WBBM-WJBT.")

MOVING 34 MILLISECONDS

Even with WJBT out of the way, WBBM still had competition for the 770 spot on the dial (later moved to 780 in the NARBA shuffle of 1941). Another CBS affiliate, KFAB in Lincoln, Nebraska, shared the channel – and presented a curious problem.

Since both stations were CBS affiliates, listeners located between the two stations heard the CBS programs coming from Chicago, then the same programs delayed by about 34 milliseconds as they crossed the phone lines to Nebraska for broadcast there. The result was a messy hash of echo and different local announcements.

Of course, there were no digital delays back then. But Atlass and his engineers came up with a solution that was state-of-the-art for the time: a series of amplifiers, coils and condenser units generated enough delay at the Chicago end to match the timing of the Lincoln broadcast.

In later years, WBBM and KFAB even managed to synchronize their carrier frequencies precisely, and the stations coordinated their local IDs during CBS evening programming, with KFAB using the first 15 seconds of the CBS station break, then going silent for the last 15 seconds while WBBM identified. WBBM even paid KFAB to sign off at 10:00 PM, when network programming ended, to allow the Chicago station to have the channel to itself for the Big Bands that still made up much of its programming.

MOVING THE CHESS PIECES

The unusual arrangement with the Nebraska station finally came to a close in 1944, when CBS worked out an arrangement that swapped frequencies between KFAB and daytimer WJAG in Norfolk, Nebraska. WJAG moved to 780, signing off at sunset and allowing WBBM to become a full 50 kW non-directional around the clock.

(Meanwhile, KFAB moved to 1110, boosting its power to 50 kW, relocating to Omaha, and sharing its channel with another CBS station, WBT in Charlotte, NC. WBT had been a Class I-A clear channel station, operating non-directionally day and night, but it downgraded to I-B and built a three-tower array for night use to accommodate the KFAB move.)

WBBM finally had the channel to itself, but one final move was necessary: relocating its transmitter away from Glenview. The town was also the home of a major U.S. Naval Air Station and, with the start of World War II, the Navy was worried about military planes taking off and landing in close proximity to the 490-foot tower that WBBM had built in Glenview in 1939 – a replacement for the original tower, toppled by an ice storm earlier that year.

MOVING TO ITASCA

The Navy paid for WBBM to move its two-year-old tower to a new site in Itasca, Illinois, 11 miles southwest of Glenview. It still occupies the Itasca site today; the station has been on the air from there for over 65 years.

With the war effort underway, the transmitter building WBBM erected was utilitarian – a squat concrete-block structure with offices in front, a big transmitter room in the rear, a garage to one side, and an unusual wartime feature: a rooftop turret from which snipers could – and did – keep an eye out for saboteurs bent on doing the station harm.

(Continued on Page 34)

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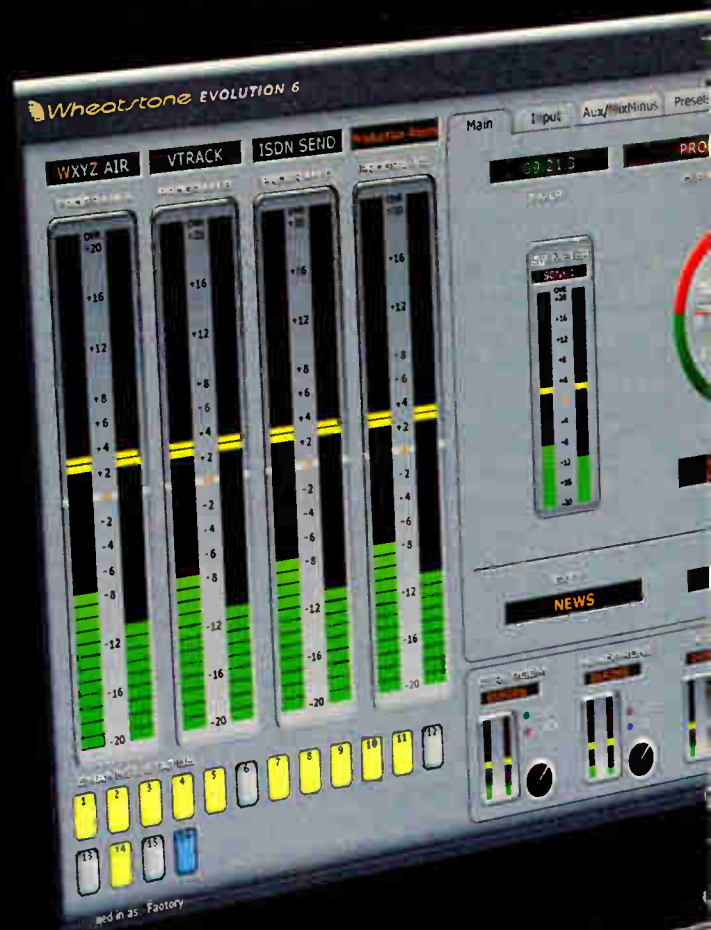
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EVOLUTION-6

The E-6 is a powerful, compact and cost-efficient networked audio control surface with built-in and a powerful set of PRODUCTION TOOLS for each input channel, allowing a single surface to be reconfigured for different talent, studio and format requirements.



E-6 INPUT CHANNELS can access networked audio sources with the press of a button. All sources are displayed right above the fader. Each fader has its own mix-minus output (in addition to the console's own 4 MXM busses). SET buttons at the top of each channel can access a powerful array of production tools individually tailored for each input strip. These include four bands of parametric EQ, compressor/limiter, expander, pan, mode, HPF, LPF and phase reverse. These EQ/DYNAMIC functions allow powerful per channel mic processing. The console has four output busses (can include 5.1 surround), 4 mix-minus busses and 4 aux mixes (all with TB). Each input channel also has two programmable buttons for customized functions, as well as ON/OFF switches with built-in machine control (logic follows source).



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THE REALTIME HI-RES GRAPHIC DISPLAY keeps operators up to date and completely informed concerning all surface functions. Metering, bus assignment, channel status and sources, event recall, monitors, EQ and dynamics—all appear here via the mouse/trackpad driven GUI. Note the surface drives the VGA monitor with built-in circuitry (no external PC required).

THE MONITOR/SET PANEL (right) has Control Room, Headphone, and two independent Studio outputs. It also allows the operator to program input channels via the SET function: aux mix and mix-minus assign (4 each; all with talkback), input source select, and pan. The panel also has fourteen programmable buttons which can initiate custom functions like remote setups, intercom, machine commands and salvos.



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The E-6 audio control surface interfaces directly with Wheatstone's E-Series network switch and associated studio satellite I/O cages. Wiring between components is via single CAT-5 cables, eliminating point-to-point multi-pair runs. Each studio surface operates independently, yet can share all network sources and mixes with others.

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WBBM – On the Move in Chicago for 85 Years



WBBM's home since 1942, complete with a guard tower. (All the windows have been bricked in over the years.)

The tower that moved from Glenview to Itasca in 1942 was dismantled once more in 1947. It was moved south to sister station KMOX in St. Louis, with a new 695-foot tower replacing it at Itasca. That tower still stands today, with a 253-foot auxiliary tower also on site.

MOVING TO FM AND TV

WBBM added an FM relay in 1941, initially as W67C on 46.7 MHz, then later as WBBM-FM on 99.3, 97.1, and finally on its current frequency of 96.3 MHz. Television came a bit later, as CBS dallied with the prospect of an all-UHF color system before belatedly coming to the realization that it needed VHF signals in big markets after all.

Fortunately, a station became available as a result of the 1953 merger of the weak ABC network and Paramount Theaters; the FCC mandated that one of the licenses be sold. Thus CBS acquired channel 4. One more shift, the result of a reallocation of VHF channels throughout the Great Lakes region, moved the new WBBM-TV down to channel 2, where it remains today.

MOVING STUDIOS

The addition of TV to the CBS portfolio, coupled with the decline of the sort of live radio for which the Wrigley Building studios were designed, led the company to seek a location where it could combine all its Chicago operations in the early fifties.

The answer turned out to be a hulking brick building at 630 N. McClurg Court, a few blocks east of Michigan Avenue's Miracle Mile. The Chicago Arena had been built as a horse barn in 1922, and later housed bowling alleys, a roller rink and ice shows. CBS paid just over \$1 million for the building in 1954, then spent more than \$5 million renovating it into a showplace broadcast facility.

"When they bought the place, it had a dirt floor," recalls WBBM Chief Engineer Don Coleman. Built on a landfill, the building was subject to sudden and unpredictable settling. Coleman recalls one incident, in 1997, when the floor of a TV control room suddenly dropped eight inches, right in the middle of the 10:00 PM newscast.

MOVING TO TALK RADIO

As "The Showmanship Station," WBBM radio continued through the fifties as one of the last of the old-line full-service stations, with live music still being heard throughout the day, as well as the occasional radio drama and comedy.

In fact, until his retirement in 1959, Leslie Atlass fought against the playing of recorded music on WBBM, and even after his departure the station eschewed "DJ shows" in favor of a format that was the progenitor of modern talk radio, with hosts such as Mal Bellairs, Paul Gibson, Dr. Frieda Kehm, and, later Jerry Williams, mixing "service" talk with political talk.

On May 6, 1968, WBBM flipped to "All-News 78," joining CBS' sister stations in New York and Los Angeles that had already made the jump.

Almost forty years later, WBBM's all-news format is still going strong, even as competitors have fallen by the wayside. Gordon McLendon's WNUS (now WGRB 1390) tried first, before WBBM, but lacked the signal or financial resources to make the all-news format work. Westinghouse tried all-news on WIND (560) in the seventies and eighties, then sold the station. It reentered the all-news arena in 1988 when it bought WMAQ (670) from NBC.

The 1994 merger of CBS and Westinghouse made WMAQ and WBBM sister stations and, in 2000, CBS pulled the plug on all-news WMAQ, replacing it with all-sports WSCR – and leaving WBBM alone with the format.

MOVING TO THE LOOP

Two years ago, WBBM made one more big jump, moving out of its longtime home on the second floor of the old Chicago Arena building. That space, retrofitted from the old full-service days for "combo" all-news operation, had become outdated, said Coleman.

What is more, CBS planned to abandon the building, consolidating WBBM and WBBM-FM with four other CBS FM stations in the Two Prudential Plaza office tower a few blocks south and building a new WBBM-TV facility in the Chicago Loop.

The new WBBM studios occupy the entire 11th floor of the Two Prudential building, filling some 11,000 square feet of space.

Built with digital networking in mind, the new facility is constructed around a Harris VistaMax router system. The two mirror-image air studios, with Harris RMX digital consoles, face out to the assignment desk in the newsroom. "It's such a radical improvement over the old studios," Coleman says, recalling when the news studio had no clear sightline into the newsroom. A NewsBoss newsroom automation system and AudioVault on-air automation keep WBBM's programming humming.

The dual-studio setup replaced a single main studio in the old facility. Coleman says that was a challenge to clean and maintain, since the studio was in use around the clock. "It really is hard to do a decent job of cleaning when they're in there operating," he said.

MOVING FROM TUBES TO HD

Out at the Itasca transmitter site, meanwhile, the big changes in recent years have been new solid-state transmitters.

The venerable Westinghouse 50HG was long ago supplanted by a Harris MW50. The Westinghouse remained in place for auxiliary duty until it was replaced by a Harris DX50, and more recently a Harris 3DX50 has joined the transmitter lineup at Itasca.



The 3DX50 Main and DX50 Aux transmitters fit in the place where the 50HG used to sit.

Other changes include modern antenna switching systems and transmission feedlines (to replace the open wire feed lines), redundant program feeds and remote control capabilities, and modern audio processing and monitoring – including HD Radio digital transmissions.



The audio and control racks give evidence of the continuous upgrading that has gone on at WBBM over the years.

Aside from the transmitters and other technical gear inside, the WBBM site has not changed much over the past 65 years. As with many transmitter sites that were located well "out in the country," it is the surroundings that have changed the most.

Indeed, the two-lane roads of the forties have given way. Now a busy freeway interchange adjacent to the site connects I-290 to the Elgin-O'Hare Expressway and makes WBBM's site one of the most visible in the nation to tens of thousands of commuters every day on the road – not to mention the thousands who see it from the air.

Scott Fybush brings to *Radio Guide* his love of radio history and facilities – especially towers. His email address is: scott@fybush.com

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attached a picture in white contact me for more info. big_plans #221542

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HANDSOME RAKE

Out of work leaf raker/bagger seeks whimsical beauty with un-kempt auburn or chestnut hair, cool coarse hands and a penchant for whistling. mellow_mo, 28, #101318

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Radio engineer seeks stable long distance relationship. Need to connect immediately. Everywhere I go, I see broadband internet, but I just never hook-up. I need to meet that special someone that will plug me in so I can be heard. Must be reliable, connect easily, forgive errors and adapt to change. Should come from a good family. easy_going #101352

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Simply put, I'm looking for a fun, casual relationship with only one person. That means one person for me and one person for you. :-). Every woman wants to feel safe with a partner, whether it's serious or not. It's key to her feeling comfortable to express her more intimate nature. I don't ask for much other than to hang out, enjoy your time with me and be available to chill.

MR. RIGHT

I'm actually posting this on behalf of a friend. Since she's been single she hasn't found the right guy and I'm doing this in hopes of helping her find Mr.Right. After you and I talk, if you are chosen then you will get to go on a date with her and who knows, it could be the perfect date and start of a new relationship. Looking 33 #

IN LOVE

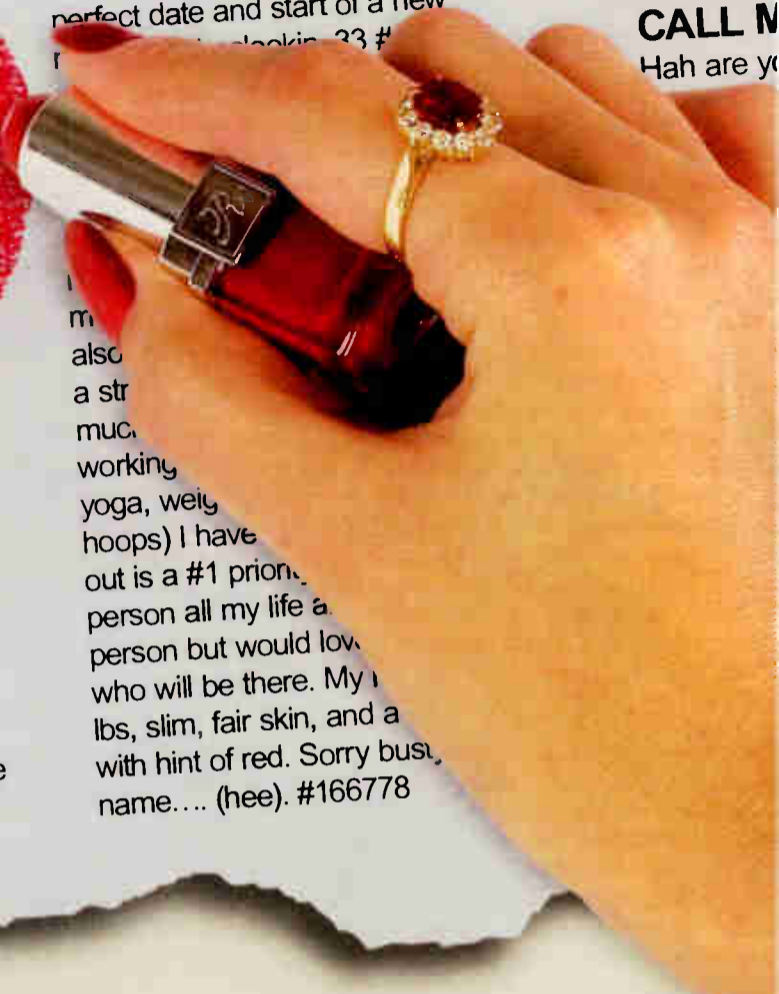
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I'm an indie/hipster girl who adores music and going to clubs and shows. Some of the bands that I'm into are Interpol, The Arcade Fire, Blonde Redhead, Bauhaus, The Smiths, Morrissey, etc. I'm into indie rock, electronica, punk, pretty much anything. I drink and smoke occasionally. I'm 21, 5'8", light-skin, dark brown hair/eyes. I work, am well-educated, funny, spontaneous, nice. #2215234



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by Jay White

Solving the Copper Theft Problem with Glue

In January 2007, Morris Radio's AM station, KNWQ (1140), in Palm Springs, California was the victim of copper theft. Overnight, a large amount of the ground system was stripped away.

When the antenna parameters were found to be out of tolerance, Chief Engineer Dan Hills went to the 5-tower array and discovered the entire ground system around the two northernmost towers was completely gone. The radials around the three towers closest to the freeway were still mostly intact, however *all* of the ground strap between the five towers was gone.

A PLANNED THEFT

A Riverside County Sheriff's Department investigator confirmed that copper theft had become very common. He believed this particular theft was based in organized or gang crime.

The theft was well orchestrated – he believed the theft of our ground system took place in about 40 minutes. He said, "They know exactly how to remove one wire from the chain link fence (which encompassed the site) with two chomps from a bolt cutter," allowing them access to the towers. After opening the fences around the towers, the copper mesh was lifted and cut, a trench around the tower fences was dug, and the radials for two towers were removed.

The investigator said they probably ripped out the system straps with trucks and hooks, using platoons of help to roll the copper and load it into the trucks. "I'd

expect them to come back for the rest," he told us, saying they would be armed – and not to approach them if we happened to see them, but to call the police right away.

Coincidentally, KNWQ's simulcast sister station KNWZ (970) was taken off the air a week earlier when a vandal attempted to cut the main feeder to the building, after shutting off what they *thought* was the main power. (When Dan arrived, the bolt cutters were still in the cable – and arcing!)

We did not believe the events were related, but we did hire a guard to monitor KNWQ and the other two AM sites Morris owns nearby.

PROTECTING THE COPPER

We needed to replace the damaged portions of the ground system, but how would we protect the new ground system from being stolen? Our radials are buried in desert sand, with little material to hold them in place or keep them from being easily removed, even by hand.

Armed with a long list of questions, I contacted several people who are smarter than I. They offered stories about a barbed-wire ground system at WOR, chain link fencing used for an AM near LA, decoy wires buried only half as deep as the real system, land mines (my personal favorite), and booby traps. I researched above-ground radials, and even considered paving all 11 acres over a new ground system – but that was pretty pricy without a WalMart to go in as well.

Meanwhile, a local developer had approached Morris Radio, wanting an easement along the KNWQ site to run a water line for their housing development. We met with him, concerned the easement would damage radials on the west and south boundaries. During our meeting, I told the developer about the copper theft, and he traded his own stories of theft in the area, asking questions about the ground system and its installation.

GLUE IT!

He said, "You need Glue. I bet Glue would keep them from digging up those wires."

"Glue" is known by many names. Mixed with water and applied to the surface or mixed in with any soil, Glue will penetrate and extend down into the soil to create a tough layer of protection. Upon drying, it binds the soil's particles together by forming a clear, plastic and resin bond. I would describe the result as the icy crust on a layer of snow. It is used in the desert sand to slow erosion and keep dust levels down. Applied thick enough, it would be very difficult for anyone to dig up a radial and pull it out.

Envirotac's website (www.envirotac.com) says "Heavier applications build durable and waterproof surfaces. This hard surface is flexible and can even withstand the demands of vehicle traffic." We visited a construction site and looked at the sand in the area; it had been treated about five years prior and had held up well.

By late spring of 2007 the newly-repaired ground system was in and the Glue was in place – laid in thick around the towers for about 100 feet and then somewhat less thick outside that radius to the end of the radials. (We reasoned that the radials are more difficult to find farther out from the tower.) The cost for our site was about \$4,000.

So far so good – it has been a year and the ground system is still intact.

Jay White is the Corporate Director of Engineering for Palm Springs, CA based Morris Communications. Contact him at jay.white@morris.com

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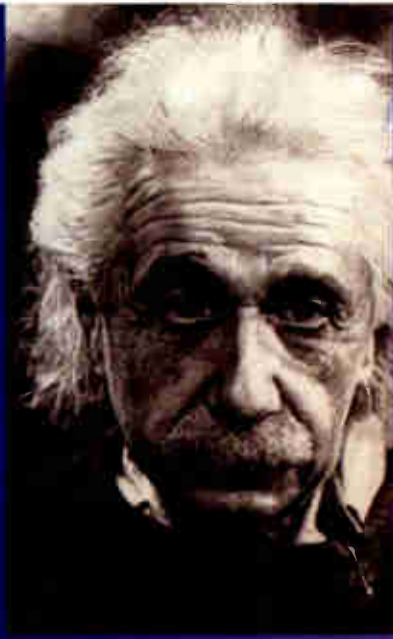
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Radio-Electronic Transmission Fundamentals

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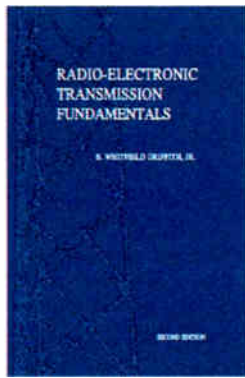
In an era of seemingly out of control cost-cutting and expense limiting, this particular book should be considered your "desktop consulting engineer."

This book is invaluable for both the entry level technician and the engineer that has been around since they invented electrons. We have all been in a position where something has come at us out of "left field" at a most inconvenient time. Changing mental gears to address this new problem could be greatly aided by simply refreshing our knowledge of the particular circuit that is giving us fits.

I first learned of this work at the *Radio Guide AM Transmission Seminar* in Charlotte, N.C. in September 2007. (The seminar itself was one of the best – if not the best – learning experience I have had since my long ago days of formal education.) *Radio-Electronic Transmission Fundamentals* was mentioned several times during the seminar. My curiosity was piqued and I decided to investigate further after I returned home.

A WELCOME AID

Due to an ongoing problem with one of our stations, and feeling that I had to have more information than my trusty old "Shrader" (*Electronic Communication 2nd Edition* by



Robert L. Shrader, McGraw-Hill) was giving me, I ordered the book. (The "Seminar Discount" on the book that Barry Mishkind arranged for us was greatly appreciated.)

I was not disappointed in the least. The information was detailed and understandable without requiring a Doctorate of Engineering Philosophy!

I now had more than the fundamentals, which is what I needed to attack the situation at hand. I will not go into detail on the exact problem with which we were dealing, but this book gave me enough information to proceed with confidence and produce a coherent game-plan without undue expenditures of time or money.

SOLID INFO, EASILY ACCESSIBLE

I have spent some time looking through the book and comparing it to other reference works that I have. I find that it has the fundamentals, as most other books do, but it has two outstanding features that set it apart.

First, it goes to a higher level of information with greater detail. Secondly, it has an index that is the easiest to navigate of any I have found. There was one minor anachronism that is noticeable: this Second Edition's reference to cycles instead of Hertz (the first edition was published in 1962) – but it does not detract in the least.

RECOMMENDED BY THE BEST

The following introduction, written by Benjamin F. Dawson, P.E. and Ronald D. Rackley, P.E., and reprinted here with the permission of SciTech Publishing, gives an excellent description of the book. I decided to include this introduction for one main reason: Mr. Dawson and Mr. Rackley are widely respected engineers whose opinions should never be taken lightly.

Introduction to the Reprint Edition

It is a distinct pleasure to see this excellent textbook on electromagnetic field theory and RF circuits become available again. Originally published in 1962, we believe that it is the best book ever written for promoting basic, concrete reasoning skills in engineers and technicians who deal with RF energy without an unnecessary emphasis on mathematics.

Today's readers will find some of the material in this book, dealing with the slide rule, for instance, interesting only in a quaint, historical sense. However, the insight that can be gained from this clear, concise explanation of antennas, transmission lines, and RF networks from the standpoint of simply presented electromagnetic field theory is of timeless value.

We highly recommend this book for the graduate engineer who is seeking a more workable understanding of concepts that may have been clouded by abstract mathematics during college and for the technician who has never before studied calculus but would like to become skilled in dealing with RF fields. It is particularly useful for the latter because it introduces and explains just the amount of calculus necessary for understanding the concepts as they are presented. The material is introduced in short chapters, which make the book particularly useful for self-study and as a convenient reference.

For mastering the subject of RF energy and gaining an intuitive understanding of how to work with it, there is no better resource than this book. As it has for us and many of our colleagues, we hope that this new edition of "Radio-Electronic Transmission Fundamentals" helps further your understanding of this very interesting, but thinly understood area of electrical engineering.

For the broadcast engineer needing concise, accurate, and immediate RF information, *Radio-Electronic Transmission Fundamentals* is exactly the repository of knowledge that should be on the bookshelf.

Radio-Electronic Transmission Fundamentals and other scientific and technical books may be purchased directly from SciTech Publishing, Inc. 911 Paverstone Dr., Suite B, Raleigh, NC 27615. Phone toll free at: 866-510-4724 or visit their web site at: <http://www.scitechpublishing.com>

Looking to fill your technical bookshelf? Some suggestions are ready for you at www.radio-guide.com/bookshelf This resource will be augmented periodically. Your suggestions are welcomed.

Rod Zeigler is the Director of Engineering for Nebraska Rural Radio Association (KRVN/KTIC/KNEB). Contact him at rzeigler@krvn.com

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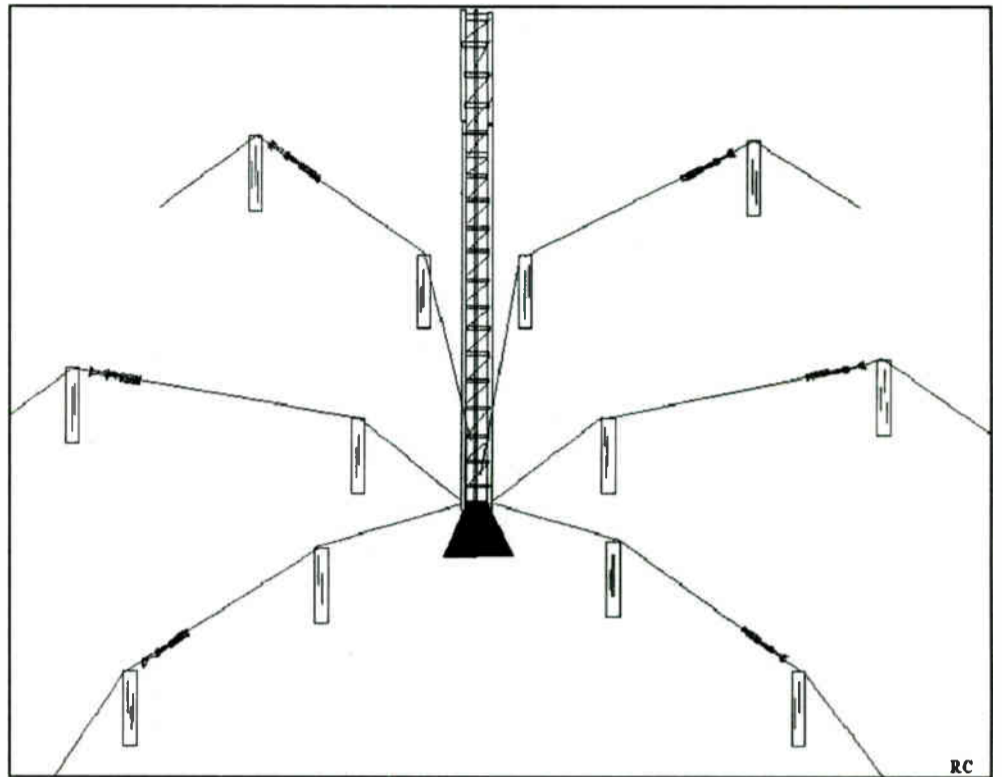
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Survival Guide

by Ken Benner, NCE

Protecting Your Credit Rating

Among his varied careers – including radio engineer, talk show producer and host, bus driver, and Alternate FCC Inspector – Ken Benner has yet another life as a consumer affairs champion. A sort of latter-day Ralph Nader, Ken has been involved for years in research dealing with credit file and credit scoring abuses. What he has learned can help you survive in these challenging times.

You need to keep an eye on what the national credit rating companies are doing behind your back. It involves billions of dollars of cost to the American public – some of it coming right out of your own pocket!

As has been widely reported, security breaches at banks, etc. expose hundreds of thousands of peoples' lives to ID theft, or worse (credit card fraud is the most common type of ID theft). A highly respected Javelin Strategy and Research 2005 Identity Fraud Survey reported ID theft for 2004 to be \$52.6 billion, a substantial portion of which is funding international terrorism.

There should be laws to protect you. Yet, instead of working for that, little or nothing has been done by Congress, whose members' campaigns are funded for the most part with unlimited contributions from well-heeled lobbyists who dictate most of the incredibly egregious legislation that evolves. You have to protect yourself.

PERSONAL DATA CRISIS

Incredibly, instead of laws mandating accurate information in credit files, agencies are allowed to continue circulating erroneous information. Most people

find out a problem exists only when applying for a credit card, home or car loan, etc. Your credit score (a number generated by the credit reporting agencies), has a major effect upon the interest rate you will pay – or even if you are offered credit at all.

However, people with perfect records in paying all their bills on time often discover their credit score is much lower than it should be. Part of the problem: few people realize that the primary product of the credit reporting agencies is to provide as much negative information as possible, whether or not it is true.

Significantly, research has documented numerous examples of substantially reduced credit scores based upon unjustified or totally fabricated denigration. A 2003 study by the U.S. Public Interest Research Group found 79% of all credit reports contain some type of error – often the result of identity theft driven credit reports – with 25% involving errors serious enough that individuals could be denied credit. Still, it is largely the credit reporting agencies that are protected.

THE FCRA

Back in the late sixties, as a radio talk show host, I used the opportunity to obtain public support for the Fair Credit Reporting Practices Act (FCRA), with the help of then Senator Mike Mansfield of Montana.

The Act was designed to restrict access to a person's credit file, conditioned only upon some act initiated by that person – applying for a credit card, employment, home or car loan and so on. As you might expect, the credit report industry promptly pressed Congress through their lobbyists to eliminate the intent and purpose of the FCRA, even pushing Federal "pre-emptive legislation," prohibiting states from enacting stricter laws protecting credit file privacy. Other implied consumer protections have met with a similar demise.

As founder of the American Council on Consumer Awareness, Inc., I have toddled off to Capitol Hill in Washington annually for the past 25 years to fight these wrongs. Successes are not easy to come by, but we keep trying.

UNEXPECTED PENALTY

Our current project was initiated when my wife Karen inherited a small sum from an uncle. She took it to a neighborhood bank to purchase a simple CD. A few weeks later she noticed her credit score substantially reduced because the bank had accessed her credit file without granting a subsequent line of credit.

Karen holds a Bachelor of Science degree in accounting with a minor in business administration and has managed our financial affairs during our half century of marriage, during which she and I have maintained an impeccable credit record. Shocked by this falsely implied "denial of credit," she immediately removed her funds and ordered the bank under threat of lawsuit to remove the costly, misleading item from her credit file.

Karen's experience generated a bit of publicity and a small research grant was provided to determine the extent to which others had experienced similar abuses.

CHECK IT OUT

Consumers lose simply because businesses pass ID theft losses on to them. One method is the "Universal Default" scheme in which rates for all of an individual's lines of credit and insurance can be increased because of a single delinquent payment – or in Karen's experience, of a mis-implied application for credit.

Whether it is a credit score reduction because you applied for credit, used a credit card, cancelled a credit card, or some clerk mis-typed an account number, the burden is on you to know and fight for your good name. We recommend you start with the free credit report you are entitled to each year from each of the three credit reporting agencies. A site like www.annualcreditreport.com will lead you to what is on your record.

If you are planning a major purchase (house, car), you may also wish to learn your credit score, so you can find out if there are any credit reporting issues and do repair work before you get surprised with an excessive interest rate.

President Emeritus of the American Council on Consumer Awareness, Inc., Ken Benner is currently performing Alternative FCC Inspections. You can contact Ken regarding this topic at acca-us@comcast.net



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by Donna Halper

RCA and the Rise of Broadcasting

The Radio Act of 1912 fostered experimental stations from Medford Hillside, MA to San Jose, CA. They were on the air sporadically, playing music and showing that radio could do more than send Morse code. However, general interest in wireless telephony was minimal. Then, among others, along came RCA.

In the first two decades of the last century, telegraph companies mostly cared about business, not entertainment. At that time, the main focus was on business communication – sending and receiving transatlantic messages by means of wireless telegraphy. The major player was the Marconi Company.

ROADBLOCK

It was America's involvement in World War I that slowed the growth of commercial broadcasting. Due to the outbreak of hostilities overseas, the Navy and the Army Signal Corps took over all of the amateur stations and put them to use in the war effort.

When the war was over, controversy erupted, because the military wanted to continue maintaining total control over all transatlantic communication.

The amateurs were not amused, nor were companies like AT&T and the Federal Telegraph Company. They had all done their part to help win the war, and now they wanted to get back to work. They pressured Congress to get their stations back – and the idea of government control of wireless went no further.

PROTECTING THE HOME FRONT

At the same time, the war brought a period of extreme patriotic fervor that swept America. There was considerable sentiment against foreigners as politicians were using rhetoric we might find familiar today, saying America should be for Americans.

In that context, it is not surprising that foreign companies which owned interests in American businesses were suddenly considered a potential liability. After all, there was not just a World War going on; there was a war to see who would control international communication. The Germans had already shown how important this was when they cut the transatlantic cables in 1918, disrupting communications between the US and Europe.

So, even though England was not an enemy, the U.S. Navy was unhappy that a company like American Marconi was under British control. Businesses like General Electric, among others, were also uneasy – despite the irony of American inventions having been sold to facilitate this foreign control.

For example, executives at GE were justifiably proud of their Alexanderson alternator, a useful piece of equipment that extended the reach and the quality of radio signals. It had already proven its worth during the World War, helping the government stay in touch with the American and Allied Forces overseas. If foreign corporations used it to dominate communication it would put the United States at a serious disadvantage.

AN AMERICAN SOLUTION

Something had to be done. And it was GE's Owen D. Young, working with representatives of business, the military (especially Secretary of the Navy Josephus Daniels) and the U.S. government, who crafted a plan that seemed to be a win-win situation. GE would sell Alexanderson alternators to the British, but the British had to give up their majority control of American Marconi.

The Marconi Company did not think it was such a win for them – but in the end, they agreed to it. On October 17, 1919, the Radio Corporation of America was created. Its main purpose at that point was to make sure American business and American technology played the dominant role in international communications. The articles of incorporation for the new company said that only American citizens could be executives, and no foreign corporations or individuals could own more than 20% of the stock.

The announcement was barely noticed, appearing in most newspapers as a very small article on page 5 or 6, with the headline:

RADIO CORPORATION OF AMERICA IS FORMED

Later, David Sarnoff would say he had been involved in the creation of RCA from the very beginning, but it is doubtful he was a decision-maker at that time. Owen D. Young of GE was RCA's new Chairman of the Board; Edward J. Nally, formerly Vice President and General Manager at American Marconi and Sarnoff's boss, became the new company's first President; and David Sarnoff was named the Commercial Manager, a position he had already held with American Marconi since 1917.

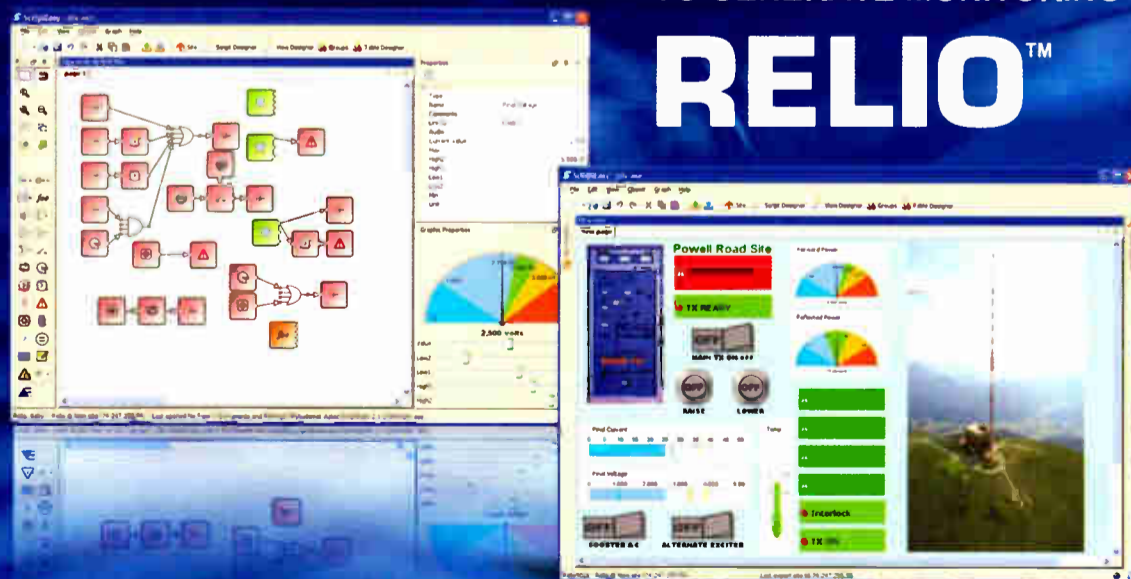
Still, Sarnoff was in a good position, as it put him into direct contact with the two biggest executives of the new company on a regular basis. Given his success in every position he had held with American Marconi, his bosses undoubtedly felt he had great potential with RCA. Sarnoff, for his part, did not disappoint. (Continued on Page 44)

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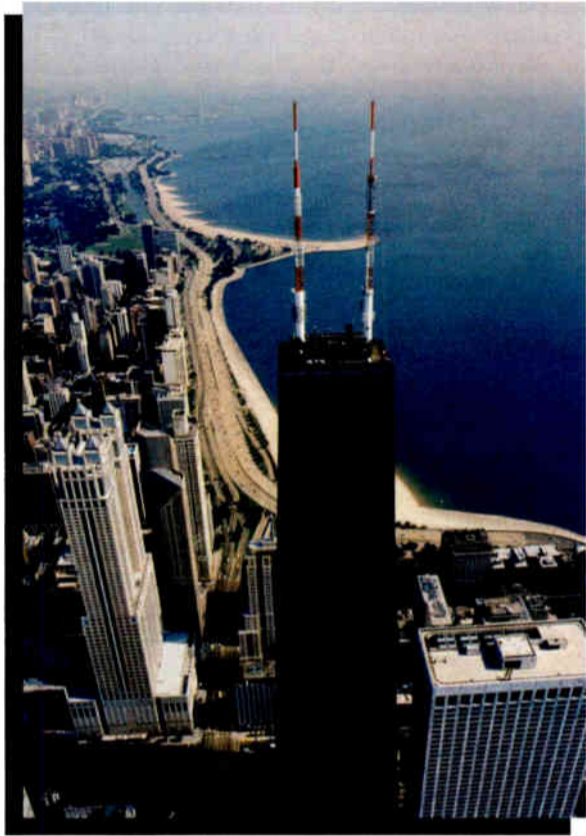
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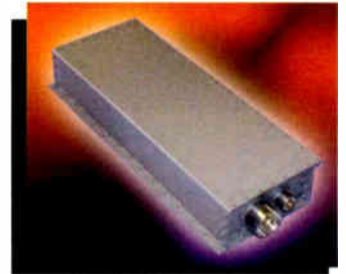
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The CMP-300 Composite Audio Mixer/DA



The *CMP-300* provides a means of combining up to three base band signals such as FM stereo, SCA, and RBDS signals. Each input has provision for level control and each of three outputs has a level trim too. Applications include combining signals to feed to excitors with only one base band input or for feeding a common base band signal to up to three locations. The *CMP-300* allows you to manage base band audio signals in one convenient package. Each input features a high quality D.C. coupled instrumentation amplifier and each output features a 50 ohm impedance line driver suitable for driving long capacitive cables without instability.

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www.Broadcast-Devices.com

Heavy Metal

by Donna Halper

— Continued from Page 42 —

A SHIFT IN FOCUS

By 1920, Radio Corporation of America was making the transition from focusing on transatlantic cable traffic to manufacturing and selling radios. However, this had not been the original plan. The original idea was for RCA to take charge of all communication to and from ships, as well as all communications to and from foreign countries.

RCA executives and engineers drew up plans to build impressive wireless stations, capable of "sending 1,000 words a minute and circling the globe." In fact, some of the company's early advertisements refer to "world-wide wireless." Newspaper articles said these new stations would be five times stronger than even the high-powered plants in Nauen, Germany and Bordeaux, France.

THE PATENT POOL

But what the average citizen did not know, nor did the press of that era say much about, was that RCA, GE and American Telephone & Telegraph (AT&T) had quietly formed a patent pool, in which all of the technology needed to make radio work would be owned by these major firms.

The intent at that time was to freeze out competitors like Westinghouse as well as individual entrepreneurs.

However, by 1921, thanks to the success the Pittsburgh-based company was having with its new radiophone broadcasting station KDKA, as well as from sales of its own receivers, Westinghouse was invited to join the group and was even given representation on the board of RCA.

These arrangements assured the financial success of these larger and more powerful companies, and made life very difficult for smaller companies like AMRAD (American Radio and Research Company) in Medford Hillside MA.

For the moment, the government looked on benignly. What appeared very much like a monopoly — or more accurately an oligopoly — was allowed to proceed.

MANUFACTURING AND MARKETING

At the same time, RCA would be selling the receivers that GE (and later Westinghouse) made. And that is where Sarnoff intervened.

Sarnoff's very thorough plan for getting RCA into the receiver manufacturing business was approved by his superiors, and RCA began providing radio equipment made for the commercial market by Westinghouse and Wireless Specialties Co.

Success was almost immediate. Some 100,000 radios were sold even before they were branded with the RCA name — many of the early units simply had the RCA name placed over the top of the Westinghouse name. 1922 sales were \$11 million. Sarnoff was promoted to Vice President and General Manager.



The Aeriola Sr. was among the Westinghouse products marketed by RCA.

SUPPLY CHAIN TROUBLES

Nevertheless, radio broadcasting still was not RCA's focus at this time — at least not in early 1922. All of RCA's advertising in the New York Times and Wall Street Journal concentrated on the ease and reliability of using the company's overseas wireless telegraphy.

While Sarnoff had given his "Radio Music Box" plan to the company, it seemed they were having trouble implementing it. The Wall Street Journal took note of RCA's problems in an article published on April 5, 1922. The headline reads "Radio Phone Demand Above Producers' Capacity."

In the article, a state representative from Illinois was demanding an investigation into possible price-fixing and complained about the "present shortage of radio apparatus." He said thousands of radio enthusiasts were being inconvenienced by the Radio Corporation of America's "apparent inability" to meet the demand for tubes. The representative also remarked that the tubes RCA was selling were being offered at "exorbitant prices."

The Journal seemed sympathetic, but disagreed with the congressman that price-fixing was the problem. The rest of the article explained that obviously, RCA had not been totally prepared to meet the sudden demand for radio equipment, especially headsets, which were in very short supply.

The Journal noted that RCA and its affiliate companies (GE and Westinghouse) were in the midst of expanding their production capacity and, in the very near future, prices would drop and more equipment would become available.

WHERE ARE THE RADIOS?

Things seemed to be improving for RCA by May of 1922, when a short item appeared in the Journal, saying that the company was now deriving considerable benefit from the "spreading radio craze" and the company's stock was on the rise.

In fact, there was lots of talk about radio, as newspapers hired their own radio editors, and new magazines such as "Radio Broadcast," "Radio Digest," and "Popular Radio" appeared for the first time. There was a Radio Show in New York City in the spring of 1922; RCA was one of the exhibitors.

Yet Sarnoff, a master at getting publicity, was being cautious when speaking about radio (or as it was then called, radiophone). The only mentions of RCA and radio broadcasting were about how, as originally planned, the radio apparatus being sold by RCA was manufactured by Westinghouse, General Electric, and the Wireless Specialty Corporation.

(Continued on Page 46)

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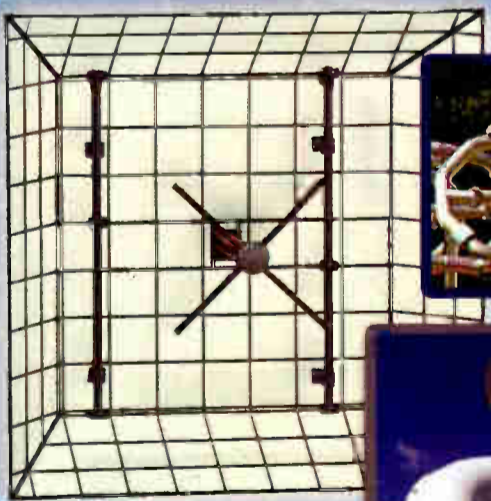
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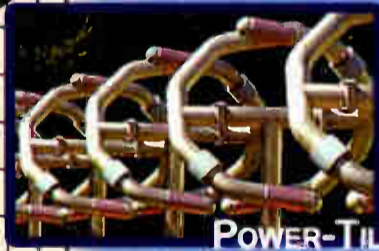
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Heavy Metal

by Donna Halper

— Continued from Page 44 —

TELEGRAPH STARTS TO GIVE WAY

Throughout 1922, Sarnoff's public speeches still stressed telegraphy. In a talk he gave to the New York Electrical Society in late November, for example, he talked about the achievements of the super-high powered wireless station "Radio Central," built in 1921, which could handle more messages than even the biggest stations in France or Germany.

Sarnoff spoke of the many benefits of wireless communication: ship to shore communication had helped to save lives, the increased speed of transoceanic messages was helping journalists get the news more quickly, and businessmen world-wide were now able to keep in contact with suppliers and manufacturers, etc. He even predicted that soon, improvements in wireless telephony would enable businessmen to talk with each other in various countries.

But Sarnoff did *not* comment on the manufacturing of commercial radio receivers nor talk about the kinds of radio stations that were playing music and reading the news. It was mostly a business talk about telegraphy and the success of RCA's cable business.

A STRONG BUSINESS

RCA was demonstrating that it was a company to take seriously: the price of its stock was rising and financial analysts in newspapers and magazines had already begun telling interested investors to buy.

One such analyst in July 1923 explained that Radio Corporation of America (at that point, the press seldom referred to the company by its initials) was "finding a

satisfactory earning position much sooner than ... expected," and predicted that investors would begin receiving dividends in 1924. It was a good assessment—by 1924, sales of radio receivers alone brought in \$50 million.

WIRELESS TURNS INTO RADIO

Everything changed in 1923. By early March, newspaper and magazine advertisements were telling of a new vacuum tube, the UV-201-A.

It had an improved filament and, according to the ad, this tube "averages about five times the emission of the UV-201 tube. This is an exceptional tube for power amplification, such as required for loud speaker operation. The tube may be operated from four dry cells, eliminating the storage battery."

Sarnoff's plan to transition RCA from being a leader in transatlantic wireless communication to being a force in radio broadcasting began taking shape slowly, but the evidence was plain: at the end of 1923 the Journal printed the financial statement from RCA. It was very detailed and, unlike 1922, for the first time there



was an entire section devoted to radio broadcasting (not wireless communication, but commercial radio transmissions for the public).

In the report, it noted that radiophone broadcasting was the fastest growing segment of RCA's business. As a result of the demand for radio equipment, RCA had its most profitable year ever. In the report, Sarnoff said that the public had spent about \$150 million on radio in 1923, and he predicted even greater revenue for the next year.

CHANGING EMPHASIS

It was in late 1923 that the focus of Sarnoff's talks finally shifted. He came to Boston in mid-December and, before a packed audience at the City Club, he gave his usual speech (similar to the one he had given in New York in November 1922).

But now, in addition to pointing out all of the achievements and amazing things the wireless stations were doing, Sarnoff was making predictions about radio broadcasting. Among his visions were for three super power stations, one in the East, one in the Midwest, and one on the West Coast, which would be able to send music concerts all over the United States.

The following year the focus of the speeches changed further, with more emphasis on radio broadcasting, and stories of how radio was changing people's lives (hearing the voices of famous newsmakers and great singers, for example). Sarnoff also told his listeners in every city where he spoke that new and improved radio equipment was making listening a much more pleasant experience.

By the end of 1924 Sarnoff was telling the press that what the country needed was a "national broadcasting system." His vision of high power broadcasting stations was not about to come true, but that did not stop him from predicting that soon, in every home, people would have access to the best programs of entertainment and education. That, of course, culminated in the creation of the National Broadcasting Company in mid-November 1926.


BRINGING STATIONS TOGETHER

During the mid-1920s, stations in cities like Washington DC, New York, Schenectady, Providence and Boston had begun to occasionally link up with each other, usually to broadcast a sports story like the World Series.

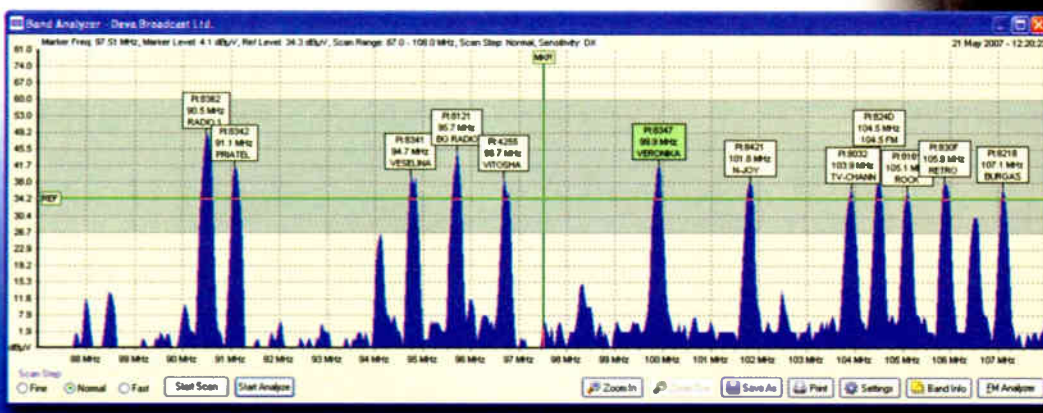

Then, in December 1924, RCA sent out press releases that told how the company was intent on providing such broadcasts. The hope was that soon a chain of participating stations would span the entire United States.


The press release reminded newspaper readers that RCA had developed a loud speaker called the "Radiola," which provided even greater acoustic range than any previous speakers. Of course, the press release left room for local newspapers to insert a plug for where these Radiolas could be purchased. Most newspapers did so.

(Continued on Page 48)




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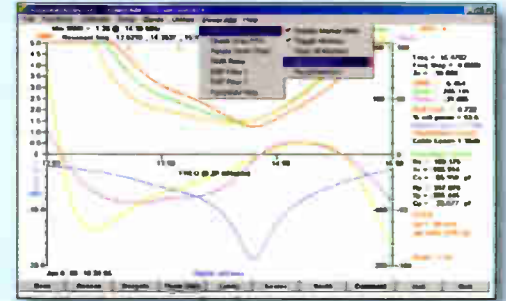
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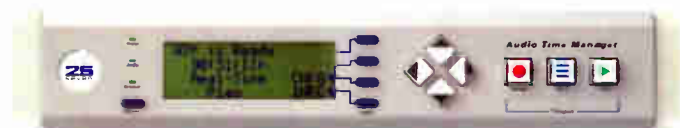
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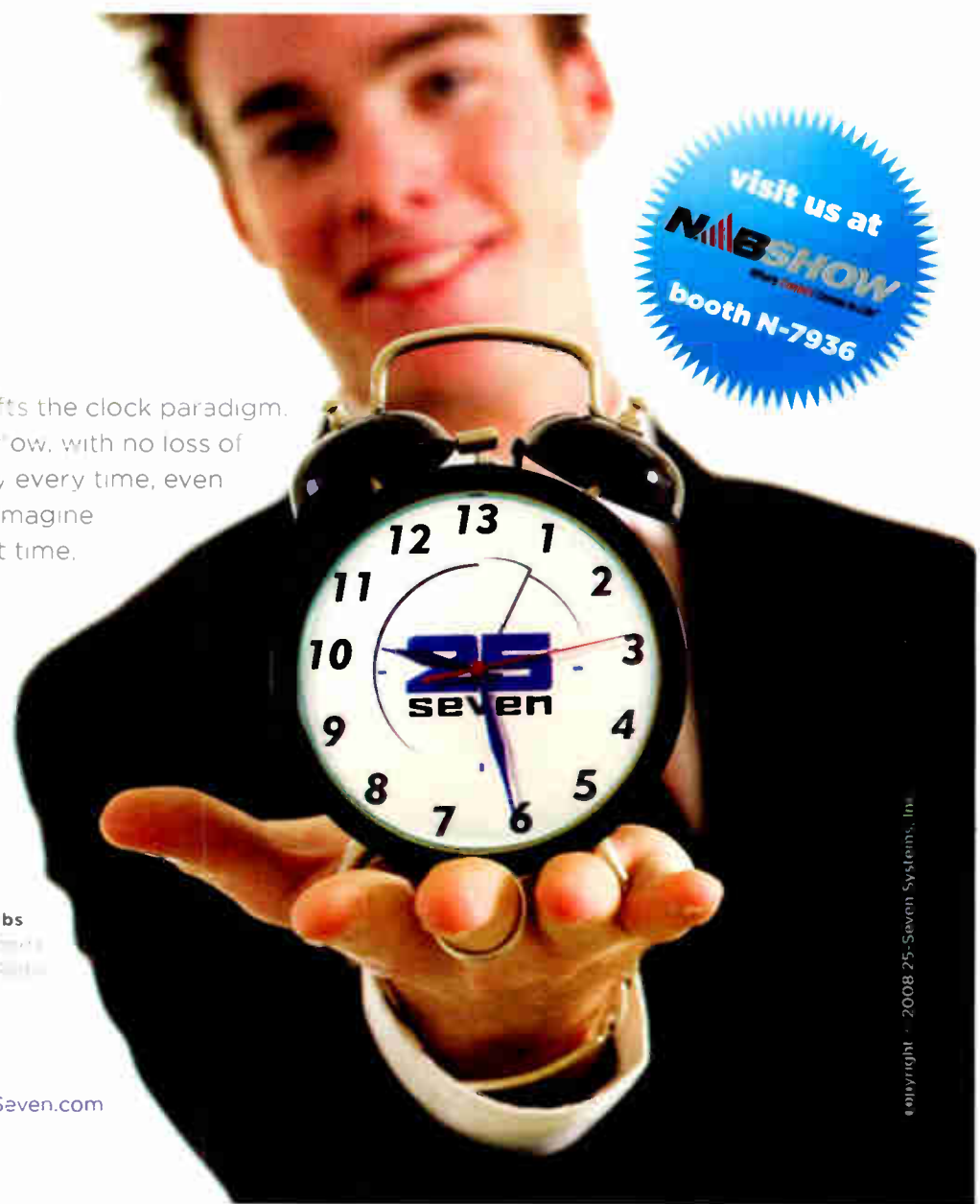
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BUILDING NETWORKS

An event in March 1925 proved how important establishing hook-ups of radio stations was to become. The success of this broadcast reinforced the idea that RCA was right to keep working on ways to link up more stations in distant cities.

President-elect Calvin Coolidge was about to take the oath of office (Presidential Inaugurations were held in March in those days). Radio was going to cover it as never before. RCA, led by Sarnoff, was there to arrange the coverage, working closely with Bell Telephone (which provided the telephone lines and loudspeakers for those in attendance to hear the proceedings) and with station WRC in Washington. Contrary to his stereotype as "Silent Cal," Coolidge would speak on the radio frequently throughout the 1920s;

The result was a broadcast heard by millions of people. It made listeners feel as if they were actually there, experiencing history being made. Well-known announcer Graham McNamee of WEAf in New York (owned by AT&T) did the commentary, and the amazing broadcast made the front page of newspapers nationwide.

PAYING THE BILLS

The only problem was one discussed repeatedly since the early 20s: while RCA and Bell footed the bill for the inauguration, it was expensive. And what about other important broadcasts – who was going to pay for them? If the public wanted the biggest names and the best programs, somehow a plan had to be devised to pay for it.

Unfortunately, the government was still on record as saying it opposed commercials. Herbert Hoover, then Secretary at the Department of Commerce, told Time magazine in 1924 that he believed allowing "direct advertising" would be the death of radio – and he had not changed his mind.

Many stations disagreed and were quietly seeking ways to bring in revenue; Sarnoff had given talks about the need for sponsorship on a number of occasions throughout the 1920s. Then, in late July 1926, AT&T got out of radio and RCA took over WEAf in New York; in Washington DC, the Chesapeake & Potomac Telephone Company closed WCAP in Washington DC, leaving only WRC, which was owned by RCA.

RCA CREATES NBC

With RCA owning a station in New York in addition to the one in Washington DC, rumors began to circulate about a radio network. As it turned out, the rumors were accurate.

The National Broadcasting Company, which would have commercial sponsorship of programs, took to the air on November 15th, 1926. Sarnoff had been instrumental in negotiating the contracts that made NBC possible. Before the new network went on the air, a massive publicity campaign was created, with full page ads in many newspapers. The ads, along with interviews from Sarnoff, promised the best programs, the best performers, and the best coverage of national events.



SHARING THE WEALTH

The debut broadcast lived up to the hype, with some of the country's top vocalists, comedians, actors, and dance bands all on display. While to us today this may not seem like such a big deal, the quality of radio programs had varied greatly till up to 1926. If you lived in a big city, you might hear some excellent shows, but in the smaller towns, getting access to talent was a lot more difficult.

National Broadcasting Company ran two networks, NBC Red and NBC Blue. As time passed, the former would be for the major events and the latter was often where the educational programming and public service, as well as the newer shows, were heard.

Now, in any city where there was an NBC affiliate, people would hear the biggest and best entertainment, as well as the most important newsmakers. For example, when aviator Charles Lindbergh returned from making his groundbreaking transatlantic flight, there was a ticker-tape parade to honor him. NBC had multiple announcers covering the entire parade route, talking to spectators and conveying the excitement of the celebration to the fifty stations that carried it.

THE GOVERNMENT STEPS IN

A book published in the late 1920s, *Empire of the Air*, was sharply critical of RCA. The author noted that RCA was using all its muscle to keep competition out and prices high. Even the City of Chicago was told by RCA that they could not build their own transmitters to contact patrol cars, as it would be a violation of RCA patents.

Sarnoff, on the rare occasions when the press questioned him as to whether RCA was a monopoly, would first state that the company had never broken any laws; then he would insist that the company's main intention was to do what was best for the American public. He would say the same about NBC when asked whether sponsorship was a good idea, telling critics that the chief goal was to render service to the listening audience – and commercials made that possible.

Finally, the government moved to break up RCA – the Consent Decree was in 1932 – although the partners were already starting to drift apart. AT&T, GE, and Westinghouse were anxious to market more effectively without competition from RCA, and so each began to sell directly to the public.

GE and Westinghouse did continue some manufacturing for RCA into the 1930's. However, not to be outdone that easily, Sarnoff bought the Victor company in 1930 or 31 and set up the manufacturing plant in Camden, NJ so RCA could make radio receivers, as well as transmitters.

When Heavy Metal returns, we will see RCA designed transmitters for the first time.

Donna Halper wears many hats, among them college lecturer, historian and author. Donna also consults stations all over the country. Her email address is dlh@donnahalper.com

David Sarnoff and the Founding Years of RCA – Page 50

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Heavy Metal

David Sarnoff and the Founding Years of RCA

by Donna Halper

Looking objectively at David Sarnoff's youth, there is no reason to believe he was destined to lead a major corporation. An immigrant who arrived from Russia in 1900, he spoke no English and only got an eighth grade education. And yet, by 1930, he would be the President of the Radio Corporation of America and a dominant figure in American media.

The story of his rise to the top of his profession is fairly well known. Having quit school to help support his family, he took a job as a messenger for the Commercial Cable Company, where he also learned Morse code. He then got a job as an office boy at the Marconi Wireless Company, where he earned about \$5.00 a week. Even in 1906, that was not a lot of money, but more important than the salary he met the movers and shakers in wireless communication, including Guglielmo Marconi himself, and earned their trust.

As historian Eric Barnouw and others have noted, even from childhood, Sarnoff always seemed to be planning for the next thing.

TELLING IT HIS WAY

Sarnoff had a great talent for self-promotion and for shaping his own image, making it difficult for later researchers to determine what he really did versus what he said he did. Getting his name into print would be a life-long preoccupation (in his early days with American Marconi, the New York Times repeatedly referred to him as David "Saranoff" – once he became an essential part of the Radio

Corporation of America's upper management, it was a mistake the paper did not repeat).

To Sarnoff's credit, he became a master at telling his story his way. One event he related, his heroism during the Titanic disaster, became a truism in history textbooks – yet its accuracy is disputed by some historians.

This much we know: Sarnoff did master English and also became an expert at Morse code. This enabled him to move up from office boy to telegraph operator. When he was only 20, he became the manager of the busy Sea Gate wireless station. After that, he was promoted to the station at the Wanamaker department store in New York City.

TRUTH OR MYTH?

Now we get to the disputed parts of Sarnoff's story. In the 1920s press releases he sent to the newspapers, he said he was a "graduate electrical engineer," implying that he went to college – which he did not.

More importantly, he claimed he had been the only telegraph operator who heard the distress signals from the Titanic in 1912. He portrayed himself as the heroic young man who stayed at his key for 72 hectic hours, providing essential information. It is an inspiring story, which Sarnoff and the RCA publicity department (as well as his biographers) spread far and wide – but it has some problems.

For one, no contemporaneous sources from newspapers or magazines of that era mention his amazing efforts. And although he may indeed have heard the signals at some point, by 1912, he was in management and no longer a lowly telegrapher. Also, the ship went down on a Sunday, a day on which the Wanamaker store would have been closed.

REAL ACCOMPLISHMENTS

But some elements of the Sarnoff story are beyond dispute. For example, when Radio Corporation of America (nobody called it RCA back then) was created, he was one of the first to realize that the future of the company was not in transoceanic cable communication but in manufacturing radio equipment for public use.

Whether or not Sarnoff actually suggested a "Radio Music Box" in 1916 – and there is recently discovered

evidence that he did – by 1920 he was certain that wireless telephony was attracting more interest. Sarnoff submitted a detailed proposal about how the Radio Corporation could do much more than be a vendor for GE's equipment. His proposal was approved.

Sarnoff gave numerous talks about commercial radio in the early to mid-1920s, and he was not just enthusiastic, he sounded almost utopian. He said radio was the miracle of the age, and predicted the new medium would combat illiteracy, unite the nations and bring world peace. Lest this sound like exaggeration, many of radio's early pioneers felt the new technology was amazing, and Sarnoff was not alone in his excitement about what radio could do.

The fact that RCA got heavily involved with radio station ownership (and later in creating a national network, the National Broadcasting Company, in 1926) was due in large part to Sarnoff's advocacy.

THE GENERAL IN CHARGE

He was handsomely rewarded for his shrewd business decisions and his ability to give the public what it wanted. In 1927, he was named to the board of directors of RCA. By mid-July 1929, he was on the cover of Time magazine. And when his friend and mentor Major General John G. Harbord retired in January 1930, Sarnoff was named President of RCA. He was 39 years old.

From then on to his death, Sarnoff, RCA and NBC were essentially synonymous. During his colorful career Sarnoff controlled the company with a firm hand, unafraid to fight with any and all who got in the way of his vision for RCA and the broadcast industry.

This leads us to how he became a General. Although Sarnoff had been turned down for military service during the First World War (he suspected anti-Semitism), he later joined the Army Reserve. When World War II began, he was named a Brigadier General, serving as a communications advisor throughout the war.

David Sarnoff had come a long way from being an impoverished Russian immigrant. He was now one of the most powerful men in America. – Radio Guide –

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RCS Master Control

by Russell Smith

After 16 years in radio, it continues to amaze me how technology and the industry are evolving. Not long ago, we were fighting with cart machines and piles of equipment that now look like fossils. Today, most stations have replaced them with an automation program of one sort or another. The challenge is to choose the right one.

I would like to share some of my automation experiences that may help you make your station better in some way.

AN EARLY ADOPTER

Early on, our stations in Atlanta saw the advantages broadcasting software brought to station operations and our audiences. Eagle 106.7 and Kicks 101.5 began using RCS Selector for music scheduling in 1990. A change in studio location in 1993, coupled with the vision to expand, made RCS Master Control DOS the easy choice as the new playback system.

The relationship we had fostered while relying on RCS for years in music scheduling was the number one factor in our choice for automation. For that matter, the industry, at the time, did not offer many other reliable choices.

The change in the studio was instantaneous. We had a system that played what we wanted when we wanted. No longer were we tied to the studio for every transition. Live assist, satellite and automation modes brought a new workflow to Atlanta. All our songs were imported into the system – and the cart decks made it to the closet.

MASTER CONTROL MEETS NT

In 1999 Master Control DOS was retired and RCS Master Control for Windows N/T was installed because it included Y2K compatibility.

Our stations did look at comparable systems, including Dalet, Enco, and AudioVault, which were in use at a few of our sister stations. The choice for WKHX and WYAY

remained clear. No other system has such fluid transition between the scheduler and the output of the automation system. Our listeners know as soon as they dial in that their favorite song or one they like is just around the corner. The combination gives a perfect output time and again.

Installation and configuration were a snap. Once again, the service that was provided made a difference. RCS built our machines prior to shipping, and then our on-site RCS installer showed up to complete the installation. One of the things we enjoyed was having someone who gave us hands-on training while talking us through the improvements in the upgrade.

ANOTHER UPGRADE

In 2004, RCS Master Control XV and Windows XP were delivered; they are still in operation today. We also launched our WKHX and WYAY HD2 channels during this same conversion.



Master Control XV

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Our disaster recovery plan is centered on RCS. Should an On-Air machine or studio be disabled we can bring a production machine on line and use any studio in an On-Air role. Should we become locked out of our studios for some reason we can make use of Internet Voice Tracking and PC Anywhere to program the stations from anywhere there is an Internet connection.

Even if our main studios became totally unusable, we have a second “admin” machine at one of our transmitter sites that can bring up On-Air operations from there for all four of our stations. A tape backup of the databases can be sent through the RCS Data Exchange service so we can build new machines quickly. With this type of security and backup, we sleep better at night.

TOP NOTCH SUPPORT

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I believe radio will continue to evolve with technology to move beyond simply providing news, music and talk. In the future these staples will be part of the package, but along with them will come things we have not even imagined. HD Radio and digital automation systems like RCS will be the source and delivery method for these new innovations.

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 Russell Smith is the Chief Engineer for Citadel in Atlanta. His email address is russell.smith@citcomm.com



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The Audion Labs Voxpro

by Bill Eisenhamer

I installed and used my first VoxPro by Audion Labs almost 13 years ago. The new company utilized a Mac computer for basic audio editing and marketed it for a quick solution to editing phone calls for on-air. It was definitely a product worth considering.

Over the years improvements to VoxPro continued to be released as computer technology continued to improve and change, even adding a PC version. Our operators use them and rely on them, day after day, to do their shows.

THE HARDWARE

VoxPro 4.1.22 runs. It is as reliable as the computer on which you run the application. I now have installed six VoxPro workstations – three on-air and three production rooms – each running on an inexpensive Dell computer (with a small footprint, to conserve space) under Windows XP Pro SP2, including a 1 GB Ethernet network interface and a RC500 USB controller. We have moved from version 3 through to the current version of 4.1.22, incorporating or activating the new features as they fit our needs.

Since VoxPro offers “self discovery” of other VoxPro computers on the network, our IT guy, JR Rogers, chose to install a Dell PowerEdge server outfitted with a 1.5 TB RAID array and 1 GB Ethernet connection to accommodate the VoxPro network and Adobe Audition network. The VoxPro is allotted 500 GB of storage.

All six are running flawlessly on their very own network.

In addition, to save time, we moved an external 300 GB USB drive from one of the workstations to the server which is currently dedicated to one station’s morning show. All told we currently have upwards of 150 GB of VoxPro audio, and knowing our personnel, we will be managing disk usage soon as they tend to save everything!

As of this writing our performance on the network has been quite good. We have noticed a slight jitter in display refresh when everyone is active. This is not detrimental to its use. I would recommend a 1 GB network as the VoxPro seems to require some extensive bandwidth during record and playback, mostly due to the file format. It is not only pushing audio data but graphic information as well. The more throughput the better.

INITIAL SETUP

Installation is a breeze. It is best to install VoxPro with access to the Internet for quick registration of the software, though you can complete the installation and register the software at a later date.

The advantage of using a network and file server is the access of files from multiple locations. Prior to the network installation all user accounts and files lived on the local workstations. Management of the local machines is easy through the Administrator account. We chose to map a folder on the server with a drive letter. This improves performance as a drive is accessed directly without the need of the computer constantly looking for the UNC path.

Once up and running with audio connections it is very easy to learn and use. Assign an administrator and immediately password protect that user so settings cannot be changed by a rouge user, nor can you add more users without going through the administrator – otherwise you will have an unmanageable list of users.

We make user accounts for full time staff and then create a common user for part time folks and weekends. (In addition we create special winner user accounts so that testimonial-type audio or winners worth archiving can be transferred to this folder for later editing and

other production elements.) The title bar indicates which user account is logged in and which folder is currently opened. This comes in handy when someone, for some reason, cannot find something. You point out they are logged in as another user; problem solved

READY TO USE

The main screen is very easy to understand and laid out for ease of use. The Time Line, Edit View, and File List are right in front of you and very intuitive to navigate. The attached controller with scrub wheel makes editing a breeze.



Audion's VoxPro takes center stage in the studio.

The File List can be sorted by clicking the header so your files will display alphabetically, by date modified, by date created, or even length. The Edit View is a graphical display of both left and right channel designed for easy editing.

Editing is quick, easy, and non-destructive. Many editing functions are provided on the controller, like marking the beginning and ending of selections, cut and paste, etc., while more in-depth functions are found through the various menu selections. When someone asks for something I direct them to the menu items and they discover new, interesting effects which they find useful. Noise reduction is now available to help remove hiss or hum, along with a headroom slider which helps with editing.

Most of the talent love the networked version, as do the production people. All files appear as if they were working in a control room. With this setup a user can go to any production room VoxPro workstation, open the application, choose his or her name on the user list, and start working. Snippet’s from the air shifts can now easily be monitored and lifted for promo’s or replay as produced bits later on.

IMPROVED AGC ACTION

One feature I postponed using until recently is the AGC. By the time Audion Labs released version 4.0, the AGC was working pretty well, but not quite to where I was comfortable.

This function operates well with good sound cards, but if you plan on using the built-in sound card of a computer the noise floor may be too high to operate the AGC. This shows how sensitive the AGC was – and still is. The improvements incorporated in the AGC makes the option more viable with good sound devices, as the attack level and peak limiting are much improved.

What I call attack level is the Sensitivity setting. In our installation we split caller audio to the Right channel and put the talent audio on the Left channel. Within the AGC setup, either one or both channels can be processed and the sensitivity can be set for each channel individually. This is quite handy, as in-studio levels can vary quite differently from caller audio levels even with gain control in the current hybrids.

Using our Sierra Automated Systems Rubicon and 32KD router system, levels for individual channels are fine-tuned independently, complementing the AGC in the VoxPro.

OUTPUT

The VoxPro playback can be configured for stereo or a mono mix. The VU meters are always active which makes setting the levels and AGC much easier. The mono mix is either a straight mono mix, a -6 dB mix, or even a -12 dB mix to compensate for the level gain in a mono mix. We use a straight mono mix due to our separation of left/right audio.

Many stations already have a system in place to create podcasts. As we plan on improving our system, the publication wizard within VoxPro may come in handy; it steps you through creating RSS feeds and MP3 files for podcasts and incorporates an FTP application for uploading the files to your website.

THE AUDIO FILES

Each user can choose audio quality depending on their needs and taste. The early versions of VoxPro created proprietary files and multiple files. The new version creates the .VPW file or VoxPro WAVE file, but VoxPro can import and export files in MP3 and WAV formats. This helps when the morning show wants to download an MP3 from the Internet, import it into VoxPro, and edit it for airing. Likewise the power users will export interviews and phone clips to MP3 for editing and archiving.

A valuable feature is the specialty skimmer recorder, which saves in high quality MP3 format. The VoxPro can be set up to scan the default location of these specialty files and import them automatically. EZ-Export is available if you wish to set a standard in the Administrator account: the user clicks on “export” and the file is stored in a predetermined location and format. In addition, the VPW file can be directly imported into Adobe Audition, so VoxPro tracks can be easily included and edited in a multitrack production.

Storing our files on a file server maintains the integrity of our audio, so a workstation crash is not as critical. However, one lesson we learned is to turn off the power-saving functions of the computer, especially the hard drive. This can avoid the loss of a file when saving to a server. Use a screen saver, but do not let the computer go into hibernation or sleep mode.

One other “Gotcha:” in order to keep the speed available for VoxPro on the network, try and place the server and workstations on the same segment. Network traffic can sometimes cause VoxPro to act in strange ways during network playback.

SET AND FORGET

We have received few or no complaints on the VoxPro system. Everyone seems to learn the system rapidly and is able to use VoxPro to its fullest potential in a short amount of time, although it is a continuing education to train people on file and disk management. In general it has been a “set and forget” system.

Its ease of use and flexibility are key. Audion Labs continues to invest time in improving their product, and there are many more features that we currently do not use though we may do so in the near future. Though I am slow to adopt some of these features, when I do, I am very happy with the results.

The VoxPro is an essential tool for any radio station.

Bill Eisenhamer is Chief Engineer for Lincoln Financial's San Diego KSON/KiFM/KBZT/KSOQ cluster. Email contact is: beisenhamer@jpc.com



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BSI Introduces OpX

by Robbie Green

Throughout my 16-year career, I have worn many hats in the world of radio. I have done a lot of technical and on-air work, in roughly equal proportions. This has given me the opportunity to install, maintain and use a lot of different automation systems. For two years now, I have been working with a new system called OpX from Broadcast Software International (www.bsiusa.com).

A NEW SYSTEM

It all started with an aging system from another vendor. I was Chief Engineer of the Cumulus stations in Midland-Odessa at the time, and Gary Kline our VP of Engineering asked if I would like to try out a new system in development. Before I ever heard OpX play even one piece of audio, I was impressed with the thought that went into its overall design.

OpX is a system consisting of a number of purpose-built modules. This approach gives you amazing flexibility. All of the modules can run on a single machine for cost-conscious operations or can be spread among different machines for increased redundancy.

The File Server module is the central database for audio storage and is shared by all of the stations in a facility. Each station has its own Audio Server module and Studio Client. The Audio Server handles playback of your station log, satellite programming, background records, etc. The Studio Client is the end-user interface, where talent can see the log and manipulate it, edit future logs, or insert voice tracks. The Studio Client also includes up to 50 pages of instant replay audio on hot buttons.

INTUITIVE OPERATION

OpX was still considered a test-run when we launched it in Midland because we had never used the system to run one of our markets completely. We were evaluating the software as a pilot project for the entire company.

For starters, we wanted to see how a totally untrained air talent would do with the system. So we intentionally kept the first DJ that would be using the system in the dark, with no instructions. The first time she saw OpX was at the beginning of her midday air shift, and she figured most of it out immediately. With very little coaching, she pulled off a stellar shift.

The layout is simple and intuitive. It can be controlled either with mouse and keyboard or by touch screen. Making changes in the log is simple. If you want to delete a log item, you simply click it to highlight it and press the delete button. To move something, you highlight it and press the move button, which will then flash and say "Move Where?" Click where in the log you want that log item to go and it moves. The insert and copy commands work the same way.



On the air at KBAT with OpX

You can instantly jump to and edit any hour of the current day's log, scroll through the log line by line or page by page. After making edits, you can return to the currently playing log item by clicking one button. Log items are color-coded by type. Songs are blue, spots are green and voice tracks are yellow.

QUICK AND EASY VT

The OpX voicetracker, built into the Studio Client module is among the easiest and best sounding I have ever used.

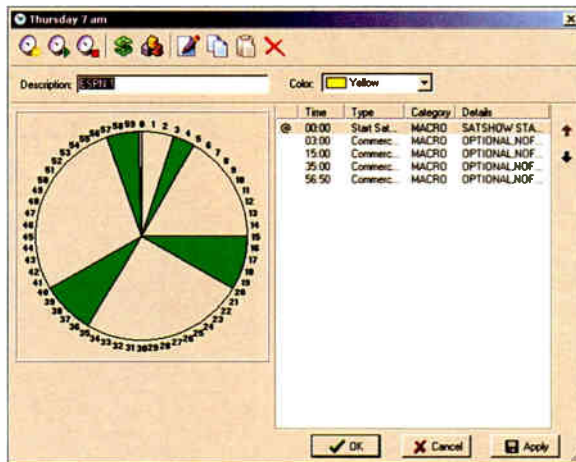
Prior to leaving Midland for our Houston cluster last summer, I did a nightly air shift on our country station, KNFM. Of course, caring for the engineering needs of six stations, I was a busy guy, so I typically had about 30 minutes to knock out a five-hour air shift. Sometimes it took me longer to find an open studio to do the voicetracks than to do the tracking itself.

Fortunately with OpX, any on-air studio or production room can be a voicetrack booth for any station in the cluster. You can edit the log or lay down voicetracks for any station from any room. The voicetrack interface is as close to actually being on the air "live" as possible. Talent can hear song intros and outros in their headphones and have complete access to the same hot button audio they use during live shifts.

A STRAIGHT-FORWARD INSTALLATION

Some automation systems I have used over the years do a few things well, but lack in other areas. They might have a great on-air interface and be loved by talent, but also hated by engineers and program directors when it is time to build new clocks for syndicated programming. OpX makes everyone happy.

The OpX Clock Builder is easy to use and powerful. Prior to building clocks, you can define all satellite sources and network closures with friendly names. Instead of "switcher input 2" you have "The Dan Patrick Show." OpX does not dictate where closures go and does not require complex steering logic. You wire closures where you want them, tell OpX where they are, and then label them however you want. "Closure input 14" becomes "Dan Patrick Rejoin Liner."



Building clocks and changing schedules are simple to do

Once everything is defined, clock building becomes a simple Q&A process. There are no macros to memorize, nor any complex wiring. The process is simple enough that engineering can generally connect and define the wiring in a very short amount of time.

If your stations have complex program schedules, OpX can handle them. Each OpX Audio Server has the ability to background-record up to four satellite shows simultaneously, and then play them back using the same easy Q&A as live shows.

SERVER LAYOUT

Security was a top priority in the overall design for OpX. All communication between modules and workstations is handled via TCP/IP. There are no Windows' file shares whatsoever, which helps minimize exposure to malware.

Most of the OpX installations in Cumulus utilize a three-tiered approach. Each cluster has a single File

Server machine that holds all audio for all stations. Each station has an Audio Server machine that handles log playback, satellite switching, and background recording. Every station also has a Studio Client machine that serves as the talent interface and handles audio for voicetracking and hot button playback.

All of these machines are located in the rack room and connected via CAT-5e cable to the studios via KVM extenders. Of course, you could locate the machines in the studio if desired.

While all modules can run on a single machine, the multi-tiered approach offers compelling advantages, redundancy being the most important. Suppose an air talent spills coffee in the keyboard of the Studio Client machine. You simply shut it down and replace the keyboard while the Audio Server keeps rolling along.

What if there is a power supply failure in one of your Audio Server machines? Simply start the Audio Server module on that station's Studio Client machine and keep going. You can utilize whatever level of redundancy you feel is appropriate for your facility.

EVEN MORE REDUNDANCY

Here at Cumulus Houston, we employ a four-tiered approach. Each studio has two Studio Client machines, one for the host position and one for co-host.

Not only does this allow the co-hosts to have all the same information the host has, but also their own hot button audio. If the main Studio Client machine ever has a problem, we can simply swing the co-host monitor around and keep going.

The main Studio Client machines here are equipped with two sound cards, one dedicated to typical Studio Client duties, the other to running Audio Server should the primary audio server for the station ever have an issue. OpX can continue to run with the File Server module shut down. Since audio for all stations exists on both the File Server and any Audio Server machines, you have great library redundancy.

OpX can handle log playback with any Windows compatible sound card, but multi-channel cards are necessary for some functions, like voicetracking to work properly. Most stations are configured with six audio outputs, three from the Audio Server and three from their Studio Client. A seventh output dedicated to cue audio can also be used, but is not required. You can cue on any of the Audio Server outputs if desired.

In some of our markets, we do not even use sound cards. We use IP audio drivers, as OpX supports various drivers from different manufacturers. OpX currently offers support for several Broadcast Tools switchers as well as USB GPIO.

IN A WORD: RELIABLE

OpX has some great features, and it scales well to any size operation, but perhaps its most impressive feature is outstanding reliability. I only wish all the other automation systems I used over the years had been as reliable as OpX.

In two years of using OpX, across nine stations personally, and dozens more in a supporting role, OpX has proven to be extremely stable. I have had the File Server and Audio Server module running for over six months without shutting down, and only shutting down then for software updates.

OpX is truly the first radio automation system I have encountered that does everything well. It is easy for everyone to operate, both talent and technical, and it is reliable.

Robbie Green is IT Director and Assistant Chief Engineer for Cumulus in Houston, TX. Contact Robbie at robbie.green@cumulus.com

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Pristine Systems' CDS32

by Stan Carter

Finding an automation system to handle the day-to-day operations of today's news/talk station can be a daunting task. There is a lot going on, and being able to handle it all smoothly is essential.

When I first came on-board at WJNT-AM in 1993, talk programming options were quite limited compared to the choices available today. After a few years, as more and more programming choices became available, it was apparent that WJNT would have to invest in an automation system that could handle programming tasks that are unique to news/talk.

EASY CHOICES

WJNT originally chose CartWorks (the predecessor to CDS32) when we installed our first automation system. For several years it handled all of our requirements at WJNT very well.

However, the news/talk programming continued to grow, and we started to push the limits of our first automation system. To accommodate our growing programming lineup, it became necessary to add external timers and mechanical relays. While this solved some problems, it was not 100% reliable.

In 2006, WJNT-AM was purchased by Inner City Broadcasting; from a standalone AM station, we became part of a 6-station cluster. One of the first items on our shopping list was a new automation system for our new talk studio.



The WJMT Talk Studio

Pristine Systems CDS32 (Content Delivery System) was the obvious choice. The other stations in the cluster were already using Pristine Systems CDS32 for music on hard drive, live-assist and satellite music formats. We found that the latest version of CDS32 was well-suited to handling our news/talk programming.

HANDLING THE SOURCES

We chose the CDS32 satellite automation system with two Broadcast Tools SS 8.2 audio switchers to accommodate our 16 different audio sources—mostly satellite, along with television and RPU sources used for TV news simulcasts, church broadcasts and remotes. The multiple audio switchers allowed us to do away with all the external timers and relays I had added on over the years, tremendously simplifying things as well as improving reliability.

If additional audio sources are needed in the future, CDS32 can be expanded even further. A third Broadcast Tools SS 8.2 switcher can be added, allowing us to control up to 24 different audio sources.

Multiple satellite sources also mean multiple contact closures. With our original automation system the number of closures was limited, meaning picking and choosing what could be accommodated and using

external timers and relays. Making programming changes could be quite challenging at times.

With CDS32, this became a problem of the past. Our CDS32 system can accommodate up to 48 input closures, which allowed me to do away with all of the previously added-on timers and relays. We were also able to take advantage of optional automation closures for return liners, optional breaks, etc. This made for an improved on-air sound.



EASY TO HANDLE CHANGES

As anyone in broadcasting knows, numerous things will be handed to you at the last minute. Again, CDS32 makes it easy to handle last minute programming changes, whether a last minute church program on Sunday, a new overnight satellite show, or adding a live break to the morning talk show.

The CDS32 script editor is extremely flexible and makes it easy to modify programming. All input sources, relay closures and commands use easy-to-read labeling. Items like time syncs, floating breaks, and hard breaks are easy to program in or modify on short notice.

One of the most challenging things we have been able to accomplish with CDS32 is automating college sporting events. The script-based automation programming used by CDS32 makes it easy to transition seamlessly from regular programming to a college sports event and back with no human intervention. Got a last minute college game that you need to air? No problem—add one command in the automation script and CDS32 is ready to go.

TIME SHIFTING

Another challenge for talk stations is time-shifting programs. We air several short features that are available on satellite, but cannot air them live.

The background recording feature in CDS32 will let you automatically record any audio source available on the audio switcher while regular programming continues with no interruption. Recordings can be based on time or relay closures. Time-shifting a one-minute stock update or a four-hour talk show is handled with ease.

PLENTY OF HOT BUTTONS

Along with our satellite programming, WJNT also airs a live morning talk show with different show hosts during the week. We also air a fast-paced afternoon talk show, along with several local high school sporting events. All of our live programming requires fast access to sound effects, drops, bumper music, and spots.

CDS32 makes it easy with Hotkeys. Up to 48 individual audio cuts are immediately available on a separate audio output. The board op or show host can access this with a click of the mouse or by using the dedicated button panel. Multiple Hotkey groups can be created, so each talk show host can have their own individually customized button panel. High school sports, live remotes, etc., or anything requiring quick access to audio cuts can have its own Hotkey group.



Hotkey Button Panel

As I mentioned before, last minute things are part of radio, and getting spot orders on short notice is quite common. In the past, it was necessary to directly record each spot into our old automation system due to file compatibility issues.

CDS32 handles multiple audio file formats with ease. It does not matter if the audio file is an uncompressed stereo WAV file or compressed mono MP3 file—just add the cart info and the file is ready to play. Adding spots at (literally) the last minute is a snap.

Add in other features like 24/7 tech support, network spot transfer, auto spot set fill, etc., and CDS32 is a great choice for anyone looking for an automation system to handle the demands of news/talk programming.

Product information at: www.pristinesys.com

Stan Carter is the Operations Manager/Chief Engineer at WJNT-AM, in Jackson, MS. Contact Stan at slcarter@wjnt.com

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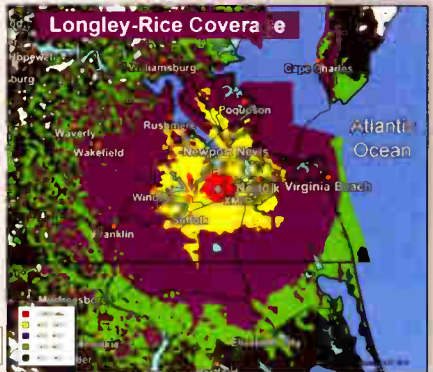
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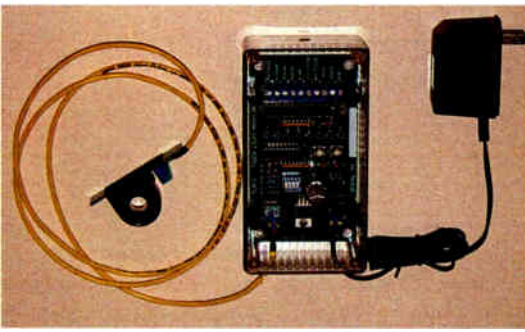
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Radio Pipeline

New Equipment

Updates and Modifications

Industry Information

Wheatstone - NTI Americas - D&H Satellite - JK Audio

Wheatstone Announces New Products on Display for NAB 2008

Wheatstone Corporation will exhibit its digital audio network systems, spotlighting its new **Evolution Series Radio Consoles**. Studios equipped with the new Evolution consoles can operate independently yet can share all sources and mixes through the E-series Network Switch—without traffic limitations, audio latency, or machine control delays.

Also on display is the **Glass E**, a software application that is installed on a standard Windows XP PC which allows the user to control any Evolution control surface from a remote location through a LAN or WAN. The Glass E graphically replicates the associated control surface with the IP address to which it is pointed.

New from AUDIOARTS ENGINEERING:

The **Air 1 Console** is an ultra compact console that retains the features and interconnect system of much larger consoles despite its small footprint. The Air 1 was specifically designed to meet the needs of on-air, production, news applications, remotes,



and the emerging podcasting market. The low profile frame, only 2-1/2" high, comes equipped with rugged tabletop mount with direct access TRS rear connectors.

The **W-12 Console** (not shown) targets small to mid market radio stations and offers high-end features such as: three stereo main busses, ten A/B dual source stereo line inputs (analog or digital), two microphone preamps, uncompressed 24-bit operation (44.1 or 48kHz), switched VU meters, built-in cue speaker with level control, and headphone jack with built-in amp.

New from VORSIS:

The flagship **AP-1000** 31-band digital spectral processor is now equipped with new technology such the Vorsis Bass Management System® algorithm in the FM Limiter/Clipper section and new five-band AGC. The factory presets have also been refined and there are now over fifty carefully tuned custom presets included.



FM-5

The FM-5 audio processor is one of the newest members of the Vorsis processing family. Features include a proprietary five-band Multiband Dynamics Controller along with a precision ten-band final limiter with distortion masked clipper. The FM-5 also ships with additional custom presets.

Wheatstone

252-638-7000 – sales@wheatstone.com
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NTI Introduces the DR2 Digital Audio Signal Generator

The new **DR2 Digital Audio Signal Generator** completes the NTI digital audio instrument family. Like the companion DL1 Digital Audio Analyzer, this digital audio generator delivers full performance and bench-quality functionality in a handheld, battery powered package.

The DR2 produces all common digital audio test signals in the digital domain, allows external synchronization to audio and video, and produces a comprehensive set of surround test signals. In addition, it includes unique functions for testing transparency of the digital channel and for measuring signal latency. The innovative multi-function rotary control wheel and efficient function keys ensure fast access to the signal functions and parameter setting.

The DR2 Digirator generates sine waves with stepped & continuous sweeps, white & pink noise, polarity & delay test signals with sampling frequencies up to 192 kHz, and resolution up to 24 bit. The signals are provided at the AES3, S/PDIF, TOS-Link and ADAT outputs. The powerful WAVE-file playback functionality allows transferring customized test signals from the PC to the DR2.

For working in a professional environment, a digital signal source has to be able to synchronize to existing audio or video clocks. The DR2 provides easy synchronization with AES3, DARS, WORD-Clock, as well as video black burst signals in the PAL or NTSC format. The load impedance may be altered between 110 Ohms, 75 Ohms and High Z.

With the appearance of an increasing number of multichannel audio formats, NTI has also implemented typical signals streams in all commonly used formats, such as Dolby D, D+, E, Pro Logic II, DTS, and DTS-HR.

The transmission of these compressed formats requires transparent audio links with sufficient bandwidth. The DR2 measures the transparency of any channel and verifies the suitability for multi-channel formats.

Additionally DR2 is able to measure the signal latency from the output to the digital input and expresses the round-trip-delay of the digital audio signal in milliseconds and as a number of video frames.

The DR2 is now available from stock, and options include an AC power supply, an output transformer for AES3id use, and a belt pouch.



NTI Americas

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D&H Satellite Introduces the Gibraltar Gemini Mount

DH Satellite introduces the **Gibraltar Gemini Mount** to compliment its premium line of antennas and mounts. The Gemini was developed in response to consumer requests for a high quality, steerable, system that will track the geosynchronous – as well as the inclined orbit – satellites with the tighter tolerances required by the digital formats. This system incorporates all of the proven Gibraltar features, but is sized for the 2.4 (8'), 2.7 (9') and 3.0m (10') antennas.

The Gibraltar and Gemini mounts are three-axis units that allow for Azimuth, Elevation and polarization control. The Gibraltar has been tried and proven over the last 20 years and has been found to be as solid as the "Rock of Gibraltar." This unit is the ultimate in steerable systems and is designed for use in the 3.7m-5.0m size of antennas. Wind speed ratings are 150 MPH.



D&H Satellite

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BluePack allows live man-on-the-street interviews through a cell phone equipped with Bluetooth Wireless Technology. This sleek belt pack provides a professional look and feel to field reporters and remote talent.



BluePack pairs to your cell phone like a Bluetooth wireless headset. The unit sports a professional microphone preamp and powerful headphone amplifier. A 3.5 mm stereo line input jack allows recordings to be mixed into the broadcast. The 3.5 mm stereo line output jack provides your full bandwidth microphone signal on the left channel and Bluetooth audio on the right channel.

The stereo headphone output gives you a mix of the XLR microphone input, 3.5 mm input, and Bluetooth audio. This powerful 1/2 Watt stereo headphone amplifier will cut through any crowd noise. BluePack also pairs to Bluetooth equipped sound cards and music players in full bandwidth stereo A2DP mode.

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The Radio Guide Event Register

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www.nabshow.com

Dayton Hamvention

May 16-18, 2008
Trotwood, Ohio
www.hamvention.org

TAB Trade Show and SBE 55th Annual Convention

August 6-8, 2008
Austin, Texas
www.tab.org/convention-and-trade-show/

NAB 2008 Radio Show

September 17-19, 2008
Austin, Texas
www.nabradioshow.com

SBE Chapter 22 Broadcast and Technology Expo

October 7-8, 2008
Verona, New York
www.sbe22expo.org/

Broadcasters Clinic

October 14-16, 2008
Madison Marriott West Hotel, Madison, Wisconsin
www.wi-broadcasters.org

Pittsburgh SBE Chapter 20, 2008 Equipment Expo

October 20-21, 2008
Monroeville, Pennsylvania
www.sbe20.org/expo.html

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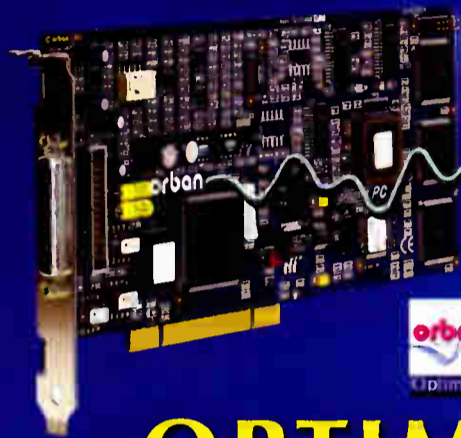


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