SBE. 50 YEARS 1964-2014

Radio

THE RADIO TECHNOLOGY LEADER

The FM Antenna System

Too often it is treated as set-and-forget

Bright idea.
All of our consoles have LED button lamps. They'll stay lit for — well, practically forever. Let's just say, your kids won't have to change bulbs, either.

Big Shot.
Your station super-sizes everything? No problem; iQ can scale from 8 to 24 faders. Handles even the most zany morning crew, talk show - or anything else you think up.

Control at your fingertips.
See these buttons? You can program them (or the button modules available for Element consoles) to perform routing salvos, system-wide scene changes and more. Because great power requires control.

Smarter phones.
Not only are hybrid controls built into iQ for direct-from-the-board control, the iQ6 phone system connects with just one Ethernet cable.

Network everywhere.
No need for cheesy A/V mixers - RAQ lets you put a networked, professional console anywhere, at a price that'll make the even stingiest GM smile.

Double your pleasure.
Did you know that one QOR.16 console engine will power 2 RAQ or DESQ mixing consoles? Makes your money go further on news bullpens, production pods, ingest stations, etc.

Step to the side.
Dirt and liquids: a console's most hated enemy. Element foils 'em with premium, side-loading conductive-plastic faders: dirt drops past, not in.

Who's da boss?
Clients rave about them, talent loves them: over 5,000 on the air makes Axia radio's favorite IP console.

Built to last... and last, and last.
Element modules are machined aluminum with wear-resistant Lexan inserts for long life. We've even designed custom-molded guides to prevent tears around the fader slot. No "ouchies" here.

Unlimited vision.
Some console makers give you "switched meters" to save costs. iQ does away with that annoyance: high-rez OLED displays meter all 4 buses at once.

A low price shouldn't mean "cheap".
Other companies cut corners on their low-cost consoles. Axia packs in as much as possible. Real conductive-plastic faders, machined-aluminum work surfaces, anodized rub-proof markings, aircraft-grade switches. At a price less than some analog "bargain" consoles.

Rack 'em up.
Turn your Radius 8-fader console into a rack-mount powerhouse. Great for OB vans, performance studios, concert remotes and more.

Good timing.
Unlike those other guys' small consoles, DESQ has an event timer and an NTP-capable clock — built-in, not extra-cost. Because time is money (pardon our pun!).

Small but mighty.
DESQ packs big console power into just 18" square. 6 faders, 2 buses, automatic mix-minus, Show Profiles and more. Perfect for standalone or networked studios.

Axia makes the switch.
No "plug-n-pray" unmanaged switches here; Axia builds our own custom zero-config, built-for-broadcast network switch right into our PowerStation and QOR console engines.

Show-off.
Element lets you store up to 99 Show Profiles - "snapshots" that recall channel sources, bus assignments, EQ settings, even fader positions. So every jock can have their own customized console.

Speak your mind.
Element consoles have comprehensive talkback features. You can talk directly to remote codecs, phone callers, adjacent studios... even individual talent's headphone feeds. Even our most cost-effective boards let you talkback to callers and codecs.

Available in small, large, and OMG.
Whatever size console you need, Element can handle it, from 4 to 40 faders in single or split frames Huge selection of standard and motorized modules, too.

Handsome devil.
Our meters aren't just good-looking; they're designed specifically to convey the most information possible at just a glance. And Axia consoles support VU and PPM metering styles - something you might not find on consoles that cost a lot more.

Big power, small price.
Radius loads you up with 8 faders, 4 mix buses, automatic mix-minus, onboard EQ and voice dynamics and more — for just $5990 USD. Shh... don't tell the accountants.

CHOOSING AXIA FOR YOUR NEXT CONSOLE IS EASY.
SELECTING ONE MIGHT TAKE AWHILE.

When we introduced AoIP to radio in 2003, some folks thought we were off our nut. Today though, broadcasters agree: picking Axia is the right choice. With over 5,000 on air daily, broadcasters have voted Axia the world's most popular networked console.

Who can blame them? Axia fans say that Livewire™ networking is the most intelligent, flexible IP-Audio system in the industry. And that our huge number of partners, with over 75 broadcast products from phones to transmitters that connect to Axia networks, makes life much simpler. They also appreciate our 5-year warranty and 24/7 technical support (not that they need it).

In fact, we calculate that thanks to our huge selection of frame, module and mixing engines, there are at least 32,209,982 different ways to order an Axia console. With that many options, you'd better get started now! Mmm... don't you just love that new-console smell?

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TABLE OF CONTENTS

FEATURES

COLUMNS

DEPARTMENTS

Cover photo by Martyn Gregory, Shively Labs.

Six Remotes in every Box

2013 Pick Hit Radio

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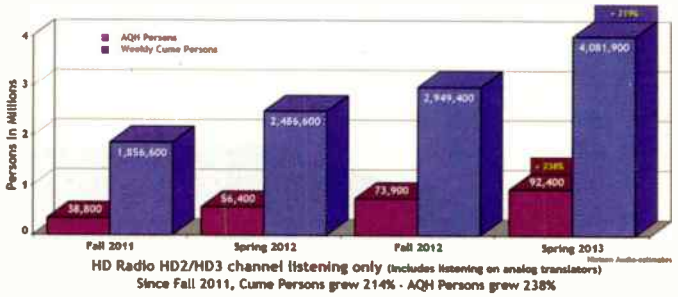
iBiquity: HD Radio Broadcast Services Grow Across North America

iBiquity Digital has announced growth in audiences in the U.S. in addition to digital broadcast services in Mexico and Canada.

According to the latest Spring 2013 Nielsen Audio Nationwide audience estimates, more than 4 million people listen to an HD2/HD3 channel in an average week. This represents a 238 percent increase in average quarter hour audience from the fall 2011 survey. During the same period, cume audience (the number of unique listeners) grew more than 200 percent. These audience figures include those listening to analog translators fed by HD Radio streams.

Currently there are 1,475 HD2/HD3 programs offered by digital broadcasters.



HD Radio HD2/HD3 channel listening only (Includes listening on analog translators)
Since Fall 2011, Cume Persons grew 214% - AQH Persons grew 238%

Kim Sacks Joins National SBE Board

Society of Broadcast Engineers President Joe Snelson, CPBE 8-VSB, announced that Kimberly Sacks, CBT, has been appointed to the national board of directors of the Society of Broadcast Engineers. Sacks works for CBS Radio in Washington, and lives in Hollywood, MD. She has been a member of the SBE since 2007.

Sacks fills the unexpired director's term of Andrea Cummis, CBT CTO, of Roseland, NJ, who was elected treasurer of the society earlier this year. The board term runs through October 8, 2014. The appointment was made by the society's executive committee.

NATE Unveils Gin Pole Guidelines Safety Resource

The National Association of Tower Erectors (NATE) unveiled a new safety resource for utilizing gin poles in the telecommunications industry. The objective of the NATE Training Guidelines for Working on Communication and Similar Structures with a Gin Pole and Associated Equipment document is to provide minimum worker training guidelines that are required for gin pole use for work relating to the installation, alteration and maintenance of communications structures.

The NATE Training Guidelines for Working on Communication and Similar Structures with a Gin Pole and Associated Equipment is available online as a free resource for member companies in the member login section of the NATE website. It is also available for purchase in a print to members and non-members.

NewBay Purchases Select *Broadcast Engineering* Assets

NewBay Media has acquired select assets of *Broadcast Engineering* - both U.S. and World editions - from Penton Media, including the brand's Web assets, trademark and subscriber lists. *Broadcast Engineering* will join NewBay Media's extensive portfolio of television and video information resources, including *Radio, TV Technology, TVB Europe, Next TV, Broadcasting & Cable, Multichannel News, Video Edge, Digital Video, Government Video* and the *Creative Planet Network*.

HD Radio
Pure Digital. Clear Radio.

iBiquity reports that HD Radio data services are on the rise. There are now more than 500 stations across the nation supporting Artist Experience on more than 900 digital radio streams.

Orban has scheduled dates for its 2014 Mobile Broadcast Laboratory. Stops include Buffalo, NY, Chicago, Dallas and Toronto.

The NAB has purchased New York's CCW and Satcon. The acquisition extends NAB events to serve two unique markets.

Yamaha is acquiring Line 6. It will operate as a wholly owned subsidiary.

FIND THE MIC WINNER
NOVEMBER ISSUE

Jeffrey Trunzo
Chief Engineer of Keymarket of PA
Brownsville, PA

He won a USX-100 USB-to-mic interface from Hosa Technology.
hosatech.com

The mic icon was hiding on the edge of the tree line.

The winner is drawn from the correct entries for the issue two months prior. No purchase necessary. For complete rules, go to RadioMagOnline.com.

FIND THE MIC AND WIN!

Tell us where you think the mic icon is placed on this issue's cover and you could win Hosa CBT-500 cable tester. Send your entry to radio@RadioMagOnline.com by February 10. Be sure to include your guess, name, job title, company name, mailing address and phone number. No purchase necessary. For complete rules, go to RadioMagOnline.com

ROC YOUR WORLD

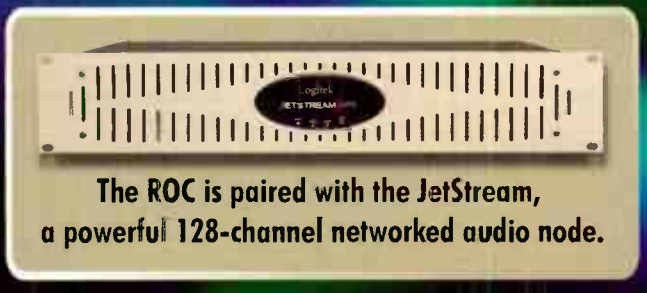
The new ROC console from Logitek

When Logitek introduced its first ROC console back in the 1990s, it marked a revolution in audio console design. One of the industry's first router-based digital consoles, the original ROC boasted simple wiring and access to multiple sources at each fader.

Over the years, the router-plus-console Networked Audio concept has become the standard in console architecture. Although the original ROC was retired years ago, Logitek has continued to develop systems for both TDM and AoIP audio networking. The new ROC takes the best of the original design and pairs it with the latest technology and styling.

Available in multiples of 6 faders (up to 24), the ROC is housed in an attractive tabletop enclosure. Durable Penny & Giles faders, OLED source indication and intuitive controls make the ROC a natural for on-air, production rooms or even in temporary studio setups. Two monitor feeds, front panel headphone connection and user-assignable softkeys will please even your fussiest operators.

Call today or visit our website for more information.



The ROC is paired with the JetStream, a powerful 128-channel networked audio node.

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VIEWPOINT

Resolutions You Really Can Keep

As the end of 2013 approached, you, like everyone, probably thought of some new-year resolutions. The usual ideas relating to personal health are always good, but they are usually the resolutions that are quickly broken. Even the easiest (or so we think) resolutions are often cast aside by the third week of January.

But there has to be something you can do to improve yourself. We shouldn't just wait until a new calendar is placed on the wall, but it's as good a reason to start as any. Here are three items you can put on your list that you should be able to keep.

Take a class. It's probably been a while since you took an actual class, but it's never too late to do so. And there are plenty of classes available from a wide variety of sources. Even a class in something you already know (or you think you know) will have some benefit. Even if the topic isn't electronics, or computer networking, or RF, going to school stimulates your thinking. Learn a foreign language. Take art appreciation. Attend accounting 101. If it applies to your daily career in radio, all the better. If you take the class only for yourself, that's a perfectly good reason as well.

Your local community college, adult education center and extension office, professional training centers and the Society of Broadcast Engineers are just a few of the places to look. But take a moment and look. And register for a class today.

Become certified. You know I'm active in the Society of Broadcast Engineers, and I support the SBE Program of Certification. But there are other professional certifications that apply to what we do in radio. Certification is an easy way to demonstrate an understanding of a particular area of expertise. Your work experience and credentials alone are part of your curriculum vitae, but having a professional certification shows that someone else has evaluated your skills.

I'm sure you reviewed the results of our annual salary survey from the October 2013 issue. In every survey we've conducted over the decades we have compared the salaries of those who hold SBE certification and those who do not. Those people who hold SBE certification on average earn more than those who are not certified. While simply obtaining the certification won't ensure a salary increase, it shows your employer you are actively involved in bettering yourself. And once you obtain the certification, be sure to notify your employer.

Learn to speak manager. There are some engineers who excel at speaking manager. Or sales. Or programming. You have no doubt seen that when you retell the story of how you prevented hours of off-air time by finding and repairing the forgotten air flow switch before it failed completely, others in the station may appreciate your enthusiasm, but likely have no idea what you're saying as their eyes glaze over. This doesn't mean don't tell the story. By all means, show your value to the station and the team by showing the results of your work and how they helped the bottom line or the ratings.

If someone wants the full explanation, share it. But learn to speak the language of those in other departments. They'll appreciate and understand the effort even more.

Save the nuts-and-bolts explanation for the next SBE meeting.

Chriss Scherer | Editor

Radio
THE RADIO TECHNOLOGY LEADER

January 2014 | Vol. 20 No. 1

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Member: American Business Media

A NewBay Media Publication

NewBay Media, LLC
28 East 28th Street, 12th floor
New York, NY 10016

SUBSCRIPTIONS: Free and controlled circulation tc qualified subscribers. Customer Service can be reached at: newbay@computerfulfillment.com or by calling 888-266-5828 (USA only) or 978 667-0352 (Outside US) or write us at Radio Magazine, P.O. Box 282, Lowell, MA 01853, USA Back issues are available by calling customer service.

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Radio, Volume 20, Number 1, (ISSN 1542-0620) is published monthly by NewBay Media LLC, 28 East 28th Street, 12th floor, New York, NY 10016. Periodical postage paid at New York, NY and additional mailing offices. Postmaster: Send address changes to Radio, PO Box 282, Lowell, MA 01853.

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Amping the AM Service

by Lee Petro

In September, the FCC sought comment on a bevy of proposed rule changes intended to revitalize the AM broadcast service. With comments due Jan. 21, 2014, and reply comments due Feb. 18, 2014, here are the major proposed rule changes.

Exclusive FM translator window for AM Stations: The NPRM proposes the opening of an exclusive filing window to provide the opportunity for AM licensees to file for a new FM translator to pair with an existing AM license. The FM translator would run with the AM station and could not be assigned separate from the AM station with which it is paired.

The FCC noted that the exclusive filing window raises questions whether it provides an unfair opportunity for AM licensees to the detriment of other broadcasters, and sought comment on the impact of the exclusive filing window on the future availability of spectrum for LPFM and FM translator windows. Finally, the FCC sought comment on whether the creation of a limited filing window would eliminate the need for "Matoon" waivers, conserving limited FCC staff resources.

Modification of Community of License Coverage Standards: Next, the NPRM sought comment on proposals to relax the community of license coverage requirements for daytime and nighttime facilities of an AM station. Currently, the daytime AM facilities must serve 80 percent of the community with at least a 5mV/m contour, and the nighttime facilities must serve 80 percent of the community with the higher of its 5mV/m contour, or its nighttime interference-free contour.

The FCC noted that many existing AM stations were licensed with facilities that may no longer serve their community of license due to changes in population and changes in community boundaries. On the other hand, the FCC is interested in maintaining viable service to communities, and new and community of license change applicants have the ability to design its facility with available tower sites, whereas minor change applicants do not have the same level of flexibility.

Thus, the FCC wants to reduce the daytime coverage requirements for existing licensees, so that, in the event of a minor change application is filed, it must only specify daytime coverage to 50 percent of the population or area of the community, but new and community of license change applicants must continue to show 80 percent coverage. It also proposed to eliminate the nighttime coverage requirements for existing AM licensees, and require only 50 percent coverage for new and community of license change applications.

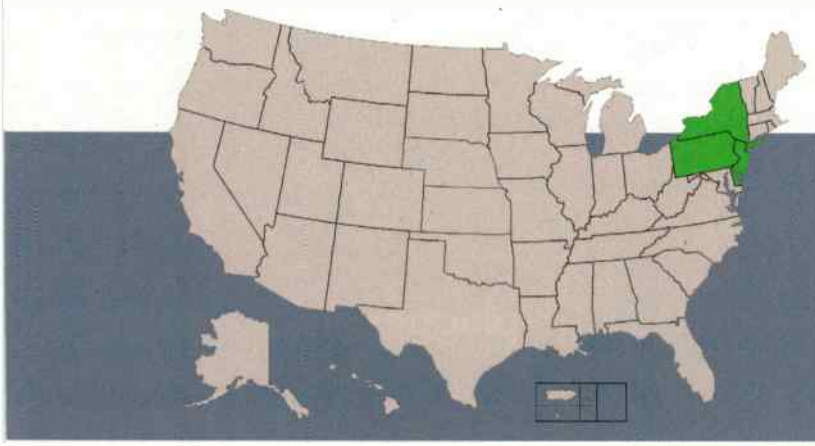
Elimination of the AM Ratchet Rule: The last time the FCC attempted large-scale revision of its AM technical rules, it adopted a requirement that AM stations reduce its interference should it seek to make other modifications. While the rule was intended to reduce the overall interference in the AM band, the FCC noted that approximately 60 percent of existing AM stations were effectively frozen at their current site locations and patterns, else they be required to reduce their power.

Thus, the FCC proposed to eliminate the ratchet rule, but raised a number of questions to determine how this rule revision could be made. The FCC also sought comment on whether there were any aspects to the rule that should remain in place, and, if so, what specific modifications could be made.

Modification of AM Antenna Efficiency Standards: The FCC also sought comment on whether it should reduce the minimum effective field strength values to permit AM licensees to take advantage of shorter antennas. The FCC believes that the use of shorter antennas, in combination with the other proposed changes, would provide additional flexibility for existing AM stations to make modifications, especially those stations operating in the lower frequencies. As such, the FCC is proposing to reduce the minimum field strength values by 25 percent.

Interested parties can either file electronically through the ECFS website, or they may file on paper. In either case, the heading of the submission should reference MB Docket No. 13-249.

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



DATELINE

January: Stations in New Jersey and New York run License Renewal Pre-Filing Announcements on Jan. 16.

February: Stations in New Jersey and New York file License Renewal Application and EEO Program Report, and Noncommercial radio stations file Ownership Report (323-E) on Feb. 3. Commence running License Renewal Post-Filing Announcements, continuing on Feb. 16, March 1 and 16. Stations in Delaware and Pennsylvania commence running License Renewal Pre-Filing Announcements, continue running on Feb. 16, March 1 and 16.

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INOVONICS BROADCAST

Demystifying Impedance Language

by Jeremy Ruck, PE

One of the most fundamental concepts in our profession is impedance. Due to the nuances of the mathematics related to this quantity, the minutia of what is taking place and the associated nomenclature on occasion is sometimes confusing. Although a more rigorous discussion of impedance probably belongs in a textbook, our discussion here will demystify some of the elusive language consulting engineers tend to use.

Nearly everyone is familiar with Ohm's Law, which states that the current through a conductor between a pair of points is directly proportional to the voltage across the two points. When two quantities are directly proportional to each other, we are discussing a division problem. In this case current is equal to voltage divided by a constant of proportionality, or resistance. Rearranging the terms gives three different equivalent forms.

$$I = \frac{E}{R} \quad E = IR \quad R = \frac{E}{I}$$

Resistance is, however, really a special case of impedance. Not only is impedance similarly the ratio between voltage and current, but it is also the sum of resistance and reactance. In other words, resistance can be thought of impedance when the reactance portion is zero. Impedance is denoted by Z, and reactance uses X giving the following two equations, in which the bold-faced variables are intentional. More on that shortly.

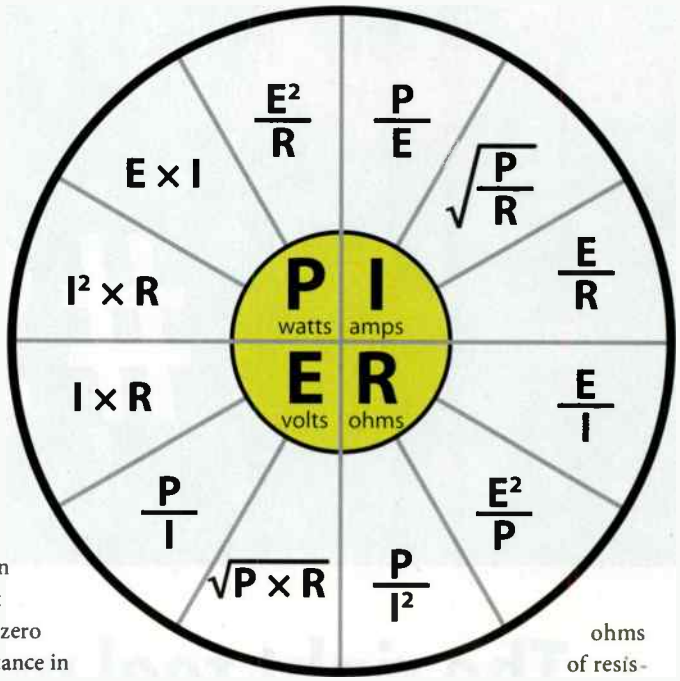
$$Z = R + jX \qquad Z = \frac{E}{I}$$

Reactance is somewhat similar to resistance, although it does differ in certain aspects. Resistance can be considered as the opposition to the flow of current. Reactance differs from resistance in that it is the opposition of a change in the current or voltage depending on the type of circuit element. While resistors dissipate energy in the form of light and/or heat, inductors and capacitors, our reactive elements, store energy in the form of a field. Inductors store energy in magnetic fields, while capacitors utilize an electric field as their method. The energy is stored up during half of the cycle, and returned in the other half. Reactance therefore depends on a signal that varies with time, it is frequency dependent, and is zero in direct current circuits. Reactance in ohms is calculated by the following to equations in which L is inductance, C is capacitance, and f is frequency.

$$+jX = 2\pi fL \qquad -jX = \frac{1}{2\pi fC}$$

The storage of the field results in a shift or phase change in the voltage and current relative to each other. In the inductor, a change in the circuit current induces a voltage that opposes the change in the current. This causes the current in an inductor to lag the voltage. Conversely, the capacitor opposes a change in voltage through the inducement of a current. Therefore, the current in a capacitor leads the voltage. A good moniker for remembering this is ELI the ICE man, where E represents voltage.

Since the reactive elements come in two different flavors, the quantity of reactance comes in two different flavors. Positive reactance is created by an inductor, or combination of components that is inductive, while negative reactance arises from a capacitor or capacitive circuit. So when we refer to a circuit that is "fifty j zero" we are saying 50 ohms of resistance, and 0 ohms of reactance. Similarly, an impedance of "thirty-five plus j five" would be 35 ohms of resistance and 5 ohms of inductive reactance.



In the above impedance equations, the j operator is equivalent to the square root of -1. This makes the reactance portion of the impedance the imaginary portion of the complex quantity, while the resistance portion is the real part. This really is somewhat of a misnomer as reactance is a very real quantity as anyone who has gotten across a charged capacitor realizes. What happens, without going into the really gross mathematics, is to give rise to the phase shift that occurs between the voltage and the current.

To visualize how this all relates, consider two perpendicular lines. These two perpendicular lines form a plane. On this plane, we will assign the x or horizontal axis as resistance, and the y or vertical axis as reactance. The location where the two lines intersect is the zero point where both resistance and reactance are zero ohms. If we move to the right of the vertical axis, then our x or

resistance value increases, while a move to the left is a decrease. Similarly, a move up from the horizontal axis results in positive reactance, or inductive characteristics, while a downward move increases the capacitance.

Note that a move to the left of the vertical axis results in a negative value for resistance. This is of course not a realizable quantity in a passive circuit, but is perfectly acceptable in an active circuit. Incidentally, towers in a directional array where the resistance portion of the drive point impedance is less than zero ohms are negative towers. Negative towers are not always the specter they are made out to be in popular engineering circles, but that is a topic for another day.

Now let us consider a run-of-the-mill impedance value of 35+j50Ω. To plot this impedance value on our plane, we would move 35 units to the right of the zero point, and then move up 50 units. If our impedance were 35-j50Ω, we would still make that 35-unit move to the right, but then would move below the x-axis 50 units. From our point, we can then draw a line back to the zero point, as well as a second line downward to the x-axis. The resulting shape is a right triangle.

On this right triangle, we will assign two additional quantities. The first is Z, which lies along the hypotenuse of the triangle, and is the magnitude of the impedance. The other quantity is denoted by the Greek letter theta (Θ), and is the phase angle between the voltage and current in the circuit.

From high school math, we can find the value of Z, which is determined by the Pythagorean Theorem. The magnitude of the impedance is the square root of the sum of the squares of the resistance and reactance.

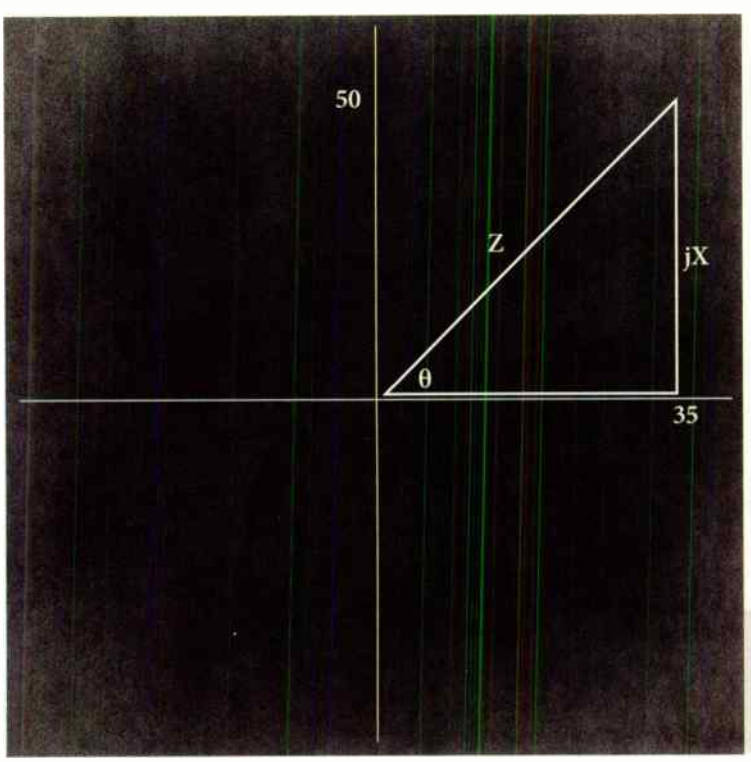
$$Z = \sqrt{R^2 + X^2} = 61.03\Omega$$

The tangent of the phase angle is equal to the quotient of the reactance and the resistance.

$$\tan\Theta = \frac{X}{R} = \frac{50}{35} = 1.43 \qquad \Theta = 55 \text{ degrees}$$

From this, we can see that the impedance can be written in two different notations. While the R+jX or Cartesian notation allows for greater ease in visualizing the magnitude of the two components, the polar or phasor notation consisting of the magnitude and phase angle allows for greater visualization of the phase angle.

In the end, the typical station engineer may only limited contact with a consulting engineer, and perhaps even less contact with antenna designers. That being said, the tip of the iceberg covered here should go a long way in demystifying impedance numbers we sometimes tend to spout. That way when the occasion arises you can confidently say, "I got this."



Ruck is the principal engineer of Jeremy Ruck and Associates, Canton, IL.

FM Antennas: The Silent Component

Too often the antenna is treated as set-and-forget.

By Doug Irwin, CPBE DRB AMD

If you were to consider for a moment the question: "What is the most important part of the transmission system?" likely the first answer you'd come up with is "The transmitter." That's not really true, though, is it? The STL, the transmitter, transmission lines, and the antenna are all equally important. With the failure of any one of those, your station will be off the air. I'll focus on the FM antenna in this installment, and in doing so I'll consider three separate scenarios that would prompt you to buy a new one: the installation of a new main antenna, the installation of a broad-band antenna as part of a back-up system, and a low-power booster (or translator) antenna.

There are many questions to be answered before purchasing an antenna; some are the same no matter which of the three scenarios are being considered, and some are of course specific to the scenario. Here are some common questions:

> What is the required effective radiated power (ERP)?

> What is the available transmitter power output (TPO)?

> What are the necessary downward radiation characteristics?

> What is the necessary polarity (i.e., circular, vertical, horizontal)?

> What is the available space on the structure?

> How high will the antenna be above the ground?

> Will the structure have the strength to hold the antenna in all conditions?

So, as you can see, some amount of research needs to be done even before you issue any kind of a request for quotations. Let's consider these questions in more detail.

Photo by Martyn Gregory, Shively Labs.

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REPLACING AN OLD ANTENNA

The ERP vs. TPO question is easy to answer in the event that you are simply replacing an old antenna, and not changing transmitters. As an example: If you needed 17.5kW TPO for 50kW of ERP (with the old antenna power gain of three, and accounting for transmission line loss) then likely you'll be getting a new antenna with the same amount of power gain and similar physical characteristics, such as the amount of space needed on the tower. In this event you would still want to make sure that the weight and wind-load characteristics of the new antenna are acceptable for the tower, and that the downward radiation characteristics are the same or better than the old antenna.

ACQUIRING A NEW ANTENNA

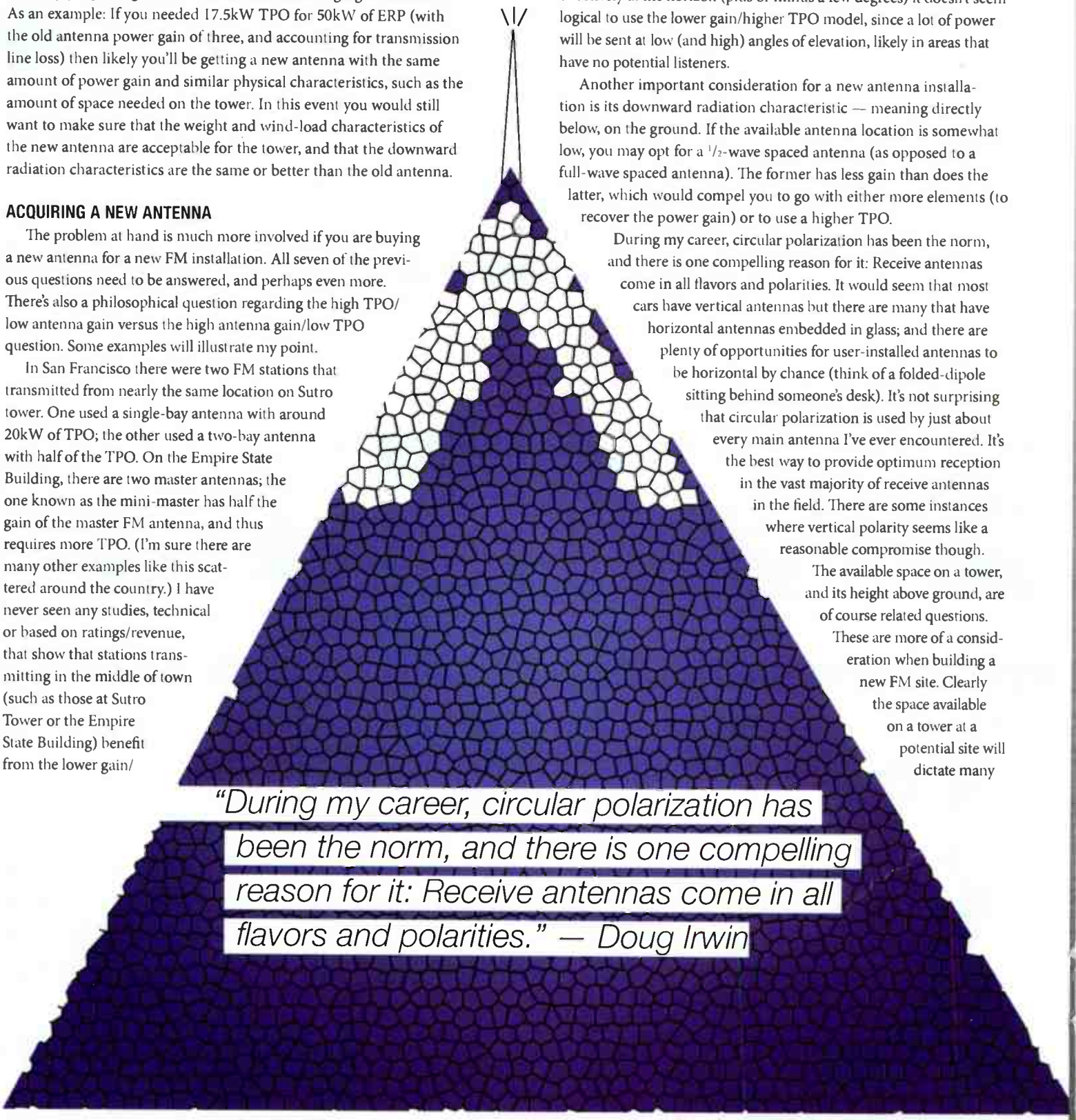
The problem at hand is much more involved if you are buying a new antenna for a new FM installation. All seven of the previous questions need to be answered, and perhaps even more. There's also a philosophical question regarding the high TPO/low antenna gain versus the high antenna gain/low TPO question. Some examples will illustrate my point.

In San Francisco there were two FM stations that transmitted from nearly the same location on Sutro tower. One used a single-bay antenna with around 20kW of TPO; the other used a two-bay antenna with half of the TPO. On the Empire State Building, there are two master antennas; the one known as the mini-master has half the gain of the master FM antenna, and thus requires more TPO. (I'm sure there are many other examples like this scattered around the country.) I have never seen any studies, technical or based on ratings/revenue, that show that stations transmitting in the middle of town (such as those at Sutro Tower or the Empire State Building) benefit from the lower gain/higher TPO model. On the other hand, if your new FM station is to be located outside of town (as most are) and the majority of the audience is effectively at the horizon (plus or minus a few degrees) it doesn't seem logical to use the lower gain/higher TPO model, since a lot of power will be sent at low (and high) angles of elevation, likely in areas that have no potential listeners.

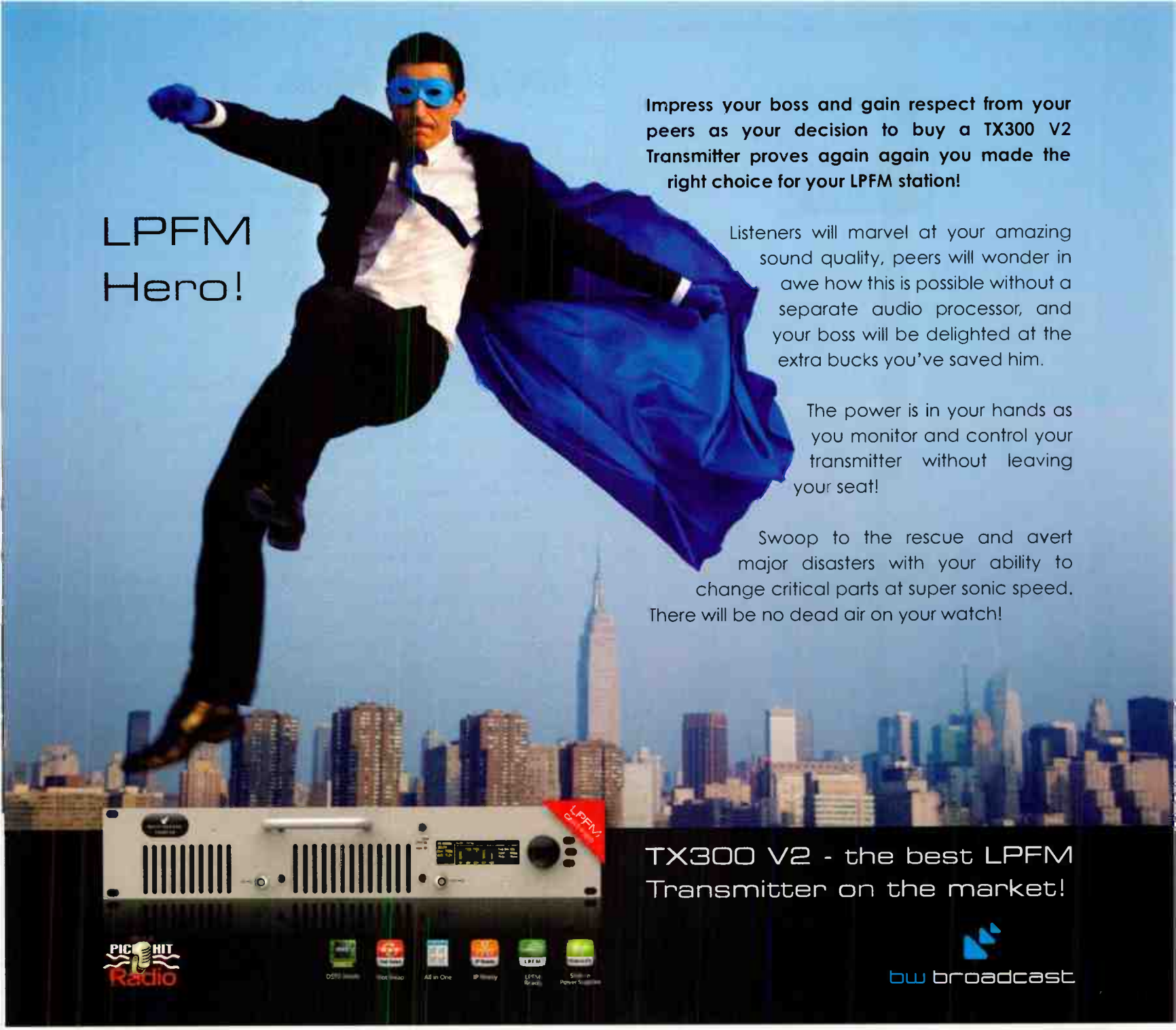
Another important consideration for a new antenna installation is its downward radiation characteristic — meaning directly below, on the ground. If the available antenna location is somewhat low, you may opt for a ½-wave spaced antenna (as opposed to a full-wave spaced antenna). The former has less gain than does the latter, which would compel you to go with either more elements (to recover the power gain) or to use a higher TPO.

During my career, circular polarization has been the norm, and there is one compelling reason for it: Receive antennas come in all flavors and polarities. It would seem that most cars have vertical antennas but there are many that have horizontal antennas embedded in glass; and there are plenty of opportunities for user-installed antennas to be horizontal by chance (think of a folded-dipole sitting behind someone's desk). It's not surprising that circular polarization is used by just about every main antenna I've ever encountered. It's the best way to provide optimum reception in the vast majority of receive antennas in the field. There are some instances where vertical polarity seems like a reasonable compromise though.

The available space on a tower, and its height above ground, are of course related questions. These are more of a consideration when building a new FM site. Clearly the space available on a tower at a potential site will dictate many



"During my career, circular polarization has been the norm, and there is one compelling reason for it: Receive antennas come in all flavors and polarities." — Doug Irwin



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of the characteristics of the antenna that ends up being chosen.

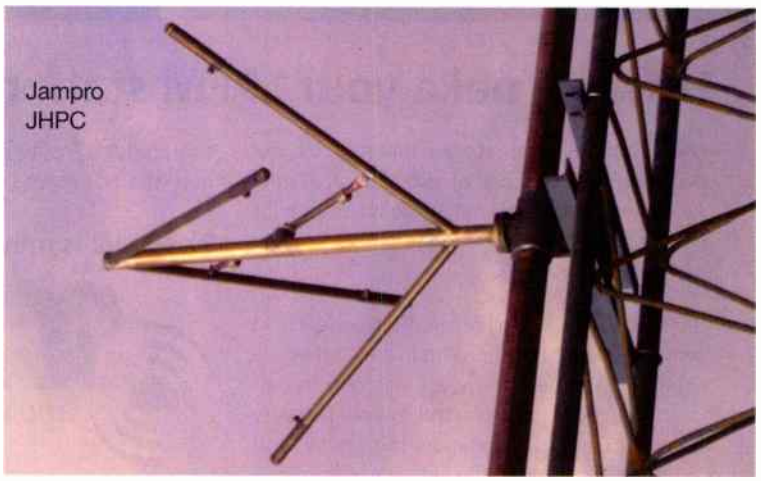
Finally, it makes sense to engage the services of a structural engineer (who is a registered professional engineer) when determining if a tower will safely hold whatever antenna it is you end up choosing. Just about any site lessor is going to make you do this prior to the installation of said antenna; and if he doesn't, you should certainly be concerned about the mechanical viability of the tower in question.

HYPOTHETICAL BUT TYPICAL SCENARIOS

So now that we've discussed the generic questions regarding the purchase of a new antenna, let's look at a couple of hypothetical installations. First, let's say you are participating in the construction of a brand new FM station. The allocation aspects are outside the scope of this article; so let's just say that you've found a potential site (a mountain top outside of town) with two potential tower locations. At one, your ERP will be 55kW; at the other (which has a slightly lower height above average terrain, or HAAT) your ERP will be 57kW. At the higher tower location, 70' are potentially available for your antenna; at the lower location, 63' are potentially available.

I'll present multiple antenna products in this article, and I'll start with ERI. When visiting the website you'll notice an antenna size calculator as well as a chart of antenna gain figures listed by the number of elements and antenna spacing (full or half-wave) for the various antenna types. Starting with the 55kW number, you decide (for starters) to look at a six-bay, full-wave spaced antenna with circular polarization. From the website, you get the antenna power gain figure (3.3028). Divide the ERP by the power gain: 55/3.3028 = 16.7kW (rounding up). The SHP-6 will give a large margin of safety on the input power (16.7kW compared to the 39kW input power rating). 50Ω 3" Heliax will also work in this application; in our hypothetical situation we find we need 225' of the line to reach the transmitter. According to ERI, the efficiency of this line length (at 93.3MHz, as an example) is 93.2 percent; so, excluding any loss attributed to connectors, our TPO is: 16.7/.932 = 17.92kW (again rounding up). Clearly a new 20kW transmitter will be adequate in this case. Also you can see on the website that this antenna requires an aperture of 65', and fortunately that's available on the higher antenna location.

However, it turns out that the lessor for the lower location will charge less, so it makes sense to see if that location will work. As I mentioned earlier, only 63' are available, so the full-wave spaced antenna won't fit. Referring back to the online calculator, we see that the SHP-10AC-HW will give us close to the


Jampro
JHPC

Mike Fitzpatrick/NECRATUS

same power gain. Doing our TPO calculation again: 57/3.126 = 18.3kW (rounding up) is needed at the antenna input. We'll use the same transmission line type and length, so our necessary TPO is: 18.3/.932 = 19.65kW (again rounding up). The aperture necessary for this antenna is 60', so it will fit.

At this point you'll need to decide if the extra height is worth the extra monthly expense. You'll have to consider the cost of the proposed ½-wave-spaced antenna for the lower location as well — it'll likely be more money (since it's a lot more material and there's more labor involved in making it). After deciding on the preferred location, have your FCC consultant calculate the RF levels directly below the antenna to make sure they do not exceed the occupational limits (referring to OET bulletin 65) and have your structural engineering consultant determine whether or not the tower can safely hold the antenna.

Jampro offers the JHPC line of FM antennas, and that is obviously worth looking at in this same application. Its website gives antenna gain figures, so you can do the same set of calculations as shown above. Likewise, Shively Labs offers the 6810 high-power series, which can be seen in detail on its website. Shively offers all the details about this antenna series — the gain figures, along with size and weight, to help you do all the same calculations that were described earlier. Dielectric also offers its DCR-C line.

ANOTHER SCENARIO

Let's look at our second hypothetical scenario. In this case our project is to come up with an antenna that will be used to combine four FM stations in to a common antenna, for purposes of a backup transmitter site. This is a low-to-mid power application; all four stations will have an ERP of around 7kW.

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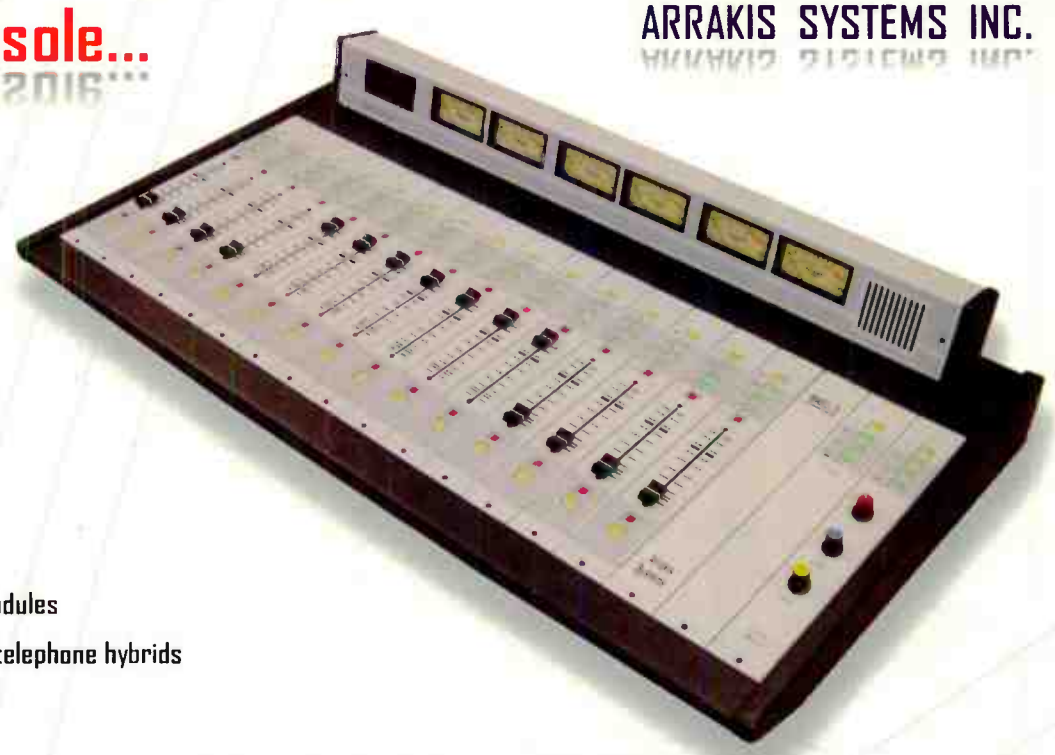

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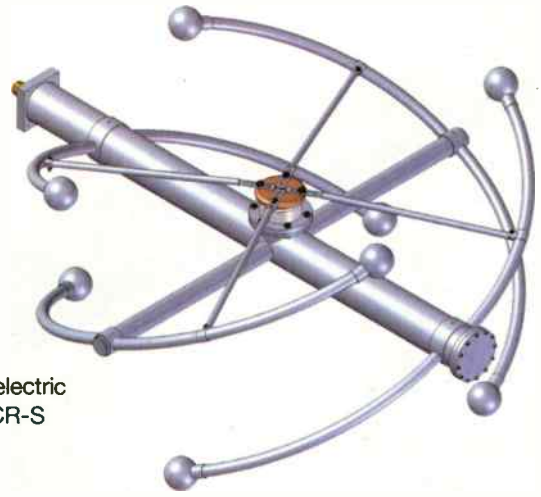
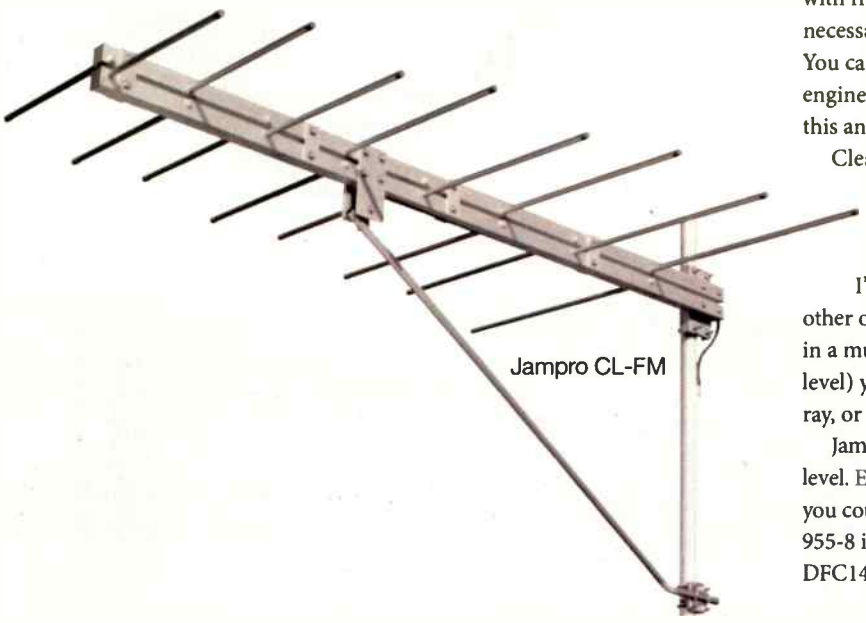


Dielectric
DCR-S



Jampro CL-FM

In this application I'll use the Shively 6832 series. The specs from the website show that the six-bay array has a power gain of 3.024 at 98MHz. (I spoke with Shively regarding this application and was told that the power needs to be limited to 2.5kW per station.) The antenna input is an EIA 1-5/8" flange. A quick check of Andrew HJ7-50A (1-5/8" coax) indicates that it would handle this power at a single frequency. I would seek advice from the antenna manufacturer in this case to be sure that the connector size and the coax can handle the four combined RF signals. Research indicates that the coax length in this case is 150', so again referring to the HJ7-50 data, the efficiency of this line is 93.3 percent at 98MHz. So, after running the same set of calculations we did earlier, we find that we'll need about 2.5kW of TPO. (Since this is a wide-band system, the power we need will vary slightly with frequency.) Again, using data supplied on the website, you can see the necessary aperture is 40.8' and that the recommended space needed is 60.8'. You can also take the weight and wind-load figures to help your structural engineering consultant determine whether or not the tower will safely hold this antenna.

Clearly if you were to plan a system such as this you would need a four-port combiner. One possibility is the Shively 2640-04-1/1. 5kW per input (max) and 15kW through the output (max) seems appropriate in this scenario.

I've highlighted Shively in this hypothetical scenario, but there are other options, of course. As one example, you could opt for the Jampro JPCB in a multiple-element array; or (although it would be overkill for this power level) you could consider a Dielectric DCR-S series wide-band antenna array, or the ERI Rototiller Axiom series.

Jampro makes combiners as well, such as the RCCC-X9X for this power level. ERI is also very well known for its combiners. Again, at this power level, you could opt for the 955-6 (if stations are spaced by at least 1MHz) or the 955-8 if the spacing is down to 800kHz. Options with Dielectric include the DFC14005CIF (for 800kHz spacing). Myat makes combiners as well; at this

power level and with 800kHz spacing, an option would be the CSFMBP8400CZ, which is a four-cavity filter (per station) constant-impedance combiner, for 8kW per station.

Our third scenario involves a different (though still common) type of antenna — the log-periodic array. This type of antenna is an option in (Part 74) booster (or translator) applications, not only because of the gain, but the directivity as well. Often times in booster applications, you will seek to pinpoint the RF power in the desired direction, while keeping it from going where you don't want it to go (to the extent possible). Probably the most well known manufacturer of this antenna type is Scala (a division of Kathrein) and its version is known as the CL-FM. You can mount the CL-FM in either polarity easily enough, and perhaps even more importantly, you can design multiple CL-FM antenna arrays (with the help of Scala Engineering) for custom antenna patterns (varying the power between elements, as well as the phase angle between elements). The CL-FM also comes in a 1kW input version. Scala will also provide power dividers for multi-element arrays.

Just as with the other antennas we've talked about, you'll need to perform the same set of calculations before using the CL-FM. Power gain is five, and Scala's specifications give the weight and wind-load.

As you might expect, Scala is not the only manufacturer of log-periodic antennas: Shively offers its 6025 which can actually handle up to 5kW (7/8" EIA flange on the input); and, Jampro makes a log-periodic that it calls JAVA, also with 7/8" EIA flange, rated at 5kW max.

I've pointed out example products from the big four antenna manufacturers but it's important to remember that there are even more makes, especially in the lower-power categories. While pricing antennas, take a look at these other manufacturers as well: Propagation Systems Inc., Systems With Reliability, Armstrong, OMB, and Scala's parent company, Kathrein.

It's difficult to over-emphasize the importance of the passive elements of a transmission system. There can be many variables that need to be considered when deciding upon the correct one, as we have seen. The antenna is the final, vital link between you and your audience and as such, you should put as much attention and financial resources that you can towards its selection, purchase and installation.

RESOURCES

Armstrong
armstrongtx.com

Dielectric
dielectric.com

ERI
eriinc.com

Jampro
jampro.com

Kathrein Scala
kathrein.de

OMB
omb.com

Propagation Systems
psibroadcast.com

Shively
shively.com

SWR
swr-rf.com

[illegible] is RF engineer/project manager for Clear Channel Los Angeles. Contact him at [illegible]

One Becomes Two

WETA adapts a console to fit

By William Harrison

How do you fit a square peg into a round hole? Well, OK, the peg isn't actually square, it's more of a rectangle. And the hole isn't exactly round, it's a three section wrap-around shape.

This was the case at WETA-FM in Arlington, VA. The air control studio had an 18-fader Studer OnAir 2000 console with audio running through it almost constantly for the last 14 years. There are only a handful of times when audio was not run from this room — when incredibly high winds threatened to break windows; two or three times for electrical work (new transformer, panel tighten down, etc); and a few times for emergency maintenance. Otherwise, it's been a workhorse, getting audio to the transmitter 24 hours a day, 365 days a year. Thanks to a modular design and redundant power supplies, even maintenance was minimally intrusive to the day-to-day operations of the room. Some parts had been replaced through the years, like faders, screens, buttons, input modules and output modules, but others parts such as the main board had seen 14 years' worth of electricity flowing through every capacitor, resistor, and integrated circuit. Intermittent errors and random audio dropouts combined with the fact that replacement parts are very difficult to find made replacing the console a simple decision.

Budgets are tight these days, and therefore options were extremely limited — as in, almost no budget. Fortunately we had one extremely over-equipped edit room containing a 16-fader Axia Element console and all the associated Axia nodes. An assessment of the equipment needed in air control, plus an inventory of available Axia equipment, equaled a quick decision to use an Axia system to replace the Studer.

One of the more expensive items in any buildout is the studio furniture, and this is where we had to get creative. In most cases, the furniture is built for the console, and WETA was no exception. The existing furniture was built for the Studer, which has three sections angled to one another so the operator sits at the center, and has faders wrap around to his left and right. The Axia Element, however, is a large rectangle. We could have just put the Element where the Studer had been, but in doing so would have made things awkward for the operator, and lost valuable counter space for keyboards, monitors, etc.

The solution? Build the console to fit the furniture. The Element was in a 24-position frame — four 4-fader modules, a monitor/navigation module, a production module, a SmartSwitch module, and a blank filler panel. Axia sells smaller frames that can be connected together, but budget prevented us from buying two smaller frames to rehouse the modules. So instead, we took the existing 24-position frame, covered it with blue painters tape, and had a machine shop cut it in half for about $100. This resulted in two 12-position frames, each missing an end panel. And as luck would have it, these two frames were just a bit smaller than each angled side of the Studer.

As additional Element end panels were not readily available, an alternative needed to be found. Since the existing studio furniture uses

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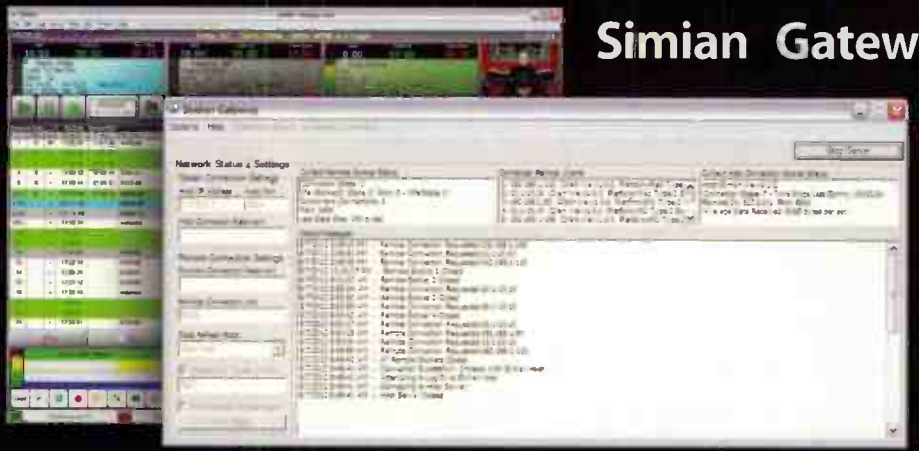

Simian Gateway runs alongside Simian 2.2 PRO to manage TCP/IP communications between Simian Remote clients & Simian 2.2 PRO.

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hardwood edge trim, cherry end panels were custom made for all four ends of the consoles. These were drilled appropriately for screws, and coated in polyurethane.

With the console complete, the audio and GPIO nodes are ready to be installed. We chose a week for the conversion, except there was not a week to be had. Production schedules and deadlines were such that the conversion needed to take place over a single weekend, and the room needed to back on the air Monday morning.

With the nodes programmed and source profiles configured, we ordered cables — one color for audio, another for GPIO — in various lengths for connection to equipment. We also ordered adapters to go from RJ-45 to DB-9, DB-15, and DB-25 for control of equipment (alas, we could not find anything off the shelf to go from RJ-45 to DIN), as well as RJ-45 to screw terminal adapters for miscellaneous use. And finally, we ordered a handful of StudioHub adapters to connect any analog equipment, the reasoning being that soldering a single XLR to a network cable gives you a neat and tidy end product for AES, but having two XLRs hanging off twisted pairs just looks shoddy.

When the weekend arrived, we switched audio and control to one of our production rooms, and double checked that everything was operational.

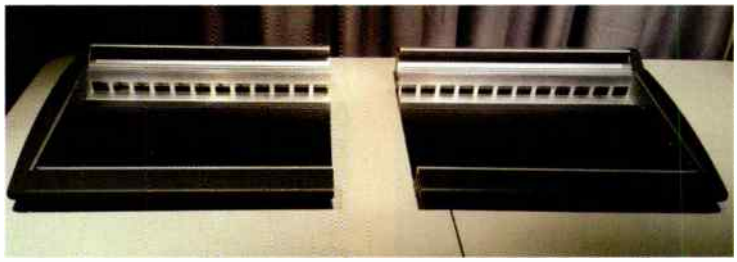
EQUIPMENT LIST

- Axia Audio Element, various Nodes
- Benchmark HPA-1
- BetaBrite Alpha
- Burk ARC-16
- Dell OptiPlex GX620
- DynAudio Acoustics speakers
- ESE analog clock
- Gentner DH30
- HHB CDR-830
- Inovonics Model 510
- Lilliput 10" LCD Screen
- Marantz PMD340
- Middle Atlantic blank panels, rack shelves, vent panels
- NAD 4300
- Neumann TLM103, U87
- O.C. White mic arms
- Radio Design Labs ST-SH2
- Raspberry Pi
- Sony PCM-R500
- Torpey digital clock
- Windtech pop guard

BEFORE AFTER

DISSECTING A CONSOLE

Then we started removing equipment from air control, followed by cutting hundreds of cable ties, and removing nearly a mile of audio and control cable from air control, followed by removing the accumulated debris of 14 years. Bear in mind that each fader of a conventional console needs an audio and a control cable (some channels in the Studer needed six audio and six control cables). In air control, every cable went to a patch panel (including control cables) before going to the actual gear and the rest of the building. In the Axia realm, only a single cable goes to the console, carrying both power and data, so all those existing cables were eliminated. Those patch panels were eliminated as well, as you can configure the Element to allow any source to appear on any fader.



After some rearranging of equipment, we installed the nodes as well as a small fanless Cisco switch for the audio network. The gigabit uplink port of this switch goes to our main Cisco switch in the tech center, carrying all audio and data to and from the room to the rest of the facility, as opposed to the 24 AES cables that were in use previously. Next we pulled cables for audio and GPIO to each device as needed, including a few extras for future expansion. AES cables had XLR connecters soldered on; analog cables were given the appropriate StudioHub adapter, and GPIO cables used RJ-45 to whatever adapters as needed.

Finally, we brought in the console halves, put them in place, and connected them to the Element power supply. Upon power up, everything behaved as expected, and we were able to start finessing the details of the configuration. For this we brought in an on-air host who helped us decide the most efficient and useful fader positions for the most used audio sources. We also locked down a few faders so that only one source would ever be available to it (such as the control room microphone). Add in some cue speakers and a headphone amp (they had been built in to the Studer), and we had a functional studio up and running in very little time.

The primary goal of this rebuild was to eliminate audio problems caused by the Studer; however, we also took the time to simplify things. Gone are two of the four LCD screens in front of the host: weather radar, news service, automation system and utility computer. Instead, two larger screens were put in place for the automation system as well as the utility computer. The news service can be run on the utility computer, and since it is rarely used (we are a classical music station) the decision was made to eliminate the dedicated computer. The weather radar screen is now on the far wall of the room, being driven by a $35 Raspberry Pi computer — no Windows updates, no moving parts and easily replaced.

As I write this, we are still making improvements to the room. The existing copy stand needs to be rebuilt to fit the new console, and the guest positions need to be rewired for use with Axia nodes for cough switches and headphones. But other than that, it is a fairly complete build, and has had very few issues since being put back on the air. Fortunately none of the issues have required any actual downtime of the console or the room.

In summary, I don't think a project like this is possible without prior planning, having a backup plan, and the flexibility of an audio over IP system. Without all three of these, this would have taken much longer, and be much more complex.

Harrison is assistant chief engineer of WETA-FM, Washington, DC.

BEFORE

AFTER

More on Remote Controls

by Doug Irwin
CPBE AMD DRB

Last month I was lamenting the fact that Burk IP-8 panels for the Burk ARC-16 are no longer available, and I suggested a method to roll your own equivalent. I have an example to share.

To roll your own, simply convert the open collector outputs from the ARC-16 to relay outputs as an example. Dennis Sloatman, my boss here in Los Angeles, came up with a great way to do this. Automation Direct makes panels with 16 relays that can be mounted to a rack panel via DIN rails, and pressed in to service easily enough. It works great in place of the relay portion of the IP8 panels. Best of all, the cost is only about $133. Automation Direct also sells a cable that gets you from the panel connector to a pigtail; just solder the pigtail connections to the DB-37.

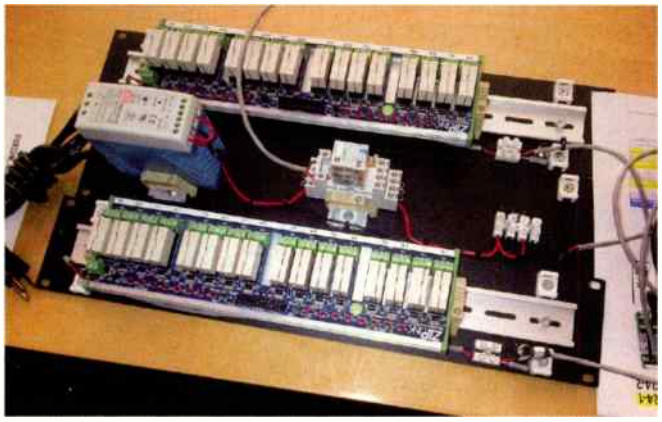


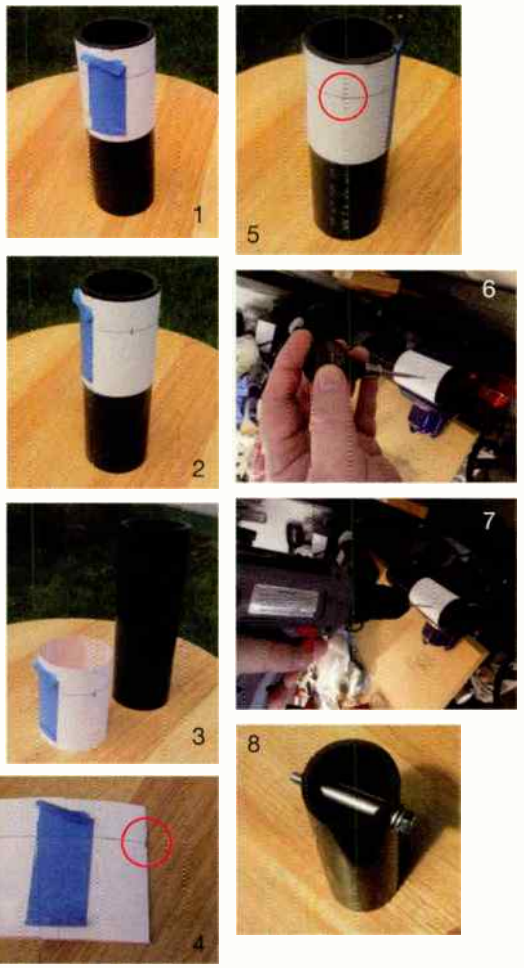
Figure 1. Two Automation Direct relay panels ready for service.

There is one very import caveat that you need to be aware of before you deploy any ersatz IP-8. If you are an ARC-16 user you know that the relay outputs do not close for any other reason except being commanded to do so by the front panel buttons, the ESI, or via AutoPilot. This is also true when applying power to the unit. If you use an outboard relay panel, be absolutely sure that there are no unexpected relay closures from your panel when either power-cycling the ARC-16, or your panel itself. Try all the combinations.

Figure 1 shows an array of three 2RU rack panels (constructed by my colleague Jerry Burnham). The top and bottom rack panels are each holding one of the Automation Direct ZL-RRL16-24-1 panels. The middle rack panel has a relay that is energized by the ARC16's 11V output (that formerly went to an IP-8 panel) and it supplies 24Vdc to the relay panels; therefore, this relay must be energized (from the ARC-16) before power is applied to either of the relay output panels. This is our protection against unexpected relay chattering on either of the 16-relay panels.

DRILL A STRAIGHT HOLE

A drill press and drill jig makes drilling a hole straight through a pole or mast a simple task. The jig holds the pole in place, and the drill press, by nature, places the bit perfectly centered on the round object. But if you don't have access to a drill press and jig, trying to drill that same hole by hand rarely results in a directly centered hole. *Radio* magazine Editor Chriss Scherer was presented with this obstacle while fabricating some mounts to use on standard speaker stands. He had the ABS pipe and the mounting hardware, but he did not have a drill press. Here's the method he devised to ensure a clean result.



Take a strip of paper longer than the circumference of the pole. Scribe a line across the paper. Wrap the paper around the pole and secure it with tape (1). Make an intersecting mark line with a pencil (2) , then remove the paper strip from the pole without removing the tape (keeping the paper in a loop) (3). Flatten the paper strip along the intersecting mark (4). Make another mark along the opposite fold. Put the paper back on the pole with the marks in the desired location of the holes to be drilled (5).

Using an awl, dimple the pole on the two marks on either side of the pole to prevent the drill bit from wandering (6). Chriss placed the pole in a partially opened vice to provide a stable platform. Drill a pilot hole on each mark through the paper (7). Expand the holes on both sides to desired size.

The result will be a hole drilled directly through the center of the pole (8).

Irwin is RF engineer/project manager for Clear Channel Los Angeles. Contact him at doug@dougirwin.net.

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Studio Design: The Furniture

The first thing in the room shouldn't be the last thing you think about.

By David Holland, Omnirax

Admittedly, as furniture builders we're biased, but studio furniture clearly is one of the more important decisions facing those involved in outfitting a single studio, a suite of rooms, or an entire facility.

Furniture design and implementation is much more than providing a surface to hold up a console and some microphones. Done well, it supports the financial, strategic and personal goals of station ownership and management. Done poorly, it can affect sound quality, installation and maintenance costs and of course, company morale. It is the goal of the following discussion to highlight the role furniture plays in bringing quality radio to the airwaves, and a framework for making effective decisions about furniture design.

FINANCIAL, STRATEGIC AND PERSONAL

In many studios, furniture is one of the main capital expenses after the console itself. Given the nature of the business, and even accounting for the rapid pace of change, in some cases it must be rugged enough to withstand the rigors of 24/7 use, with a life expectancy of a decade or more. And along with the cost of the furniture itself come those of assembly and integration.

The shape, the look and the functional design can go a long way towards advancing a station's strategic goals. While the equipment and technology is at the heart of any operation, the furniture is the first thing advertisers, sponsors and talent see when they tour a facility. Purpose-built furniture is more efficient to work at and matching quality electronics with quality furniture attracts quality talent. This can be achieved through color scheme, consistent thematic design, advanced materials and precise fit and finish.

Everyone involved in the station has a personal stake in the furniture. Station owners must feel they are getting value for their investment. Engineers – often responsible for assembling the furniture, installing equipment and maintaining the whole system – are the most directly affected by the furniture's design. And of course, talent, board ops, producers, screeners and guests are all directly affected by the ergonomics of the furniture layout.

NEW CONSTRUCTION, REMODEL OR RETROFIT

Naturally, the nature of the project has a direct impact on the approach to furniture. New construction can be a station owner's dream or his worst nightmare. It presents an opportunity to get it right the first time, avoid problems created by a legacy environment, and take advantage of today's technologies and manufacturing efficiencies. But with the high cost of construction today, it raises the stakes in favor of careful planning and forethought. Thinking ahead about sound and sight lines, multi studio interaction and the omnipresent need for wiring interconnectivity will pay dividends all the way from a project's inception through to its completion.

Building a larger facility with multiple stations and a large complement of support studios affords the opportunity to purchase production furniture by right-sizing the studios. Scale can also work towards customized furniture at near production prices. Nearly all

furniture manufacturers use CAD/CAM production methodology – driving down the costs of replication, mirroring or minor variations from room to room.

Smaller facilities present their own challenges as studios often tend to need to support multiple functions – on-air, production and interview all sharing the same space.

A station or studio remodel is a chance to correct the mistakes of the past, get more stuff in less space (today's studios tend to be smaller) and/or repurpose an existing space to accommodate new technology.

Lastly, a retrofit can be precipitated by new equipment, new management or a change in format. The new furniture must fit existing space, wire runs and sight lines. From a furniture design standpoint, it's the equivalent of playing the hand you're dealt and this is often the case.

Each of the above cases requires cohesion among the project manager (engineer, owner), architect, landlord, contractor and the furniture designer. Managing this team well will make for a successful project.

10 QUESTIONS

Being asked to design and build hundreds of studios a year has led us to a relatively straightforward, detailed and efficient process in the design of a studio or space. These questions or talking points come into play regardless of the scope of the project or size of the budget.

1. Do you have a drawing? Furniture design is about marrying function with space. It all starts with a drawing or floor plan; from a sketch on a napkin to CAD of the building – they all work and provide the canvas for what follows.

2.What is the function of the room or rooms? On-air, production, talk, or a hybrid/combination – the function of a space will often drive the layout of the furniture. So too, will the way a suite of rooms work together.

3. How many people will be in the room and how do they relate to one another? As computers continue to get more powerful, the impact of equipment upon furniture size diminishes. Unfortunately though – people seem to be getting larger, therefore – the number of people and how they interact in a studio tends to be a significant determinant of the size of the furniture.

4. What does each person have in front of him? Console, monitors, keyboards, paper, etc. all must be factored into a considered layout.

5. Where are power and data coming from? Access points for wire entry will often be a constraint upon furniture design. Naturally, from anywhere under the floor is the preferred answer, but more often than not, this is not the case.

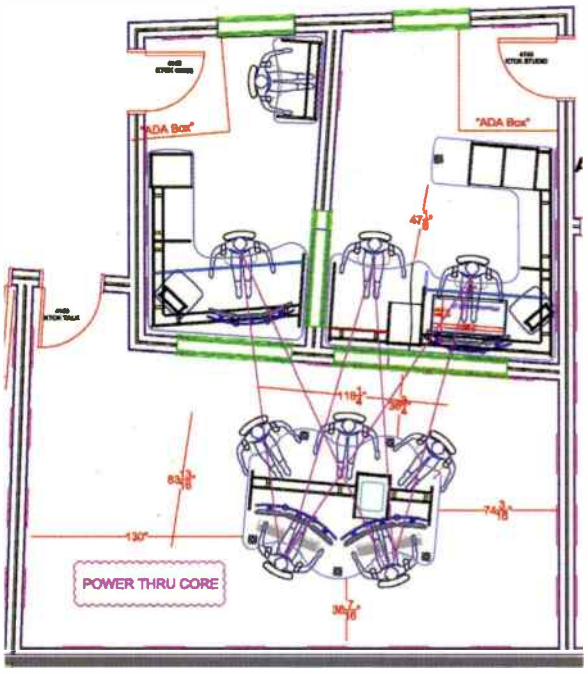
6. If there's a console, how big is it, and does it penetrate the countertop? The console is many times the focal point. Its size and construction will drive placement, proportion and wire runs.

7. Is this studio sit-down or stand-up? Our standards are a countertop height of 29.5" and 36" respectively. We've built everything in between and up to about 44".

8. How many equipment racks and how much storage space is required below counter? With an average of 13RU per sit-down and 16RU per stand-up, rack bays can hold a considerable amount of equipment. Aside from the number of people, the amount of rack bays and the structure to carry wire is the largest contributor to size of the furniture.

9. Is there a need for any above-counter racks? These days, the trend is toward fewer and smaller (less rack space). Removing bulky turrets clears sight lines, opens counter space and simplifies wiring – if you can do without.

10. Do you have budget in mind? We have built studios for as little as a few thousand dollars to upward of $25,000. Building to budget will point to production solutions or allow for custom design. It will drive meaningful decisions about function vs. flash or simply about "putting your money where the mouth is."



Studio plan showing sightlines

Now that you know why the first thing in the room shouldn't be the last thing you think about in studio design, hopefully you will give it some forethought going forward. We're often asked how long it will take to build the furniture. In our shop construction happens quickly – it's everything else that takes the time. Production orders can be processed in a matter of weeks, but executing a custom design is a process that includes design, order and payment processing, CAD work, material sourcing, cutting, building, documentation, packaging and transit time. A simple rule of thumb - if you're thinking about a new studio, you should be talking to someone about furnishing it now.

Holland is VP design, Omnirax Furniture Company, Sausalito, CA.

This advertiser index is a service to readers. Every effort is made to ensure accuracy, but *Radio* magazine cannot assume responsibility for errors or omissions.

Do You Remember?

by Chriss Scherer, editor

The Electro-Voice 668, released in 1964, was touted for its lightweight and variable equalization settings. Designed for use on a boom for TV and film, its appearance is very similar to EV's flagship radio mic, the RE20.

The tail of the mic could be removed to access the "computer-style programming pins" that could be moved to change the equalization from flat (from 40Hz to 12kHz), bass or treble rolloff, treble boost, and 80Hz or 8kHz cutoff. The impedance was also selectable for 50, 150 or 250Ω via a pin selector.

The 668, like the RE20, featured a Variable-D design to create its cardioid polar pattern. Its foam windscreen made it look very much like a Shure SM5, although the suspension is very much like the EV 309A, which is used for an RE20.

The 668 was used as part of the audio pool feeds at the 1964 Republican and Democrat National Conventions on the lectern.

This Month in SBE History

2014 Marks the 50th Year of the Society

One of the founding principles of the Society of Broadcast Engineers is the establishment and continuation of high engineering standards in broadcasting. In the earliest days of the society, the organization looked to bolster the individual FCC licensing process and ensure that broadcast engineers were indeed qualified to take the responsibility placed upon them. The December 1964 issue of the *Journal of the Society of Broadcast Engineers* included an article that discussed need. In the article, R.J Hendrick suggested the need for better education and training to acquire an FCC First-class license. There was concern that the license-mill programs were diminishing overall engineering standards in broadcasting.

But the idea took some time to catch on. Over the years, the SBE submitted proposals to the FCC to implement and enforce higher standards. None of those efforts really took hold. Little by little, the SBE seemed to realize it may not be able to enforce individual standards across the industry, but it could impose standards on its members.

At the January 1973 Board of Directors meeting, Ed Karl proposed creating a Code of Ethics for SBE members. That work resulted in the SBE's Canons of Ethics.

The SBE continued to push for higher standards in individual licensing as well. As the FCC moved to eliminate individual licensing for broadcast station operators, the SBE shifted its focus from leaning on the FCC to creating its own voluntary certification process. In 1975, the SBE Program of Certification was approved.

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