Method of Moments | Trends in Tech: AES-X210, The "Missing Piece" of AES67?

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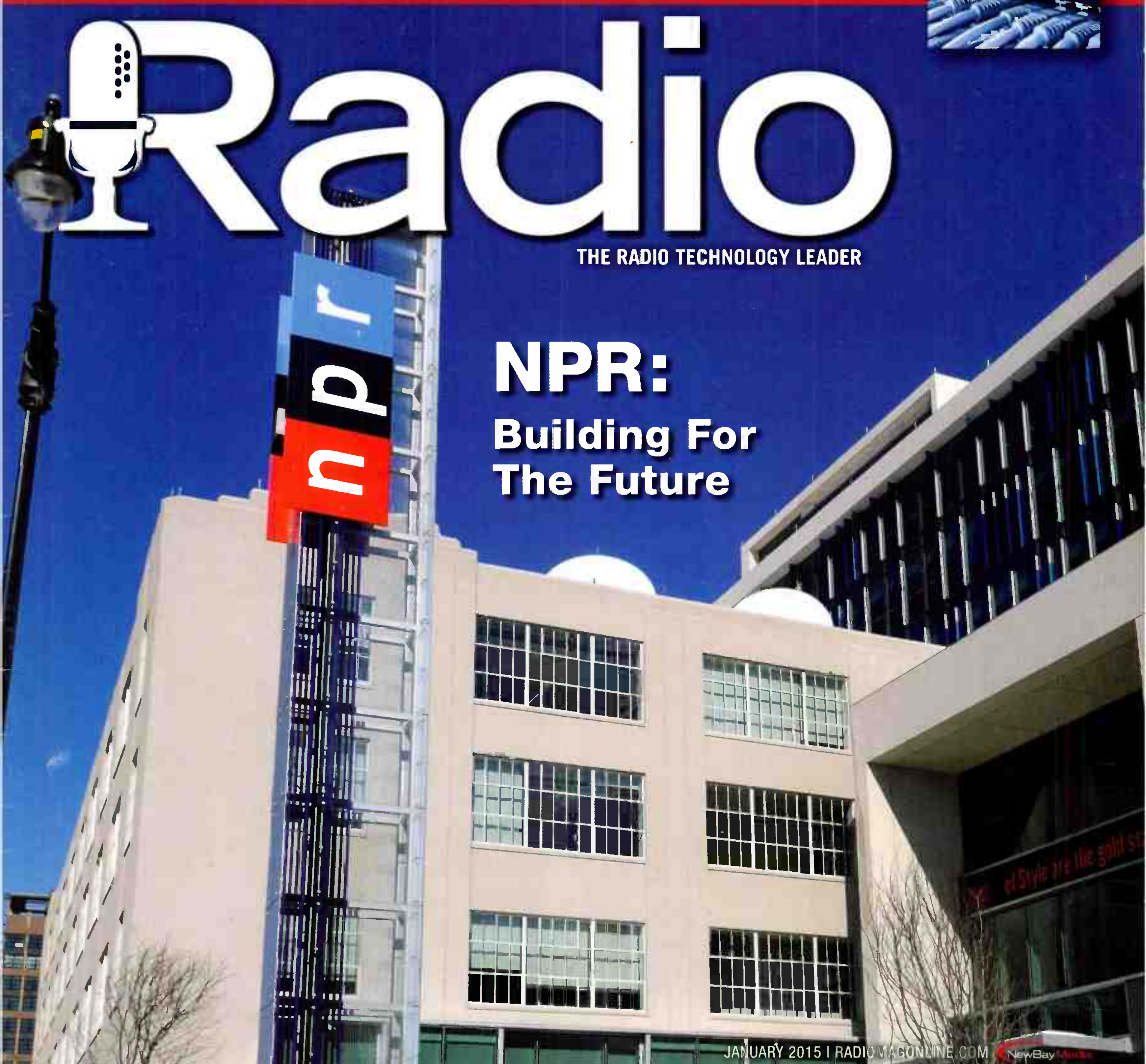

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LPFM and the Audio Arts

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Congratulations to Sharon Scott, Sean Selby, Tim Barnes and all the others at ARTxFM, on their new non-profit LPFM after three years of hard work and involvement in the Louisville, Kentucky music community. We love your experimental music format, your shows, and the fact that you're out there in the community covering the music scene. We're listening.

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Go to: INN18.wheatstone.com

Hand it Over, Internet

With satellite delivery no longer widely available, broadcasters are turning to Tieline's Genie with WheatNet-IP inside for distributing programming over the public Internet.

If you're thinking about handing over program distribution to the public Internet, Brian Kerkan of Crawford Broadcasting in Detroit has some advice for you.

Brian suggests oversubscribing on bandwidth, using SNMP to get in front of any packet problems you might have, and to use a good codec. Oh, and to grow a backbone - you're going to need it.

"Was a I nervous about using the Internet? Oh, yes," relates Brian, who is the engineer for Crawford's WMUZ-FM, WEXL-AM and WRDT-AM in Detroit where the Bob Dutko show is syndicated. But, he adds, the Internet has become so much more reliable in recent years.

His group was able to successfully switch over to Internet program distribution for its Bob Dutko nationally syndicated show using the Tieline Genie, now available with WheatNet-IP inside. Crawford Broadcasting's Detroit location is a Wheatstone facility.

Here's advice for anyone wanting to do the same:

Go to: INN18.wheatstone.com

Oh, The Voices – Part II Adjusting for Taste

by Steve Dove, Minister of Algorithms

Here's what else you need to know about getting the most out of talent voice, starting with what frequencies to tweak.

The most basic, and arguably the most powerful, tool for getting vocals to sound good is equalization.

A low-frequency shelving equalization section can do a good job of correcting for proximity effect. A wrong-headed approach is to try to use the high-pass filter to do this – generally they are too steep (too rapid a rolloff) to be a good match for the more gentle tilting response. A shelving section is far more suited.

A high-frequency shelving section is excellent for establishing an overall tonal balance for the presenter/microphone combination, particularly once any sibilance issues have been dealt with by the de-esser, and proximity effect is dialed out with LF shelving. Particularly bright microphones (budget condensers in particular named and shamed) can benefit mightily from de-brightening with this section!

A parametric, or sweepable bell-shaped equalization section, can be of use in minimizing unfortunate characteristics of the microphone. (Or indeed of the presenter...) In particular, some dynamics and certainly some lower end condensers have a high-mid boosting peak, in the name of "articulation" but which in today's better and more controlled air-chain environment can just plain sound harsh. Dialed in to, say, between 2kHz and 5kHz with a fairly low Q (broad bandwidth) and just a touch of cut can make a world of difference.

More tips from Steve for adjusting the voice can be found here:

Go to: INN18.wheatstone.com

TABLE OF CONTENTS

The lobby of NPR's 1111 North Capitol Street headquarters. Video displays on the wall scroll features, news and other information.

COLUMNS

FEATURES

DEPARTMENTS

On the cover: Satellite dishes peek above the roofline of the NPR building from the street.

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VIEWPOINT

Welcome to 2015

Happy New Year from Radio magazine. We all have those "holiday horror stories" but I hope the end of 2014 was enjoyable and for the most part uneventful around your broadcast plant.

The past year brought a number of stories from all corners of the industry. Many of them touched on regulatory issues under consideration by the FCC, but we've also seen an increasing focus on IT security, mobile broadband, and streaming (particularly in cars).

The year 2014 also saw several legacy broadcast equipment companies close their doors. These included SRS Electronics (where George Marti still occasionally worked on the RPU and STL equipment bearing his name), Energy-Onix (following the death of Bernie Wise late in 2013) and most recently, Dayton Industrial. The fact that these companies are no longer around is a direct reflection of the changing faces of broadcast technology and the broadcast engineer. IP codecs are fast replacing RF RPU links and STLs; solid-state transmitters have become far more "modular" and easier to maintain than even the simplest grounded grid designs; and there are new options for facility and signal monitoring on the market. Knowing how to maintain an RF and audio plant continues to matter, but knowing how to maintain the broadcast IT infrastructure is equally if not more important.

Here are a few of the areas we'll continue to watch in 2015:

- Audio over IP, including the developing AES-X210 standard
- The increasing use of IP codecs between facilities as program loops, ISDN lines and other legacy services are discontinued by telephone companies
- HD Radio, including receiver availability in new cars, and possible all-digital operation for AM stations
- LTE and Wi-Fi Connectivity in cars
- FM chips in smartphones and the NextRadio project
- Proposed FCC actions including AM band revitalization, online public files for radio broadcasters, EAS rule changes, broadband availability and net neutrality
- The changing role of the broadcast engineer in today's broadcast facilities

If I have one takeaway from 2014, it would be "the more things change, the more they stay the same." Many of these stories sound familiar and have been covered in the past, but they continue to develop and gain importance.

Radio is a medium that many people are passionate about. Despite the grumblings from some about programming becoming "generic" and competition from other media sources, there are still a number of very talented people producing compelling radio content on a daily basis. One of my colleagues used to refer to radio as "a rare medium, well done." The technology continues to change and our industry faces many challenges, but the things that make radio unique have not. I look forward to what 2015 will bring for the industry. 0

Shane Toven | Editor

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FCC Proposes Online Public File Rules for Radio

by Lee Petro

As the radio industry enters the new year, the FCC is proposing to usher in a new online public file system for radio stations. In December, the commission adopted a Notice of Proposed Rulemaking that proposes to revise its online public inspection file rules currently imposed only on television stations to now include satellite, along with most cable systems and radio stations.

The current rules for television stations require the posting of public inspection files on an online filing system maintained by the FCC. While applications, EEO and ownership reports and authorizations are pulled directly from the FCC's CDBS filing system, other documents such as issues/program lists and annual EEO public inspection file reports are uploaded manually by the stations to the online public file.

The FCC proposes similar requirements for radio stations. In doing so, the commission recognized that there are certain necessary changes to accommodate radio services. For example, the FCC is seeking comment on how to provide copies of the contour maps for AM stations. Because AM contour maps are not easily generated from the FCC's records, the agency is considering a requirement that would have AM licensees upload their contour maps when they transition to the new system.

Stations would not be required to upload documentation that is already in their public files when the rules go into effect. So, with respect to the station's political file, the FCC would not require the past two years' worth of information to be uploaded upon the effective date of the new rules. Moreover, the FCC is proposing to exempt the posting of letters from the public, but will require the inclusion of NCE radio station donor lists in the online file.

The FCC's current online public file system is organized by subject matter folders for each station (i.e. authorizations, applications). The political file is organized by year and type of advertisement. The FCC is proposing to carry over this structure for the radio online filing system, but seeks comment on any necessary changes.

To ensure that the public is aware of the online public file, the FCC proposes to require radio stations with websites to post a link to the online public file maintained by the commission. The FCC is also considering a rule that would require publication on a station's website of a contact person that could receive comments or questions from the public regarding the station's public file.

Most significantly, the FCC is proposing to use a staggered implementation schedule. The initial requirements would only be imposed on commercial radio stations in the top 50 markets that have more than five full-time employees. Subsequently, the new rules would be imposed on the remainder of the commercial radio stations, and NCE stations two years thereafter. The FCC believes that this schedule would reduce the impact on smaller stations, and also serve to protect the online filing system from being overloaded during the implementation period.

Interested parties can either file comments electronically through the ECFS website, or they may file on paper. In either case, the heading of the submission should reference MB Docket No. 14-127.

EEO Reminder — The FCC takes seriously the requirement for all broadcast stations to follow the EEO rules and widely disseminate notices of job openings. In late December, the FCC dropped coal into the stockings of two broadcasters that had failed to disseminate job openings widely to outside referral sources, and failed to conduct self-assessments of the success of their EEO referral sources. In addition, one station failed to provide notice to referral sources that had specifically requested such notices, which is a separate violation of the FCC's EEO rules. Since stations will be filing their mid-term EEO reports starting this year, the ability to certify compliance with the FCC's EEO rules will be very important.

Petro is of counsel at Drinker Biddle & Reath, LLP. Email: lee.petro@dbr.com.

DATELINE

Jan. 10, 2015 — Stations place issues/programs lists in public file.

Feb. 17, 2015 — Comments in Revisions to Broadcast Contest Rules, MB Docket 14-226.

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AES-X210: The "Missing Piece" of AES67?

by Doug Irwin, CPBE AMD DRB

I believe most of us would agree that standards in communication protocols are of great benefit to our work in broadcasting. One only needs to consider Ethernet and IP if you are not thoroughly convinced.

In this article, we're going to discuss Open Control Architecture, also currently known as AES-X210. It's a proposed standard for what I would loosely call "machine control" over IP. But first let's put it into context. In the pages of Radio we've discussed communications protocols extensively over the last several years. I've contributed several articles that are germane to the topic — the first was about the AVB standard. More recently, I've written about AES67, certainly an important topic if you make use of audio over IP.

In a nutshell, AES67 is a standard for audio over IP transport, allowing different manufacturers' equipment to "talk" to one another. However, AES67 is only for audio transport, and there are important functions that broadcasters are accustomed to that are not considered. "[T]here's a whole world of other functionality that broadcasters expect, like device start/stop functions, monitor mutes, on-air tallies, the ability to control peripherals from the console, the ability to know when an audio source is live and ready for air, the ability for playout systems to control fader on/off functions and more. Those are functions that AES67 alone doesn't provide for," said Marty Sacks, vice president of equipment manufacturer Axia.Sacks continued, "AES67 is a great start toward a unified standard, but when the first AES67 devices hit the marketplace, they will also need to support this additional functionality, no matter whose system they use, in order to provide an integrated control experience for the user — otherwise they're going to be no better than AES3 streams, with serial GPI cables running alongside."Andrew Calvanese, Wheatstone vice president of engineering, expressed similar sentiments. "AES67 is the first step in what we hope will lead to a totally interoperable environment that includes not only transport, but the means to control and discover all devices and functions within the network. We are working with other engineering teams to standardize on the control and discovery protocols that can make that happen at an overall, interoperable level."

Now to the topic at hand: AES-X210, or "Open Control Architecture."

OCA is meant to be an open standard that will allow for "the control and monitoring of media networks, not for the transmission of media content," said Jeff Berryman, senior scientist at Bosch Communications (one of nine members of the OCA alliance). "When the X210 project is complete, it will yield a set of standards for control and monitoring of media networks. OCA will work with any of the current and emerging media transport standards such as AES67, AVB, Cobranet, etc."

What kind of features can we expect to be supported in the future? In OCA version 1.1, we have the following, among others:

- Gain controls
- Muting
- Switch position (up to n positions)
- Matrices
- Cross fading
- Level sensors (meters)


OCA Alliance at AES 2014

The OCA Alliance recognizes that OCA has many applications related to broadcasting, including:

- Widespread networks, with perhaps thousands of nodes
- Transcontinental networks using leased facilities, for IP transmission
- Interfaces to broadcast mixers
- Voice over IP interfaces
- Portable and/or fixed location nodes
- Multiple subnets, multiple sites, multiple work environments, some of which could be different locations
- Configuration/Administration by IT departments

The OCA Alliance has published a detailed set of design parameters, the entirety of which is available from their website at ocaalliance.com.

Now let's move on to greater detail, or what OCAA calls "architectural goals and constraints."

Functionality: OCA will by design allow for the discovery of all OCA compliant devices attached to the network. It will manage media streaming connections. In other words, it will "set up" and "tear down" streams between devices. It will control operating and configuration parameters of OCA compliant devices, and it will monitor operating and configuration parameters between OCA-compliant devices. For devices with reconfigurable signal processing and/or control capabilities, it will allow the user to define and manage configuration parameters. The upgrade process for software and firmware will include fail-safe features.

Security: The following security measures will be offered for control data: entity authentication, prevention of eavesdropping, integrity

radiomagonline.com | JANUARY 2015 13

Licensing AM Stations Using Method of Moments

by Jeremy Ruck, PE

Once construction on an AM antenna is completed, the time comes to prove to the commission that the array meets the authorized specifications. For many years, the traditional method of proofing patterns was the only acceptable way to accomplish this. This method requires numerous field strength measurements, both in non-directional and directional modes, plus "talking down" the array, and extensive analysis. The result was a license application roughly the thickness of some engineering textbooks — and the expenditure of significant resources, both in time and treasure.

Although the traditional method remains a viable alternative, the commission in the last half-decade has allowed the use of computer modeling to prove that an array is functioning as it should. The momentous change in the rules, however, did not happen overnight. As is typical with significant changes to FCC policy and rules, the journey from start to end was indeed epic. In fact, the journey to get from petition to approval took twice as long as the 10-year journey of Odysseus to Ithaca after the fall of Troy.

The computer modeling method revolves around the use of the method of moments to make the appropriate calculations. The method of moments is a computational method that is applicable to many complex engineering problems in electromagnetism, and other disciplines such as fluids and acoustics. In a nutshell, the method takes a large problem and splits it up into smaller pieces, solves these smaller pieces, and then recombines the individual solutions to arrive at a global solution. The Numerical Electromagnetics Code or NEC was developed by Lawrence Livermore Laboratory. It, or a variant thereof, is utilized in the computer modeling process.

Proofing an array by the moment method eliminates the days of trudging around with a field meter taking measurements. It also reduces, or ends, the suspicious looks and questions from locals, who for many days have seen mysterious people with out-of-state license plates carrying strange brown boxes, and skulking about their residences.

But, since free lunch is a rarity, there are caveats to its use.

While the traditional method remains viable for all directional arrays, it is important to realize that modeling is generally only applicable to "typical" arrays. Some of the odd configurations found are excluded simply because of the difficulty in accurately modeling them, and their effects on the sampling system. A candidate array must consist of series-fed radiators. Top-loaded elements are acceptable if series-fed, but folded unipoles (skirts) and sectionalized antennas are not. Additionally, the ground system must be of a standard configuration, which includes the run-of-the-mill 120 radials 90 degrees in length.

Since the model is predicated on the locations and heights of the structures, it is necessary to have the array surveyed by a licensed surveyor. A tolerance of 1.5 electrical degrees in location at the frequency of operation is permitted. If values fall outside of this range, a construction permit application must be filed to modify the array. This modification application may, however, be filed concurrently with the license application.

The other core component of the model is the impedance of each of the towers in the array. The impedance of each tower is to be measured with all of the other towers in the

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array shorted and/or floated. These measured values are then compared against those derived from the model on an initial run, and must agree within 2 ohms and 4 percent for both resistance and reactance. Most likely, the numbers will not initially agree on the resistance side due to the velocity of propagation through steel, and on the reactance side as a result of effects from the base insulator, stray capacitance, the feedline itself, and other items in the tower base region.

In cases where disagreement is present, the model is then tweaked to arrive at the measured values. The element height may be adjusted to bring the resistance values in li ne. For the reactance side we can add a lumped series inductance of up to 10 μH, and a lumped shunt capacitance of up to 250 pF. Other items in the base region such as lighting chokes, static drain chokes, etc. must be specifically measured, and included in the model as well.

Once the model converges, the current magnitudes and phases are derived. These values are then normalized, which give us our currents and phases that we are to see at the antenna monitor. At this point, the array is then adjusted to obtain the currents and phases derived from the model. An operating tolerance of 5 percent of ratio and 3 degrees of phase is permitted; however, this tolerance is applicable once the array is set to the model output parameters. The tolerance is not to be applied to the model output, and the array set to the tolerance-adjusted parameters.

Under the traditional method, the antenna was adjusted based on field strength measurements, with the parameters indicated on the phase monitor corresponding to those measurements. As a result, the field strength readings were the important part, and the phase monitor readings could be whatever they were since they served primarily as a reference point. Therefore, the exact length of the sampling lines, torroid

Method of Moments Measurement Setup

or loop performance, and the like are not really critical. If a component failed, you replaced it, "partialled" the pattern, and moved on.

With modeling the converse situation occurs where the field strength values are based on the antenna monitor parameters. It is therefore critical to ensure that the sampling system is correct. In verifying the sample system, three items need to be taken into account. First, the monitor must be calibrated in accordance with the manufacturer specification. Secondly, the sample lines must be accurately measured. Finally, the response of the torroids or loops must be known.

The measurement of the sample lines is a somewhat arcane process, but one that can be accomplished with several different pieces of gear with varying cost. The open-circuit resonant frequency closest to the carrier frequency is determined to establish the length of the lines. The resonant frequency is hit where the measured impedance of the open-circuited line is zero. Additional measurements are performed at 1/8 wavelength above and below that resonant frequency to establish the characteristic impedance of the lines. This second set of measurements comes out of transmission line theory where the open-circuit impedance magnitude is equivalent to the characteristic impedance of the line at odd multiples of 1/8 wavelength from the resonant frequency. The line lengths must agree within one electrical degree, and the impedance magnitude must be within 2 ohms.

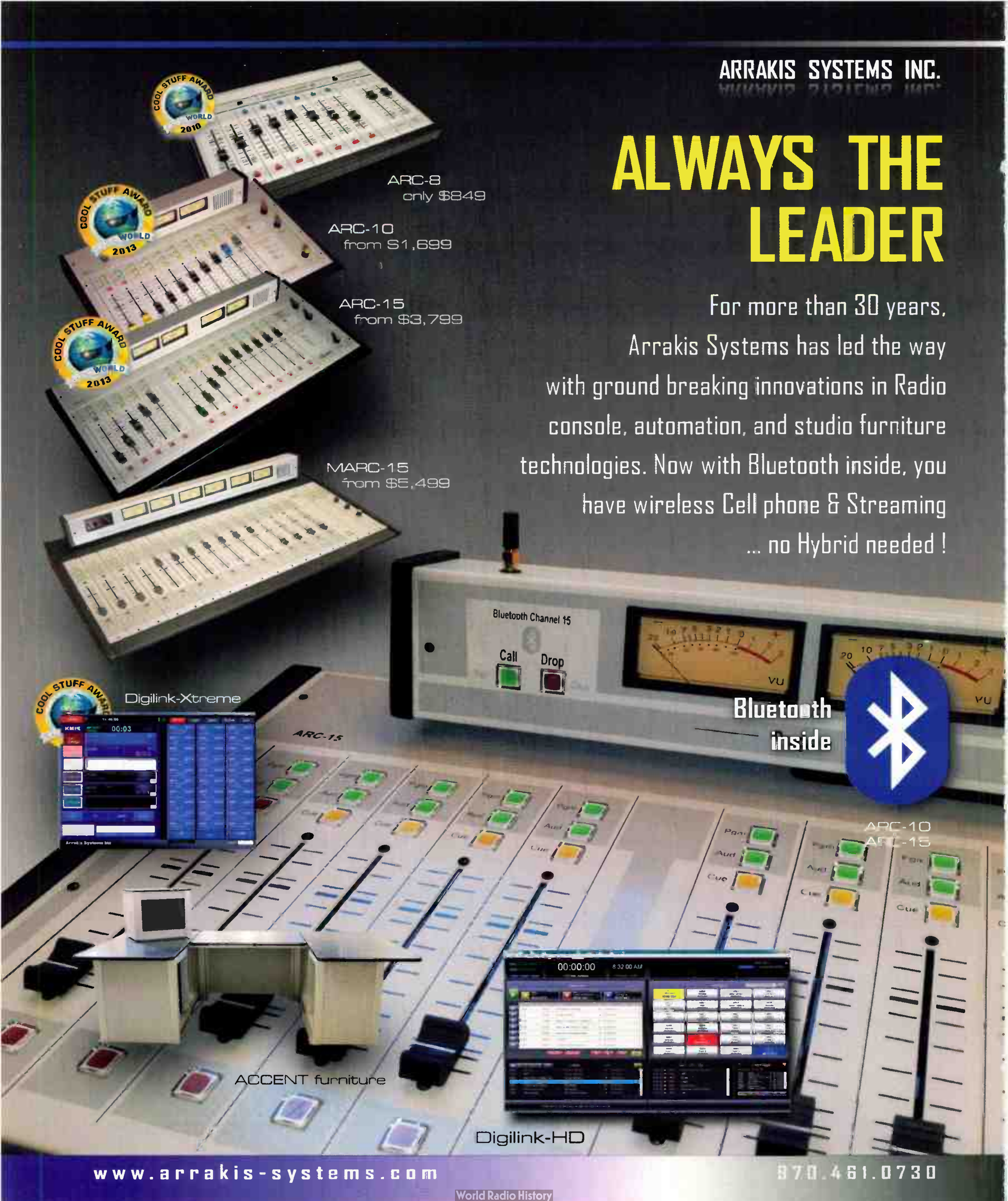
Sample loops are more difficult to measure than base mounted torroids due to their typical locations on the tower. However, the assumption can be made that the loops are all equal, so it comes down to characterizing the lines properly, which on a half-wave tower will not be an easy task. Torroids are easier as a test jig can be created with the station RF as a source, and the transformers all ganged together with a single feed. Remember that when doing this all torroids must be grounded and terminated, otherwise damage may occur. The indications by the phase monitor from the torroids must agree within manufacturer specifications, which will probably be 2 percent and 3 degrees.

Lest we think that monitor points are gone forever, the moment method proofs still require reference measurement locations. These locations provide a quick field check on the array, and are to be established on azimuths of pattern maxima and minima. Although they do not need to be regularly measured, the savvy engineer will do so to ensure array health. On each of these radials, at least three locations are to be established. For each location, the measured field strength must be determined along with a description of the location, which will include GPS-derived coordinates with the datum reference specified. The datum reference is important as NAD27 and NAD83/WGS84 will vary by several seconds in the western portion of the United States.

Finally, the array must be recertified every 24 months. The recertification process involves verifying that the torroid performance has not changed. Additionally, the sample lines must be rechecked to ensure that no changes in the length or impedance have occurred. Changes in length or impedance would typically result from damage or contamination. Along with this recertification, the reference field measurements are to be repeated. All of this data is then to be compiled and retained in the public file.

While I must admit I was skeptical of the computer modeling proofs, time has definitely changed my opinion. The commission has put sufficient safeguards in the process to ensure that the methodology is standard and repeatable. Additionally, the inclusion of the reference measurements allays the fears I had of "dry-lab" proofs, and provides an external method of verifying performance in problematic situations. Finally, the recertification process creates a situation where at least every two years an array is rechecked instead of being reduced to a neglected artifact of a bygone golden age.

In the end, the moment method proof should save time and money, even with the recertification process. Any new construction should strongly consider its use, and older arrays plagued with significant re-radiation issues should look into a conversion from the traditional method. I still have a drawer full of log-log paper, but have added the software to perform the modeling. Translation? Another tool has been added to the box, and for a guy like me, that's pretty cool. ⓡ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A reporter works in one of the small production booths.

Overlooking the newsroom from the fourth floor; MOPS and POC 31 are shown on the third floor below.

location for the new building be identified that would allow appropriate telecommunications connectivity and a clear view of the satellite arc.

LOCATION AND FUNDING

The new building is in the heart of a DC neighborhood known as NOMA, for "north of Massachusetts Ave." This neighborhood is undergoing a transformation and revitalization as new businesses move into the area. The site originally housed the historic C&P Telephone building, which dated back to 1927. Part of that building was preserved and integrated into the new construction.

The budget for the project was approximately $200 million. Of this, $165 million came from DC Tax Exempt Bonds and $35 million came from the sale of the old building. $24 million of the budget was allocated to constructing the technology infrastructure within the facility, according to a presentation given by NPR representatives at the 2014 Public Radio Engineering Conference.

CONSTRUCTION

In 2007, planning for the project began. In April of 2013, following six years of planning and a highly compressed construction schedule, the first broadcasts from studios at NPR's new 1111 North Capitol Street headquarters went live. Just prior to that, operations of the satellite system were migrated to a newly constructed NOC in the building, and approximately 300 of the 800 staff had been moved to their new offices. The new building will house the current staff with room for future expansion. A key requirement during the build and move process was that there be absolutely no disruption in services to stations or staff. This was no small task for a facility that provides 24/7 programming to nearly 900 stations.

The new building is seven floors and approximately 331,000 square feet. The first floor features a large lobby area, conference room, multi-function space (which features a Lawo MC²66 console and can be used as a fully equipped studio), a cafeteria, and a brick-and-mortar version of the online NPR Shop. On the second floor is the satellite distribution division, including the NOC and the main tech core. The third and fourth floors house the newsroom and studios. A large open area spanning the two floors overlooks the news bullpen and "MOPS" (Master Operations Production Support) — the replacement for "master control." The fifth through seventh floors are dedicated to office space and future expansion.

TECHNOLOGY

One of the largest changes in moving to the new facility was that while 635 Mass. Ave. had been almost exclusively analog (with digital technology "bolted on" over the years), 1111 North Capitol would be digital from the start.

In fact, the 10,000-square-foot "tech core" of the facility, with room for 350 equipment racks, is designed more like a data center than a typical broadcast rack room. Redundant UPS and generator-backed power feeds are distributed throughout the core; large HVAC systems and a robust network switching architecture ensure maximum uptime. This "core" is shared among all technology systems in the facility (IT, telecom, audio engineering, satellite distribution, digital media). There are virtually no punch blocks. The number of coaxial cables has been minimized as well. L-Band satellite RF between the tech core and dishes on the roof is carried via fiber. An IPTV system is used to distribute audio and video content throughout the building independent of the main production and distribution systems. Much of the infrastructure wiring was done using pre-constructed harnesses terminated in RJ-45 connectors, and many of the racks were pre-assembled and tested off-site.

The distribution division's NOC supports the Public Radio Satellite System and other commercial satellite clients.

MULTIPLE GROUPS, ONE MISSION

Like many organizations, NPR has multiple groups under one roof. The audio engineering group is responsible for all audio production and engineering (in connection with news and other content production groups) while distribution is responsible for getting that audio to member stations via satellite.

Lawo hardware is used on the audio engineering side for all audio routing and production. Redundant Lawo 73 HD routers are used at the audio engineering core with redundant I/O frames throughout the facility. IFB and other control functions are handled with Virtual Studio Manager (VSM) hardware and software from LSB. The various feeds from audio engineering are then handed off to an Axia Livewire based system in the NOC for distribution via satellite.

A unique feature of the NOC, the "Egg Chair" allows some isolation for critical listening.

MOPS, SOPS, POCS, NOC

NPR has some unique terminology to describe its studios.

In past years, an audio engineer was almost always present when content was being produced. Now, however, much of that process has been simplified and the news staff can produce pieces with little or no

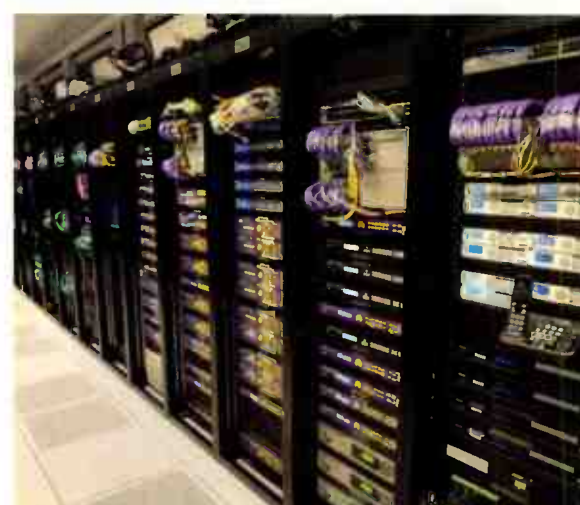
Producer positions in one of the POC control rooms, overlooking the main control position and the studio.

The studio in each POC can accomodate one-on-one interviews, small musical ensembles, or a large number of reporters and guests.

assistance. The small studios that allow this are known as "SOPS" or "Self-Operated" content production studios. There are 10 of these SOPS in the facility (five pairs), each equipped with an eight-channel Lawo Crystal console, which is concealed in the furniture when not in use. Each of these pairs can be operated as two independent studios, or joined for additional functionality. These are the studios used for top of the hour newscasts.
In addition to the "SOPS," there are 6 small "booths" with four-channel Lawo Crystal consoles for basic production such as phone or other remote interviews.

The "POCS" (Program Origination Centers) are larger studios used for producing "news magazine" style programs. At the heart of the POC control room is a Lawo Sapphire 24-channel console and multiple Lawo Nova 17 frames. An audio engineer operates the studio (with additional positions for directors, producers and other production personnel) while the hosts and guests are seated in a separate talk studio. These studios are spacious and can accommodate everything from an intimate one-on-one interview to a small musical ensemble. There are three POCS in the facility.

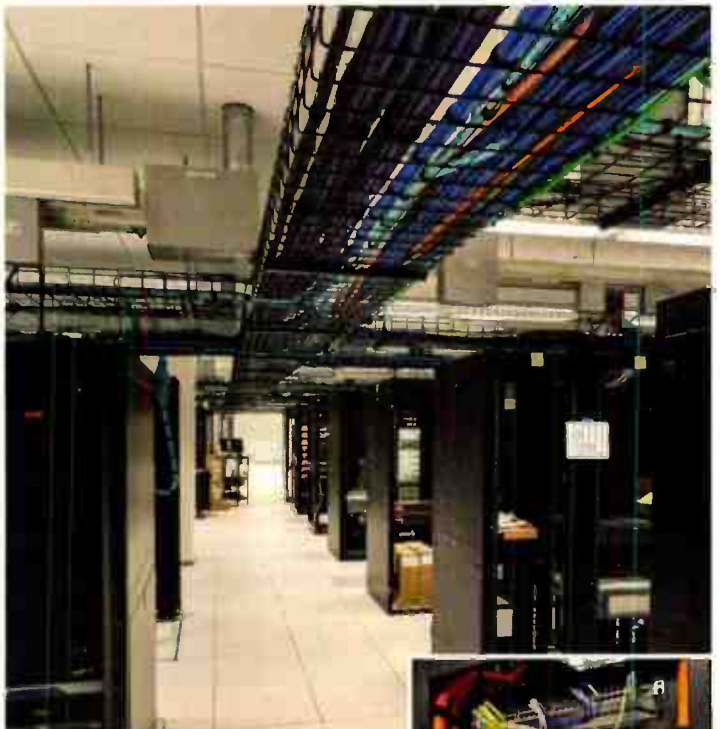
"MOPS" (Master Operations Production Support) is the heart of the audio engineering and production side of the house. This critical position supports all of the audio content production. Here,



Banks of audio codecs and audio routing hardware in the tech core.

all feeds from the field, and from the studios are monitored and routed before heading off to the NOC for distribution. Large video displays show metering information for all critical paths at a glance. Personnel are available to assist news staff with audio production issues 24/7.

The NOC is the final stage in the chain before the audio heads out to member stations via satellite. Here, the feeds coming from MOPS are checked a final time and monitored during distribution. The NOC is also responsible for other feeds coming from sources outside of NPR to be distributed to member stations.



Tech Core

One of Two Redundant Audio Routers

In the NOC are three workstations for monitoring content distribution, a pair of QC workstations for checking file based content, and a supervisor's workstation. A large video wall gives access at a glance to all RF uplink and downlink parameters, network traffic, video cameras trained on the rooftop dish farm, audio routing and level metering, automation, and a variety of other systems. One of the most unique features in the NOC, however, is the "egg chair," which allows some isolation in order to listen critically to audio when necessary regardless of any other noise in the room.

For over 40 years, NPR has pushed the envelope both in technology and content production. The new facility and its flexible design will allow them to continue this tradition for many years to come.

Efficient Use of Rack Space

by Doug Irwin
CPBE AMD

Rack space is often a very precious commodity at a transmitter site. Naturally one will load up equipment in the front of the rack, but if you think of the rack as a cube, what about the other sides? Can they be used in some fashion? Let's take a look at some ideas on how to get more stuff in a rack and making the best use of that "real estate."

In my very first tech tips, I wrote about using the sides (as some call them, the "cheeks") of a rack for various functions.

When you have racks mounted side by side, it's easy enough to use that interior space by mounting pieces of 3/4-inch plywood on the inside of the rack, oriented vertically. Paint them black to make them far less noticeable. These pieces of wood are great for wire management or facilitating the installation of small devices such as matchboxes, "stick-ons" and the like. The last thing you want to do is waste rack space for those. After the front of the rack, the back is probably the most convenient place to mount other things, but it's obvious that space has to be used judiciously. You can load up stuff in the back of a rack (assuming you bought it with rear rails, right?) but you need to leave a convenient means to reach through and get to the back of the gear that is mounted in the front of the rack. The rear rack rail space has limited uses, for sure. Take a look at Figure 1.


Figure 1: STL With Filter and Duplexer

Notice a couple of things here. First, the rack rails are pushed in far enough to allow for an outlet strip to occupy space at the very back of the rack. The reason behind this is simple: If you push those outlet strips too far in, deeper rack-mounted gear might get in the way of some outlets.Second, you might well recognize the rear end of a Moseley 6000 series STL transmitter in this picture. Since the RF output is on the rear of that unit, it makes sense that related RF components are also in the back of the rack, mounted to the rear rails. What you see in this picture is a 950 MHz duplexer, as well as an ISM band transceiver and injector. Note that there is nothing directly behind the Moseley. In the front of the rack behind the cans of the duplexer is space for either rack blanks or a piece of gear that isn't very deep. They don't physically interfere with one another.

Another item that mounts well on the rear rack rails is an Ethernet switch. From a cable management standpoint, the reason for this is pretty obvious: While almost every device with an Ethernet port has it on the rear panel, the switch generally has all of its ports

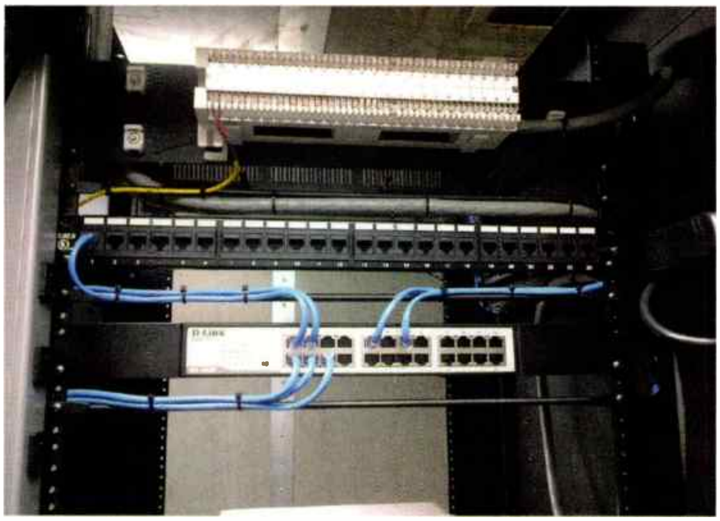


Figure 2: Network Switch, Patch Bay and Krone Block

Figure 3: Four-Port Switch Mounted in the Top of the Equipment Rack

on the front. Putting the network switch in the back of the rack simplifies cable management. See what I mean by looking at Figure 2.

Here you see an Ethernet switch mounted in the rear of the rack. Note that other interconnecting devices such as the RJ-45 patch bay fit nicely in the back of the rack as well. Krone blocks (or whatever your preference is) can easily be mounted to blank rack panels for additional interconnects such as audio and remote control.A common mistake (usually not discovered until later in the build process) is using rack panels that are too large. They invariably block too much access to the front of the rack. Blanks or devices occupying one or two rack units usually work fine and will not keep you from accessing gear mounted in the front of the rack, as long as you space them out. Make sure you can get your arm through the spaces between components mounted in the rear of the rack.

The top of the rack is a space that many don't think of, but it has its uses as well. See Figure 3. In this particular instance, it made sense to mount a four-port RF switch right in the top of the rack. This was part of a project to add a backup transmitter to a site that previously had just a single transmitter. As you can see, a large round hole was cut in the top of the rack, and then the switch was mounted on four bolts. The transmission line ran right above this rack, so all that needed to be done was cut it, add elbows, then attach the elbows to the switch. The four bolts facilitated leveling to align the transmission lines with the switch perfectly. The location of the four-port switch limits the depth for items that are placed at the very top of the rack, of course. The solution is to put items that are not very deep at the top of the rack. In our case, it was a wattmeter panel.

It's typical just to consider racks as two-dimensional devices; but with a little planning, strategy and three-dimensional thinking, you can get a lot more in them.

WE NEED YOUR TIPS

Tech tips may be suitable to earn SBE recertification credits. Send your tips to radio@RadioMagOnline.com.

Zoom H6: Flexible Field Recording

by Chriss Scherer, CPBE CBNT

It's obvious that there is a plethora of handheld, portable audio recorders. Even your handheld device (we used to call them phones) can record audio at a decent quality. So why look at yet another recorder with the Zoom H6? Because this one packs all the expected recording functions into one package, but it adds a variety of input options with multiple mic capsules and input jacks, and allows you to record up to six tracks at once.

At first glance, the recorder by itself looks like many other recorders. It's about as tall and wide as a smartphone, but much thicker. Still, it fits comfortably in one's hand. The bright, color display measures about 1.2 x 1.6 inches. It shows the recording status of the six recording channels with record ready, level setting, lo-cut filter, compressor and phantom power (selectable for 12, 24 or 48 volts), as well as the settings for the current storage folder, recording rate ad bit depth, file name, recording counter, storage remaining time and battery level.

The physical controls and connections are logically placed around the recorder. On the face are four level-setting knobs for inputs 1–4, which include pad switches, six record-ready buttons to arm the recording channels and the transport controls. There are two combo XLR/TRS jacks on each

Zoom H6 With X-Y and M-S Mic Capsules

TOP FIVE FEATURES

- Multiple mic capsules
- Multiple audio input options
- Multitrack recording
- Compact size
- Large, bright display

side (inputs 1–4). On one side is the power button (with function hold), playback volume, 3.5 mm headphone out and the SD card slot. On the other side is the USB jack (for file transfer and remote power), a menu button and a menu select toggle. On top of the unit is a multi-pin connector to attach the various mic modules. The bottom has a 3.5 mm line out jack, remote control jack and two slots for a hand or camera strap. The underside has the battery compartment, speaker and a threaded tripod mount.

The recorder includes two mic capsules (X-Y and M-S) with a wind screen, four AA batteries, a USB cable, a 2GB SD card, a copy of Cubase LE and the operating manual. This is all housed in a compact plastic case.

There are some optional accessories: A shotgun mic capsule, an external XLR/TRS adapter and an accessory pack that includes a wired remote control, a hairy windscreen and an AC adapter.

RECORD ... READY!

Operation is typical for a recorder. I will note that it takes about 20 seconds for the unit to boot and be ready to record. Via the menu, set the various recording parameters for the destination folder, sampling rate, bit depth, the compression (six settings and none are available), the lo-cut filter (selectable from 80Hz to 237Hz in 10 steps) and the recording format. A two-second pre-record can also be set. Once these are set, you'll probably not need to dive into the menu again.

To record, attach the desired mic or input capsule or plug in a favorite mic, arm the tracks (the buttons show a steady red light), set the recording level and press record. The display has individual level meters to show the recording level of each track. The L/R inputs are locked as a pair. The other four inputs can be left as individual tracks, or can be linked in pairs (1/2 and 3/4) by pressing the 1/2 or 3/4 arming buttons together. As you record, if the level exceeds the maximum level, the bargraph of course shows red, but the arming indicators will flash as well. That's good visual feedback that's easy to see while using the unit. When using the L/R input mics, a backup file can be simultaneously recorded at a level 12 dB less than the regular recording. This can save your recording if the audio unexpectedly gets too hot.

To play back, press the menu button, select the folder and the file to hear. The record-ready buttons will light in green to show which tracks have audio recorded on them. To transfer files to a computer, go to the menu and select USB > SD Card Reader. From the computer, there will be folders and subfolders with the recordings. Files will be saved as mono or stereo files depending on the initial record settings.

IN THE FIELD

Because of its multitrack capability, the H6 can be used for much more than simply capturing sound bites. With my field recording work I had two specific uses in mind. I have owned a larger Zoom multitrack recorder for several years, and I still use it frequently. But that recorder is larger than the biggest laptop. Some newer models have a smaller footprint, but you sacrifice simultaneous record channels as the size decreases. Having six channels in a handheld unit appealed to me.

In one instance, I recorded a concert band with my own X-Y mic on the ensemble. That has always worked well. But if there is a soloist or an announcer, the X-Y pair doesn't usually capture enough of them. Rather than set up the large recorder for one or two extra tracks, or run a separate recorder and try to synchronize the files later, the H6 captures it all. I can layer the added track to fill in the final production.

In another case, I recorded a quintet. I also like to use an X-Y on this ensemble, but there are times when one instrument simply overpowers another. With six tracks, I placed a clip-on mic on each instrument to give me the direct sound I needed for a later mixdown.

But what's the use for radio? How about recording a live band in X-Y and adding crowd mics to give it a richer sound? Or maybe even setting the other four mics in a surround setting? Perhaps you need to record a three- or four-person interview. Put a mic on each speaker rather a single mic in the center. Now you can control each speaker's level and reduce some of the unwanted noise the silent guests are making.

The H6 has certainly more capability than many traditional stereo recorders, and it offers the additional functions at an affordable price.

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FIND THE MIC WINNER
OCTOBER ISSUE

Jon Scott
AT&T Services
Danville, California

He won a CBT-500 cable tester from Hosa Technology.

hosatech.com

The mic was hidden in the text on the floor.

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GALLERY

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FIND THE MIC WINNER NOVEMBER ISSUE

Marvin Collins
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He won a USX-110 mic-to-USB interface from Hosa Technology.

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The microphone was hidden in the window above the sign.

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Musings From the Wandering Engineer

by The Wandering Engineer

An industry stalwart that has been in broadcasting since the days of Marconi and Tesla gives his thoughts on the current state of broadcast engineering and the broadcast engineer.

The idea of broadcasting via electronic means was a revolution, sending content to the masses fairly quickly. In the United States, that commercial-based business model launched around 1925, then reached most homes and many automobiles within a decade. Adding a broadcast service with pictures came into its own in the 1950s in the form of television, roughly the same time most of today's working broadcast engineers were born. Many classic radio shows moved to TV, but some made the transition better than others. Broadcast engineers struggled to adapt to the idea of "pictures" with radio.

This transition from radio to TV is where the first division among broadcast engineers occurred. For the longest time, most TV stations were attached to radio stations and in some cases newspapers. Broadcast engineers could move between radio and TV if they chose to and had the opportunity to keep up the required skill sets. By the time the Society of Broadcast Engineers was formed 50 years ago, it had become harder to keep up with both fields as the technology between the two became more complex and less similar.

Station owners, vendors and trade magazines specialized in ever-increasing numbers. More SBE chapters became either more radio- or TV-oriented. Educational programs for broadcast engineers split into three pieces: radio only, TV only and "both." In the beginning, "both" was some radio frequency, audio, physical plant and infrastructure, with some regulatory pieces like EAS.

This is where the second division occurred. "Both" began to include ever-increasing amounts of information technology. In the beginning, many broadcast engineers would move between IT and "everything else," but IT rapidly dominated the entire plant; including the distribution channels which were once so RF-oriented that it was the "license" that allowed a broadcaster to broadcast.

No one doubts that the role of IT will continue to grow, but this transition did something curious. IT brings radio and TV back together. Anyone with a Web browser can get content with text, audio or video, more or less at will. There is no big economic or technical difference between the two. Early in this convergence, radio started to send texts and tiny images over the air. Today, the modern radio studio is starting to look more like a TV studio, including cameras to stream video over local cable systems and the Internet.

The strange fact is that radio and TV's differences are far less a matter of technical or economic limits, but one of choice and tradition. A broadcast engineer that thinks they are "TV" or "radio" was probably born in the '50s, and concerned that there isn't anyone in line to take their place.

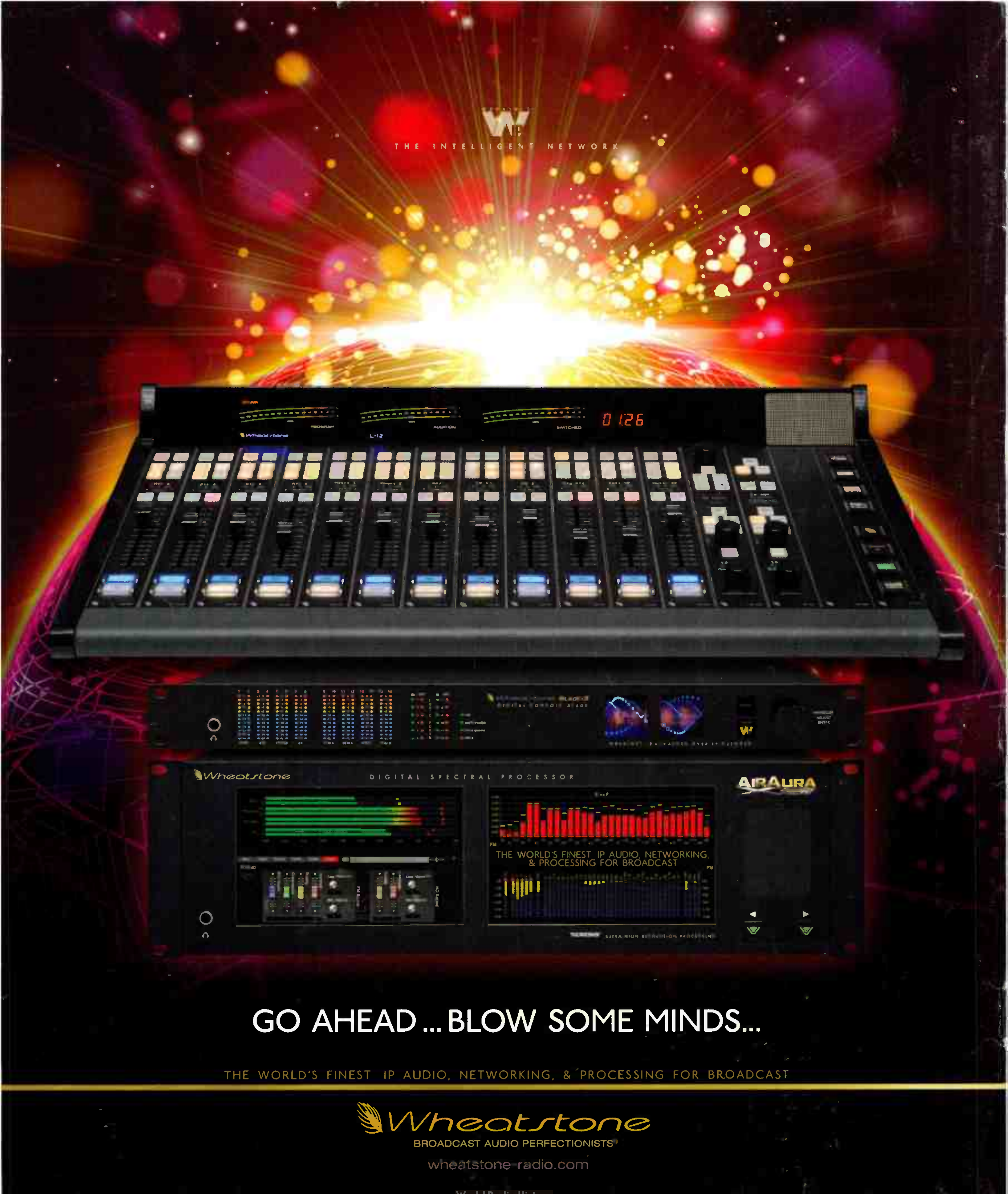
The stations that I work with are all typical. There are broadcast engineers who spend most of their days in front of a computer screen remotely managing the broadcast enterprise; there are others who spend most of their days working on the wiring infrastructure, RF plant and other hardware.

The IT-oriented broadcast engineers are constantly maintaining, rebuilding and moving content or functions from platform to platform. The lifetime of IT hardware is shorter than "traditional" hardware, so maintenance of drives, motherboards, power supplies and the inevitable corruption of key pieces of software is constant. Re-licensing and working with legacy serial connections are time-consuming pain points. Interfacing each new social media or other Internet-based distribution platform into the facility and finding the new app that will be useful and popular for maybe a few days or weeks is the fun part for the IT-oriented engineer.

The infrastructure-oriented engineers do a lot of IT, but someone has to keep up with the signal routing, cooling systems, transmitter sites and all of the other things you can't maintain from a desk. They tend to be older and a lot more concerned with reliability, spares and maintainability.

The interesting thing in my stations is that the IT guys are usually more popular and, frankly, "alpha." Simply put, more resources are put into what is often the IT "toy of the week" than into the rest of the plant. Fortunately, there is little to do in the way of maintenance on the actual RF side with today's transmitters and related equipment. The same story applies for much of the production equipment. When something does go wrong, it's almost always an IT issue and well within any of the engineering staff's capabilities.

The unfortunate fact is that these shifts have left many stations with horrible infrastructure that is so poorly installed and documented that it's nearly impossible to maintain. It's often easier to just to add a new workaround on top of the last workaround than clean things up and document them. To be continued …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