Radio

THE RADIO TECHNOLOGY LEADER

Airstream Brings Radio to Lower Eastside Girls Club

MARCH 2015 | RADIOMAGONLINE.COM NewBay Media

The Scoop on Codecs for IP Audio

Using the Internet for audio distribution makes sense, but the problem is a little like the holiday rush at the Post Office.

There are simply too many packets of data for the pipeline.

You need a codec to bit-reduce the audio stream. So what's it going to be? AptX, Opus, G.722 or AAC, and if so, which version of AAC? We asked Charlie Gawley from Tieline, "The Codec Company" and a Wheatstone technology partner, to fill us in on Opus, the EBU ACIP standard, and how the AES67 factors into the use of codecs for IP audio delivery.

For the entire story...

Go to: INN20.wheatstone.com

Beyond 4K at CES... The Internet of Things

What at CES 2015 could possibly interest a couple of audio network nerds?

Well, yes, gadgets of course. But there was also this: the Internet of Things (IoT). One analyst counted 900 exhibitors with IoT products there. Thermostats, coffee makers, watches, jewelry, dog collars, ovens, smart sports apparel ... baby bottles. All connected to the Internet of Things.

It's a great concept, this idea of connecting appliances (not to mention, that new 4K TV) to the internet and controlling them through your smartphone or laptop.

For the entire story...

Go to: INN20.wheatstone.com

Processing Tip from THE Processing Guy

Here's a helpful tip from Wheatstone Processing Guy Mike Erickson on keeping track of presets:

"One thing I try to remember to do when I'm making presets for a new install, or adjusting presets on a processor that's already online, is to date the presets. This not only gives you a good track record as to when you created that perfect sound, but it also allows you to go back if the PD complains that the processing 'sounded better last week' ... you'll know what preset to go back to even if you didn't physically write it down! Saving presets with the dates allows you to do the processing version of 'System Restore.' Also, it's a good idea to back up your presets. ALWAYS! I recall a Memorial Day failure of a processor in Market #1 going back almost 7 years ago. The backup switched on via silence sensor and I was able to swap out the main with another of the same model we had on the shelf and load the custom presets. Within an hour, we were back sounding as good as you could get with that box! The PD was nervous while I was swapping hardware that we wouldn't sound the same because all the presets were lost on the hardware. If I hadn't backed up the presets, weeks of work would have been down the drain."

This tip is brought to you by our new FM-55 audio processor, which is so easy to adjust from the front panel, you might want to save and date presets for the presets.

For more great information on processors and how to get the most of them...

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OK, this spread is an advertising space paid for by Wheatstone. But hopefully you'll find it informative, entertaining and compelling.

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CREDIT: Cheryl Fleming

FIND THE MIC AND WIN!

Tell us where you think the mic icon is placed on this issue's cover and you could win a pair of Hosa headphones. Send your entry to radio@RadioMagOnline.com by April 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

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*All these broadcast manufacturers now feature StudioHub+ compatible RJ-45 connectors.

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In Vegas, Plenty to Talk About

IP infrastructure, FM boosters, drones, the behavior of FM receivers, digital on the AM band … these are among topics of engineering sessions at the NAB Show. Among the more promising:

On Saturday Wayne Pecena, director of engineering for Texas A&M University/KAMU, will give a three-hour "Tutorial: Router Configuration" as part of the SBE Ennes Workshop. "Wayne will build a network from the ground up, show us how to add access points, implement practical security [and] teach us about what we can learn from our routers in terms of traffic and use patterns," the program promises.

That afternoon, Kevin Gross of AVA Networks will talk about "Implementing AES-67, Audio over IP in the Station and Studio." It will be interesting to hear about "what's next" now that AES-67, with its promise of interoperability, has been in place for a while.

We'll be interested too in hearing what Sam Matheny, executive vice president and chief technology officer of NAB, will say in his keynote for the engineering conference; that's Sunday morning.

Then Hal Kneller of GeoBroadcast Solutions will update attendees on "New Technologies in FM On-Channel Boosters." It's part of a three-hour group of presentations called "Advanced Radio Technology" chaired by Milford Smith of Greater Media. Also included are "The Curious Behavior of Consumer FM Receivers During Hyper-modulation" by Jeff Keith at Wheatstone; and David Layer of NAB gives more info about the ongoing tests of all-digital operation on the AM band.

Jim Peck/NewBay Media

At the 2014 NAB Show, Ricardo Da Silva of BW Broadcast and Alan Kilgore of WRVM(FM) in Suring, Wis., discuss FM transmitters.

Sunday afternoon brings a "Radio Technology Forum." Samples: John Kean of NPR Labs will review a "Study of Audio Loudness Range for Consumers in Various Listening Modes and Ambient Noise Levels" and there will be a discussion of "–10 dB IBOC at Combined Transmission Sites" by Dan Fallon and John Schadler of Dielectric.

The senior band gets an entire "AM Radio Boot Camp" occupying most of the day Monday, with topics from RF safety and antenna system modeling to how to lease out space on towers. Monday also brings a discussion of "Preliminary Findings From Preparations for The IPAWS National Test" by Al Kenyon of FEMA, part of a track on "Technical Regulatory Issues for Broadcasters."

A Tuesday track focuses on "Radio Facilities" and is hosted by Barry Blesser of 25-Seven Systems; it will include discussions about personal broadcast platforms, aiming parabolic dishes and Blesser's own presentation on "Monitoring for Ratings." A Tuesday afternoon track on "Radio Connectivity" includes a number of experts on codecs and telephony.

On Wednesday, Garrison Cavell of Cavell, Mertz and Associates moderates an all-day "RF Boot Camp," and the Technology Luncheon is sure to be crowded when John McAfee (yes, that John McAfee) comes to speak, and NAB honors Tom King of Kintronic Labs and Richard Friedel of Fox Networks with its Engineering Achievement Award.

Review the agenda at *www.nabshow.com/attend/broadcast-engineering-conference.*

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EDITORIAL
Editorial Director: Paul J. McLane
radio@RadioMagOnline.com

TECHNICAL CONSULTANTS
Contact them via radio@radiomagonline.com
Jeremy Ruck, P.E., RF and Transmission
Lee Petro, Legal
Russ Berger, Broadcast Acoustics
Doug Irwin, CPBE DRB AMD, IBOC

CONTRIBUTORS
Doug Irwin, CPBE DRB AMD
Chris Wygal, CBRE

CORPORATE
President and CEO: Steve Palm
Chief Financial Officer: Paul Mastronardi
Controller: Jack Liedke
Group Circulation Director: Denise Robbins
Vice President of Web Development: Robert Ames

VIDEO/BROADCAST GROUP
Executive Vice President: Carmel King
Vice President of Sales/Group Publisher: Eric Trabb

ADMINISTRATION AND PRODUCTION
Editorial Director: Paul J. McLane
Production Director: Davis White
Production Publication Coordinator: Lisa McIntosh
Advertising Coordinator: Caroline Freeland

CIRCULATION
Group Director, Audience Development: Meg Estevez
Circulation Manager: Kwentin Keenan
Circulation Coordinator: Michele Fonville

ADVERTISING SALES REPRESENTATIVES
Publisher, U.S. Sales: Steven Bell
sbell@radiomagonline.com | 212-378-0400 x519

Southern Europe, Africa, Middle East: Rafaella Calabrese
rcalabrese@broadcast.it | +39 02 9288 4940

UK, Ireland, Central and Northern Europe: Graham Kirk
gkirk@audiomedia.com | +44 1480 461555

Japan: Eiji Yoshikawa
callems@world.odn.ne.jp | +81 3 3327 5759

Asia-Pacific: Wengong Wang
wwg@imaschina.com | +86 755 83862930/40/50

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28 East 28th Street, 12th floor
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danny.grubert@lakegroupmedia.com

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Overhaul of Remote Pickup Rules

by Lee Petro

The FCC is seeking comment on proposals to make changes to the rules for broadcast remote pickup facilities.

The Society of Broadcast Engineers and the Engineers for the Integrity of Broadcast Auxiliary Services Spectrum raised attention to several issues affecting RPUs, and the FCC clarified certain rules and sought comment on the proposals.

One main focus of the petitioners is the "stacking" of spectrum and identifying a "center" frequency to specify on the FCC authorization. When the FCC last addressed RPUs in 2002, the goal at the time was to adopt rules that would permit the sharing of equipment by RPU licensees and Private Land Mobile Radio Service licensees, with whom the spectrum is shared.

However, if an even number of channels are stacked to provide adequate bandwidth for audio RPU uses, the petitioners argued that the licensee is unable to specify a center channel. As a result, licensees are requesting more bandwidth than necessary so that they can comply with the FCC's rules. In addition, the current RPU rules do not authorize digital equipment, and the petitioners argued that the analog RPU equipment is not sufficiently precise to permit the licensee to specify a center frequency required under the FCC's rules.

FLEXIBILITY

In dealing with the center frequency issue, the FCC stated that the current rules provide sufficient flexibility for applicants to specify an appropriate channel. In particular, the FCC stated that the rules currently permit the applicant to specify a center frequency that falls between the channel centers specified in the FCC's rules. Therefore, an applicant that combines six channels is permitted to choose the center frequency of the combined spectrum, even if that center does not match up with a center frequency listed in the FCC's rules.

Moreover, the FCC acknowledged that analog RPU equipment is not as precise as digital equipment, but concluded that the petitioners' concerns were misplaced. Instead, the FCC confirmed that so long as the RPU equipment was operating with an approved emission mask, and the facility was centered on the frequency specified in its authorization, the FCC would consider the station operating in compliance with the FCC's rules.

With these clarifications out of the way, the FCC moved forward in making several proposals and sought comment.

First, the FCC proposes to permit RPU licensees to operate RPU equipment using digital technologies such as Time Division Multiple Access and Next Generation Digital Network (NXDN). The FCC noted that the use of digital technologies would mirror the technologies used by PLMRS licensees and would promote the use of PLMRS equipment by broadcast licensees.

In order to effectuate this change, the FCC is proposing to modify its rules to permit RPUs to specify "digital modulation" and list specific digital emission masks in its rules. The FCC also proposes to expand the maximum authorized bandwidth from 25 kHz to 50 kHz, which would permit the stacking of up to eight 6.25 kHz segments for RPU use.

At the same time, the FCC is seeking comment on removing language in its rules that permits RPU applicants to specify 100 kHz RPU channels. The FCC noted that there had been scant interest in such channels over the years, and that 100-kHz channels restrict available spectrum for other users. The FCC is also seeking comment on adopting the parallel station identification requirements for both PLMRS and RPU licensees.

Finally, the FCC rejected a request by the SBE to grant a blanket waiver of the rules and permit digital operations while the rulemaking is pending. The FCC is apparently concerned that a blanket waiver at this point would permit divergent uses of the spectrum, which may conflict with other users. Thus, while the FCC will permit parties to seek individual waivers to use digital RPU equipment, a blanket waiver was denied.

The deadlines for comments and reply comments have yet to be set in this proceeding, although the FCC did adopt an expedited comment cycle — 30 days for comments and 45 days for reply comments. Please check back next month for those dates.

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

DATELINE

March 16, 2015 - Online Public File for Radio Stations NPRM Comment Date, reply comments due April 14, 2015.

April 1, 2015 – Stations in Delaware, Indiana, Kentucky, Pennsylvania, Tennessee and Texas with five or more employees must place Annual EEO Public File Reports in public inspection file.

April 1, 2015 – Noncommercial stations in Texas must file Biennial Ownership Reports (323-E) and place reports in public inspection file.

April 10, 2015 – All stations must place 1st Quarter 2015 Issues/Program Lists in public inspection file.

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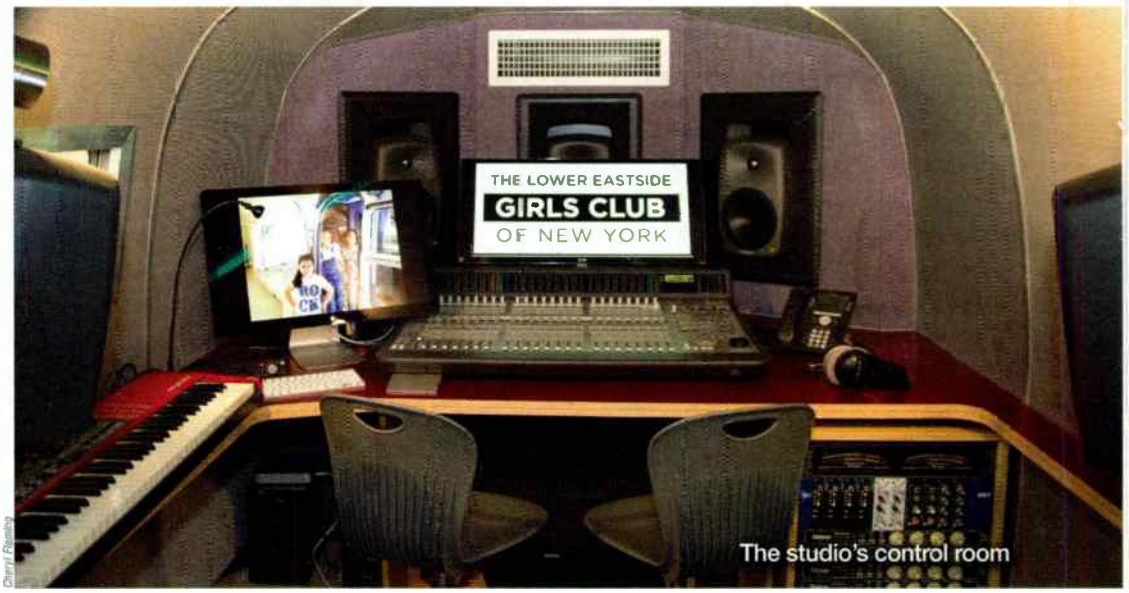

The studio's control room

Airstream Brings Radio to Lower Eastside Girls Club

by John Storyk
Co-Principal, Walters-Storyk Design Group

Parked behind a wide floor-to-ceiling window on the second floor of a new $20 million building on Manhattan's once wild and wooly "Alphabet City," the Lower Eastside Girls Club's new WGRL Internet broadcast studio is helping to revitalize radio's role in young people's lives.

BUILDING BACKGROUND

In a move designed to empower, inspire and educate young women to achieve their creative potential, LESGC co-founder Lyn Pentecost and a diverse group of community, grassroots and financial supporters created the LESGC in 1996.

Pentecost and her associates built a unique and formidable organization. In the process they not only raised consciousness, they also raised the funds for a sustainably built 12-story mixed usage building at 101 Avenue D in the heart of NYC's storied Lower East Side. They broke ground for the project in 2010 and completed construction in 2013.

Featuring an array of educational options — ranging from a digital photography/computer graphics/3D-printing lab, to hands-on BioBus labs, small business training and incubator space (commercial kitchen, bakery, gift shop, cafe) and a 64-seat planetarium — the LESGC stretches across three floors and 30,000 square feet.

Incongruously capping this eclectic assemblage of educational and career training options for low-income teens is a classic Airstream Trailer, circa 1958.

Far from ornamental, the Airstream houses a professional-level streaming, recording and teaching studio. A pet project of TV editor/musician/LESGC

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Director of Technology Dave Pentecost, the trailer was purchased by the Pentecosts as a sidecar to their upstate New York cabin in the Adirondack Mountains. When the LESGC building became a reality, they decided their Airstream could serve a better purpose in the community as a sound studio, and they brought it to Manhattan.

TRAILER MEETS BIG CITY

I'd met Dave years earlier and was pleased to reconnect with him in 2010 when he called with one of the most unusual project requests we've ever had. Was it possible, he wanted to know, to create a viable recording studio within the confines of a 140-square-foot Airstream Trailer?

The obvious answer is yes, although the geometry, the equipment selection and the acoustic considerations did present us with significant design constraints.

The Walters Storyk Design Group has been around for more than 45 years. We've designed TV, broadcast and music recording studios all over the world in such disparate environments as a basement (Electric Lady), a duplex penthouse (Jungle City) and a warehouse building (Circo Beat Studios), but we'd never been asked to build a broadcast studio in an Airstream Trailer.

As a visiting professor of acoustics and studio design for the Berklee College of Music and other schools, I have an abiding interest in educating young people. Dave Pentecost's compelling challenge was an opportunity to help create a useful studio with the potential to turn a new generation of bright young women into creative broadcasters. This need was particularly important because, strangely enough, New York City has few, if any, distaff alternatives to the city's various Boys Club organizations.

Bringing the Airstream to New York and hoisting it into its new home on the second floor of a 12-story construction site was a project in itself.

Cheryl Fleming

A recording session in the studio.

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Once the Airstream was gutted down to its aerodynamic shell, WSDG Project Manager Matt Ballos and I began working with our design team to maximize the interior and develop an acoustic treatment program that would ready the studio and its compact control room for 5.1 surround recording and mixing assignments. We also compiled a gear wish list that would facilitate the planned studio's missions, including recording, mixing, streaming and instructing.

Courtesy John Storyk

Two LESGC members interview John Storyk at the opening event.

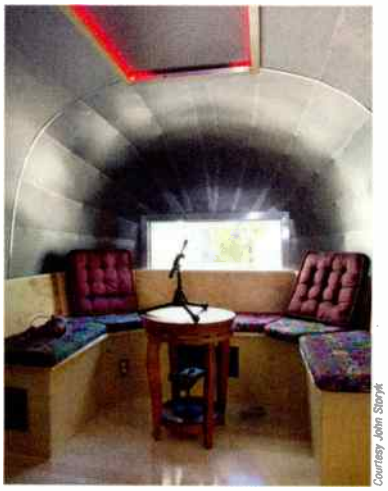
MULTIFUNCTIONAL SPACE

The Airstream studio comprises a live room for recording and broadcasts and a control room to produce and mix programming for the club's new WGRL Internet station. It is also used to create sound tracks for student videos and for the LESGC Planetarium's educational presentations.

Capable of accommodating up to three students and an instructor in the control room plus four additional artists/interview subjects in the front booth area, the Airstream, visible from the street, resides in the second floor's stage-equipped community room, which also serves as a combination classroom and performance venue.

Though compact, the Airstream control room is 5.1 surround sound-ready and features an array of professional gear that includes an Avid C/24 mixing console, Genelec Speakers, outboard processing technology from Manley, API, Neve, Universal Audio, SSL, etc., and microphones from Neumann, Royer, Shure and Sennheiser.

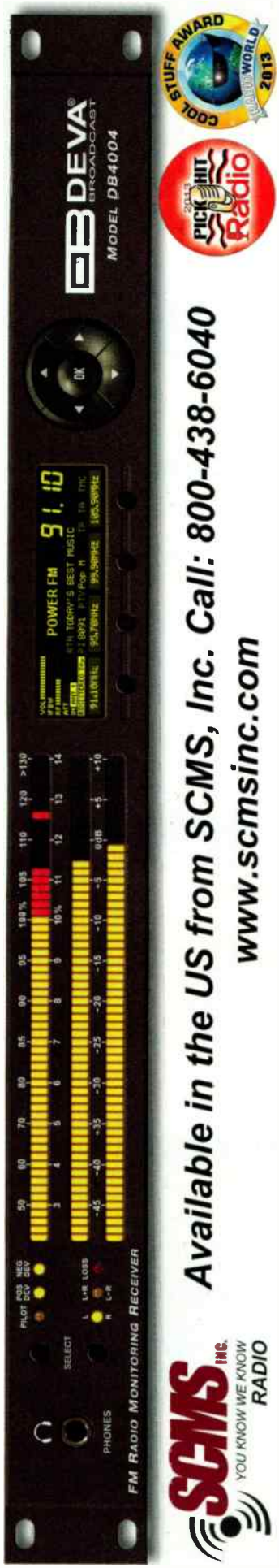
This serious, professional-level studio provides LESGC members with a real-world, hands-on recording experience and full capability to compose, produce, record and mix an entire music or streaming production from A to Z.



Courtesy John Storyk

Here is the interior of the recording booth.

Since its official opening in December, WGRL has produced, recorded and streamed hundreds of interviews, performances and remote programs that run the content gamut from covering a politically inspired art event in the Andaz Hotel on New York's Fifth Avenue to sharing a dim sum meal at Joe's Shanghai Restaurant in Chinatown, and an interview with two activists from The Grail, a nongovernmental organization focused on promoting women's rights,



health, education and international solidarity.

"MAKING WAVES"

In November, the LESGC hosted "Girls Making Waves," a music and technology conference, in partnership with the Willie Mae Rock Camp for Girls. The free event included 40 girls ages 11–18 and featured workshops on coding technology, radio production, beat-making and sound design. The camp also presented a panel of women from the fields of music and technology.

Courtesy John Sheryk

The recording workshop classroom and performance stage.

The Lower Eastside Girls Club and Willie Mae Rock Camp are partnering on a 10-month sound design program, "Making Waves: The Science of Sound," that teaches girls about digital sound design, multimedia production and diverse careers in music technology. Girls also have the opportunity to meet professional women at the forefront of new technologies in the music industry.

For samples of WGRL programming visit *https://soundcloud.com/wgrlnyc/sets*.

Lyn Pentecost reports that Odetta Hartman and Kiya Vega, the women who teach the LESGC WGRL Radio and Beats by Girls classes, are making real progress with the studio.

Although they're still teaching themselves to take full advantage of the technology, and while their creative programming is still "getting off the ground," the instructors are deeply impressed with the level of enthusiasm from the girls and young women, aged 8–23, with whom they've been working. LESGC members are proving themselves adept and industrious young broadcasters.

According to Pentecost, their "funky" Airstream has been graced by visits from some pretty cool supporters and well-wishers. Since the studio was completed, they've welcomed a number of artists, including former Sex Pistol bass guitarist Glen Matlock and recording star Regina Spektor, who came by to say "hi" and drop a few beats with the girls who are learning Ableton Push Controller. Actress Heather Graham, TV personality Tyra Banks, DJ/performer Donna D'Cruz and Tommy Boy Records founder Tom Silverman have toured the building and the Airstream. Tom Petty sent the LESGC a few guitars, and the girls have also had the opportunity to sing and record with Moby, Joan Baez and Roseanne Cash in the on-site planetarium.

LESGC instructors are teaching the girls how to do professional interviews, and this summer they will be ready to launch a weekly series of podcasts.

UNIQUE FEATURE SET

Drawing on her undergraduate degrees in architecture and design from the Cooper Union, where she studied under John Hejduk, and from her two years as an apprentice to architect Paolo Soleri, Pentecost took the design lead on the Girls Club project, working with the architects of record.

As a result, The Lower Eastside Girls Club has features not before seen in a youth center. In addition to the full-dome planetarium and Airstream studio, the building showcases a dramatic interior proscenium staircase in the academic center; artist-commissioned art bathrooms; an art-filled café adjacent to a courtyard with a Kiki Smith fountain; high ceilings, maximum natural light, a sedum green roof; and strategic use of whimsical neon to send a welcoming message in a low-income community where most architectural design falls short.

WSDG was pleased to be involved with the LESGC Airstream Studio project. It may not be entirely coincidental that we are currently engaged in two contrasting public radio station upgrade projects on the West Coast. Whether in an Airstream Trailer or a brand new state-of-the-art broadcast complex, radio stations remain an important aspect of the WSDG Active Project list.

Lunch Ain't Free at FM Plants, Either

by Jeremy Ruck, PE

In the 1800s, taverns offered free lunch to entice drinking customers. The earliest extant references to a notion that there is no free lunch date to the 1930s (serendipitously, the decade that witnessed the birth of W1XOJ, the first FM station). Milton Friedman helped popularize the idea in the 1970s.

Engineering an FM plant typically involves tradeoffs, and that is our topic of discussion.

One of our goals is to get the most bang for the buck. Sure, there is the public interest component; but the harsh reality, whether we want to admit it, is usually that the dollar is a driving force.

The FCC's model tends to view all stations with identical contour radii as equal in coverage, but not all contours are the same. Stations with high structure density in their service areas may wish to opt for greater effective radiated power and lower height. This allows for greater effective field strength to punch through building walls. Conversely, in a more rural setting, the prudent choice may be to consider less power and more height. In such a situation, you would wind up with a larger coverage radius for listeners in vehicles but still be able to penetrate the frame construction

typically utilized for building construction.

The tradeoff is one of front- versus back-end economics. A situation involving lower height and greater power may bring higher startup costs for larger transmitter, transmission line and antenna, and possibly lower initial costs for the tower due to its height, though a larger antenna may be required. Later, more power means a larger utility bill. In the converse situation, you may pay less for your box, antenna and line, and perhaps enjoy a lower power bill; but steel erection costs will spiral upwards. Expect higher long-term maintenance costs for a taller stick as well.

Nevertheless, even with a particular ERP and height, there are additional parameter changes that can be made, resulting in other tradeoffs.

For example, a single-bay antenna with really big transmitter will produce the same ERP as a 12-bay antenna and smaller transmitter. At an ERP of 50 kW, a single-bay circularly polarized antenna would require input of approximately 108 kW. Although transmission line is available to support such a set of parameters, you would be pressed to find an antenna with that power rating. At the other end of the spectrum, with a 12-bay full-wave spaced model, the input to the antenna would be around 7.3 kW. So, with a hunk of 1-5/8-inch, the plant is ready to roll.

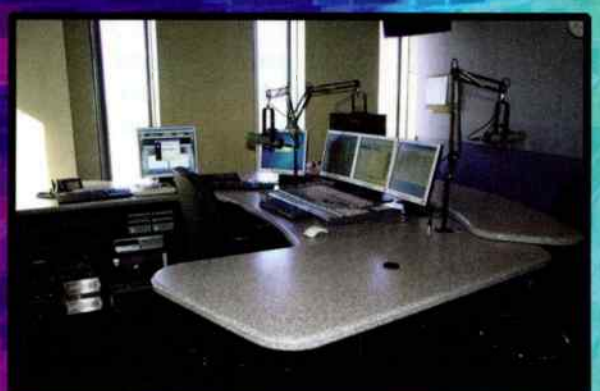
More common scenarios involve six- or eight-bay antennas, which give an input power range of approximately 11 to 15 kW.

The 12-bay solution may seem kind of silly, but in certain circumstances it may demonstrate a brilliant tradeoff. In such a scenario, antenna and tower costs will be greater, if nothing else due to the difference in materials utilized. However, long-term benefits of a lower power bill may offset this, especially if the site is located such that vertical radiation characteristics are less important. In cases where a site is between population centers, downward radiation is less critical, given that radios tend to be a rarity among field vermin (unless of course your name happens to be Nicodemus or perhaps Mrs. Frisby).

At first glance, the 12-bay solution may seem kind of silly, but in certain circumstances it may demonstrate a brilliant tradeoff.

Other tradeoffs may be required due to the mechanics of a particular site.

Spacing between bays of one wavelength is the most common antenna design. Reducing



spacing will lower gain, requiring a greater input power to achieve the authorized effective radiated power. This reduction may be necessary due to structural concerns or to avoid radiofrequency radiation exposure issues at a site. This type of scenario tends to be common on mountaintops where a short tower and high ERP are utilized. While higher transmitter power may be required and the antenna may be more costly, this tradeoff may avoid lost revenue for RFR coordination, eliminate the need for a taller tower or reduce monthly rental fees.

THEORY VS. PRACTICE

Design and installation location also raise questions of tradeoffs.

For instance, on paper, a "typical" FM antenna and an antenna with a panel design will cover the same area. In reality, that is not the case.

There really is no such thing as a non-directional antenna because the environment always influences the pattern. Face size, distance from leg or face, and orientation relative to the face or leg affect the radiation pattern. Therefore, even though an antenna is considered non-directional, it is not unusual to see an effective boost in the pattern of a couple of dB along some azimuths. However, once again, there is no free lunch; other azimuths will have corresponding reductions such that the RMS of the pattern comes out close to the theoretical value for the non-D antenna.

With panel-style antennas, however, this "boost" disappears; the tower's impact is less because of the directionality of the individual elements pointing away from the structure. I observed this when a station in the eastern part of the United States changed out a rototiller-style antenna for a panel. Although the station received numerous coverage complaints, field measurements confirmed that the antenna was performing as it was supposed to. The issue was that the beneficial effects of the tower along certain azimuths were not realized until the old antenna was modeled. In this case, the station made a tradeoff of "directional non-directional" coverage for nearly non-D coverage. Unfortunately, the population densities were sufficiently skewed geographically to actually degrade the coverage.

This same phenomenon comes into play in station upgrades, especially in the noncommercial educational world, or where commercial stations seek contour protected authorizations.

If changing a facility from a non-directional to directional configuration, you must take extra care to ensure no significant audience loss. Obviously if the station is starting up with a directional antenna, there is no frame of reference. It is possible that in converting from a non-directional to a directional antenna while doubling the facility ERP, you will experience net coverage loss.

One major antenna manufacturer has a nifty utility that allows you to explore the impact that a particular tower size will have on their patterns. While it is not a substitute for actual controlled measurements, it does show that certain combinations of antennas and tower size can result in a distorted relative field of 1.5 relative to a non-directional RMS of one. The effects of the tower therefore induce a relative power of up to 2.25 along certain azimuths yielding an ERP boost of more than three dB.

FCC rules are quirky in this regard, as they ignore the contributions from the tower if the antenna is non-directional but require them to be considered if the antenna is licensed as directional. Therefore, if your antenna is directional, the maximum ERP on the license is the maximum ERP radiated at any azimuth. If licensed non-directional, it is likely the authorized value plus some more.

COVERING UP

Radomes present another tradeoff consideration. For stations where winter rarely brings anything other than liquid precipitation, radomes probably are unnecessary. Further north, they can make the difference between reliable full-power operation (and by extension full coverage) and substantial downtime. Radomes add expense, installation and maintenance considerations to an antenna purchase, but their impact is greatest in structural loading.

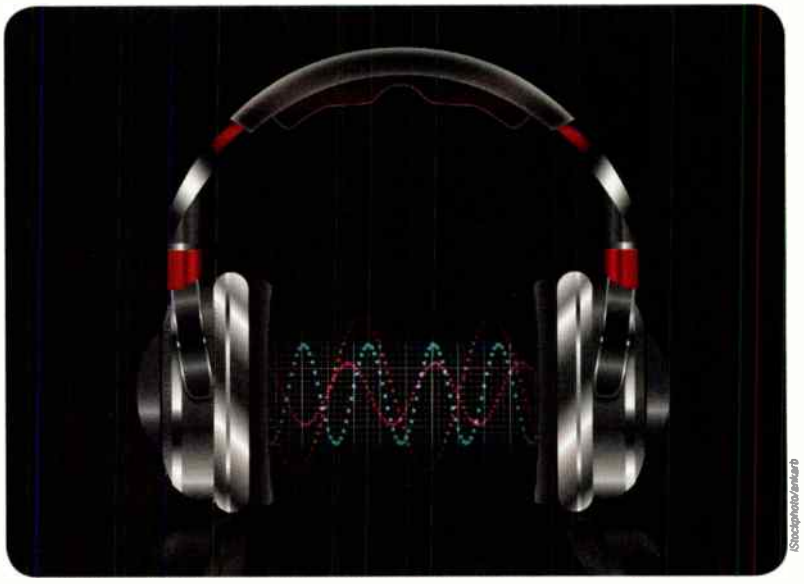
Traditionally, vertical real estate is based on a combination of lineal footage consumed and installation elevation above ground; a radomed antenna of a certain length results in the same revenue or rental fee, depending on your side of the equation, as its naked counterpart. Since an antenna with radomes will soak up more of the available capacity of the structure, they should garner higher rental fees. If radomes are proposed in a region of marginal utility, will the potential loss of revenue from downtime offset the added costs? On the flip side, if you were the landlord, would the use of radomes by a tenant unnecessarily preclude future revenue streams?

The minutiae of antenna tradeoffs go beyond what we have covered, but we have proved a quintessential snippet of wisdom. Perhaps the intersection of philosophy and technical stuff is one of the main reasons that we dig playing with radio so much. I'll mull that one over lunch and get back to you.

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

Analog vs. Digital Consoles For Radio Use

by Doug Irwin, CPBE AMD DRB



The evolution of the broadcast mixing console continues. Much is written about digital consoles and IP-based systems; but analog consoles are still manufactured and sold.

Are there circumstances where it makes sense to go with an analog system?

The purpose of an audio mixer remains unchanged after all these years: It allows you to "add" or mix various dynamic audio sources to form an output program that subsequently is sent off to listeners. In the 1960s, a transition from vacuum-tube to solid-state occurred, as well as one from mono to stereo; in the 1990s, digital consoles came into play; and during the 2000s, IP-based systems entered the business.

The fact is that all accomplish the same thing; it's just that the

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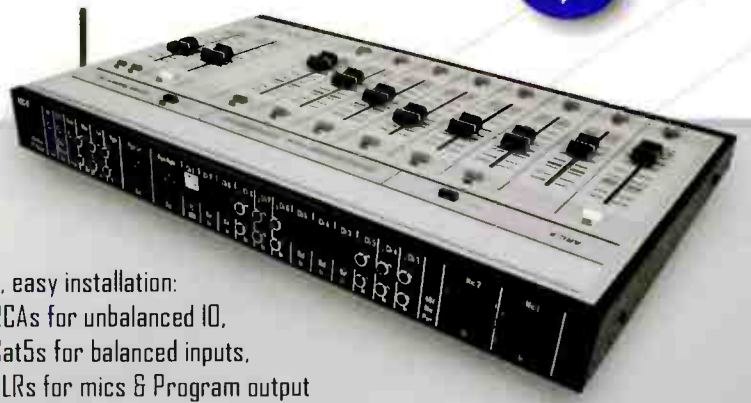

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functional complexity of a console has greatly increased over that time. If the basic functionality is all you need, perhaps an analog console — an updated version of what one would have used in the 1930s — will suit your needs.

The most basic function of an audio mixer is that of adding multiple microphones together. Since microphones are themselves inherently analog and the end user likely will receive the program content in an analog fashion (e.g., AM or FM radio), one could make the case that there's no functional advantage to converting everything to a digital format for the console, then re-converting just before transmission.

Even with a 24-bit digital system, the noise floor (as measured at the output side of the console) will be limited by the noise floor of the analog mic preamp; the noise floor measured for the means of transmission (again, either AM or FM) is going to be higher than that.

Analog microphones aren't the only source coming in to a console, though. It's like that you'll have at least one other source, some device that plays out music and pre-recorded items (commercials or other sponsorship announcements). Here, the evolution was from live mics to records, then to taped sources, then to digitally stored sources (CDs and now playback systems). Again, none of these sources presents a compelling reason to use a digital console, because all will have left/right analog outputs in addition to digital outputs.

From an installation standpoint, wiring up sources and destinations in an AES format is much easier than the analog counterpart; there are only half as many cables, and one need not worry about left vs. right channel phase errors. Additionally, the balanced nature of the vast majority of AES sources and destinations gives fantastic noise immunity to the system.

The choice between a simple analog console and a more sophisticated digital console has a lot to do with your level of expectation as to what is possible in your studio facility.

Remote sources are the next class to examine; whether discussing telephone hybrids, or ISDN codecs, or satellite receivers, all will have analog and digital outputs, easily accommodating analog or digital console types.

What I've said about console input sources could be extended to the console outputs in the analog versus digital debate. The destinations typically found at a radio station will have analog and digital inputs, unless they date from the mid-1990s (or earlier of course). Again, from an installation standpoint, AES-3 (balanced) is simply easier.

THE ADDITION OF ROUTERS

When your studio facility gets large enough to necessitate audio routers of some flavor, the advantages of digital consoles become apparent.

With a multiple-studio facility, there will likely be sharing of audio sources such as ISDN and/or IP codecs, satellite receivers and other studio sources such as the outputs of a talk studio or performance studio. Two techniques traditionally have been used to accommodate these needs: distribution amplifiers and patch-bays.

A variation was the use of mechanically interlocked switches (shadow switches) for source selection. A routing system (analog or digital) performs the function of the DA and source switches because one source can be shared among multiple destinations (the DA function), and conversely, a destination (such as mix minus send back to a remote) can be switched (electronically) so that is comes from one studio or another (the shadow switch function). By placing a router controller at a new location and through the addition of two pairs of audio, one could extend all the router's sources to anywhere in the house quite easily.

The combination of digital console plus digital router provided even more functionality for a studio because many of the digital consoles had input channels that were routable and configurable as sessions. Multiple changes in the sources of audio that appeared on a given module, or feeds that went to different destinations, could be changed on a day-part basis, which some users found to be very useful.

While it might seem as though I'm getting off-track here, my point is that the strictly analog consoles available today don't include this type of functionality. The choice between a simple analog console and a more sophisticated digital console has a lot to do with your level of expectation as to what is possible in your studio facility.

If your facility is a relatively small stand-alone — say, with one on-air studio and a production/backup studio; or perhaps you are building an LPFM (non-commercial) station — analog consoles will likely live up to your needs and expectations. Let's take a look at a few analog console offerings. This is certainly not a comprehensive list but gives a flavor of offerings from some of the industry's most familiar brands.

AUDIOARTS

A familiar brand of analog consoles is Audioarts. Its AIR-4 console comes with four microphone preamps, the outputs of which can be wired to any one of the 12 stereo input fader modules (each of which have A/B input selectors). The console has a 13th fader set up

for telephone calls — with a mix-minus derived to send back to the caller. Each of the fader modules has a logic output for a start function.

There are two output busses (balanced and switchable between stereo and mono) along with switchable VU meters. (Output peak level = +20 dBu). The console also has a USB connection that allows for a simple connection to PC.

The monitor section switches between PGM 1, PGM 2 or external inputs, and it has a split-cue function that sends whatever is dropped in to the cue bus to the control room left channel monitor, while L+R program continues feeding the right channel monitor. The console also comes with a studio monitor feed, with independent input selection, and a control room to studio talkback button.

Module inputs and line output wiring is accomplished on the rear via RJ-45 connectors.

ARRAKIS SYSTEMS

Arrakis Systems' ARC-15 is a 15-channel console, with two stereo program outputs, up to five mic channels and up to 12 stereo line-level inputs. The mic level inputs are accessed via XLR connectors; the line-level inputs use RJ45 style connectors.

Another input channel is dedicated to telephone, with the appropriate audio and logic connections that support a hybrid. The user can listen to the caller off-line in cue, and a talkback button allows the user to talk to the callers off-line, as well.

The program outputs are available via XLR connectors as well, and unbalanced versions of program are available via RCA-style connectors. A USB connector on the rear allows the user to record or play audio directly from the console to a PC or Mac; and, optionally, one can use Bluetooth via the 15th channel on the console to connect directly to a smartphone, giving the user one more option in terms of getting callers on the air.

RADIO SYSTEMS MILLENNIUM SERIES

The Radio Systems Millennium series comes in six-, 12-, 18- or 24-channel versions.

Audio inputs are balanced instrumentation amps, with gains that can be set to accommodate input levels from –60 dBm up to +10 dBm (max input peak level is +22 dBm).

There are three output busses (program, audition and mono), actively balanced with an output peak level of +22 dBm. (Optionally, you can add a DA card, or a dual-mix minus, or four output mix-minus boards.)

Each console includes a monitor section, allowing studio monitors and headphones to select any program or cue source, as well as up to four remote monitor inputs.

Additionally, there is an eight-position switcher panel that can be used to control any external device remotely using one of eight closures and LED indicators, or as the control for the (optional) four-source audio switcher or (optional) intercom selector card. The console I/O wiring is done via five-pin removable barrier strips.

GATESAIR

This company, part of what used to be Harris Broadcast, has an analog offering. Its Flexiva Oasis is a stand-alone audio console for on-air or production studios.

It comes in eight- or 12-channel versions, with four mic preamps. Other input card options include balanced analog (with A/B inputs); an AES A/B input and finally an USB/AES A/B input card. Oasis has two program busses (with analog and digital outputs) with switchable metering; two optional telco faders; optional 8X1 remote line selectors; and a USB interface for playback and recording. The console supports the "studio/control room" function since it comes with studio monitor and headphone outputs; talkback to studio; control room and studio logic; and optionally, studio remote monitor level controls. Maximum line level input is +24 dBu; maximum line output level is +24 dBu. Digital outputs are of the AES-3 standard, 44.1 kHz sample rate, 24-bit word.

SANDIES

The Dynamax line of analog audio consoles is built by Sandies. The MX series comes in eight-, 12- and 18-module frame sizes; it's all modular construction, so channel modules can be added or removed without shutting down. The console comes with two stereo and two mono mix busses, with metering for each. The standard configuration is for two mic channels, though the console can be loaded with more of those as necessary. Line-level channels have A and B inputs with individual level adjustments and independent remote ON/OFF logic. MX also comes with two 4X1 input selector switches. Maximum input and output line levels are +24 dBu; mic inputs are adjustable from –65 to –35 dbu; line levels, from –15 to +10 dBu.

The decision between analog and digital consoles boils down to the level of functionality a radio station needs, and its size. For small commercial operations, small non-commercial operations and LPFM stations, I see no compelling reason to go with digital consoles. In smaller operations such as these, cost obviously is a factor, and some relief will be gained by going with analog consoles.

With careful study of the available products, and by knowing exactly what is needed for a given station, an engineer can provide for great functionality that will satisfy all concerned.

Move Remote Broadcasts to The Web

by Doug Irwin
CPBE AMD
DRB

Back in September I contributed an article to Radio magazine about electronic newsgathering for radio. In this edition of Tech Tips we're going to look at a method that could certainly be used for RENG—although the real purpose, in this case, for KOHL(FM) is remote broadcasts.

Tom Briseno is broadcast instructor and program director of KOHL(FM) at Ohlone College in Fremont, Calif. Tom wrote to me and described some 21st century techniques in use there.

"I wanted to share with you how we do remotes now that our digital STL gives us a huge delay," he began.

"Radio— the last analog broadcast medium — uses the digital infrastructure to link studio to transmitter and to stream its content on the Web. Another radio standard that needs to move to the Web is that of remote broadcasts. The old, crappy sounding, pre-recorded phone call-in should have been put to rest in the last century."

I'm sure most of us agree with those sentiments.

Tom went on: "With Wi-Fi-capable smartphones and reliable 3G and 4G networks, pre-recorded 320 kb MP3 content or news breaks can sound fairly close to studio quality. The best part is that it hardly costs anything. Every news reporter and air personality has a smartphone and almost every radio station has a VoxPro, the main ingredients of great-sounding remotes."

Twisted Wave

Tom mentioned a few apps that are available.

First, Twisted Wave, for iOS. (Costs $9.99, *http://twistedwave.com/mobile*). Some of its important features:

- The waveform is updated in real time
- Drag the waveform to move, pinch to zoom
- Undo/redo works instantly
- Copy/paste
- Amplify or normalize to adjust levels
- Add faces in or out

- Configure multiple FTP accounts
- Send compressed files (AAC) to save time and bandwidth

Another app used by KOHL is the iRig recorder from IK Multimedia (*ikmultimedia.com/products/irigrecorder/*). Among its important features:

- One-touch recording with real-time monitoring
- Non-destructive editing tools to cut, crop and loop your recordings
- Organizes your recordings by creation date and tags with geolocation
- Transfer files via email, Wi-Fi or iTunes File Sharing with upload to FTP or SoundCloud
- Export files as compressed .m4a or uncompressed .wav
- Recording time is only limited by the storage space on your iOS device

The iRig Pre

Actually, IK Media has an interesting set of products for use in recording with both iPhones and Android devices. Tom also likes the iRig Pre, which is basically an XLR interface for your iPhone, iPad or Android device.

"Also needed is a cloud service to upload the MP3s. Dropbox works flawlessly. The VoxPro can be set up to automatically download any files from the cloud service, eliminating the need for recording manually by a studio operator. Do this by configuring VoxPro's 'auto import' function (which is in the settings pulldown menu) to scan the Dropbox folder.

"Once a break or actuality is recorded it can be renamed and "shared/sent" to the cloud service, and will automatically pop up in the studio VoxPro for airing. The File will appear as a number, or it can be named before sending it from phone.

"It is best to use Wi-Fi to send the MP3s. It is not uncommon for an 8-minute MP3 to take 8 minutes to upload via 3G cell network, about 4 minutes via 4G. The same size file would take about 2 minutes via Wi-Fi.

"We have successfully used this method at many client remotes, to everyone's satisfaction. It is generally agreed by all participants that the sound is preferable to phone call-ins or RPU remote pick-ups."

We're always looking for tech tips such as this, and I thank Tom for sending this one to us. If you have a slick application or technique that you'd like to tell us all about, please send it on to me via *radio@radiomagonline.com*.

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

Edom Hill AM Array Digs Out

by Brian DuBose

On the morning of Sept. 8, 2014, an unprecedented storm ravaged much of the area around Palm Springs, Calif., in particular the top of a small desert spot known as Edom Hill. This is just north of the I-10 freeway in Cathedral City, nestled among the small cities that make up the Palm Springs area and known locally as Coachella Valley.

I am vice president of programming and operations for CRC Broadcasting based in Phoenix. Our CRC Media West business operates two AM stations whose transmission facilities are at the base of Edom Hill.

They are KXPS, licensed to Thousand Palms, and KPSF, Cathedral City. They share the transmitter site, powered by generator and diplexed into a five-tower array. KXPS at 1010 kHz has been licensed for decades. KPSF at 1200 was put in several years ago by Mueller Broadcast Design.

The facilities supporting these two stations were damaged in the 2014 storm, as the accompanying photos demonstrate. The repairs described here were coordinated by my two fantastic engineers: Bill Watson, our local engineer (and first on the scene); and Mark Mueller of Mueller Broadcast Design. I spent my time coordinating crews of earthmovers,

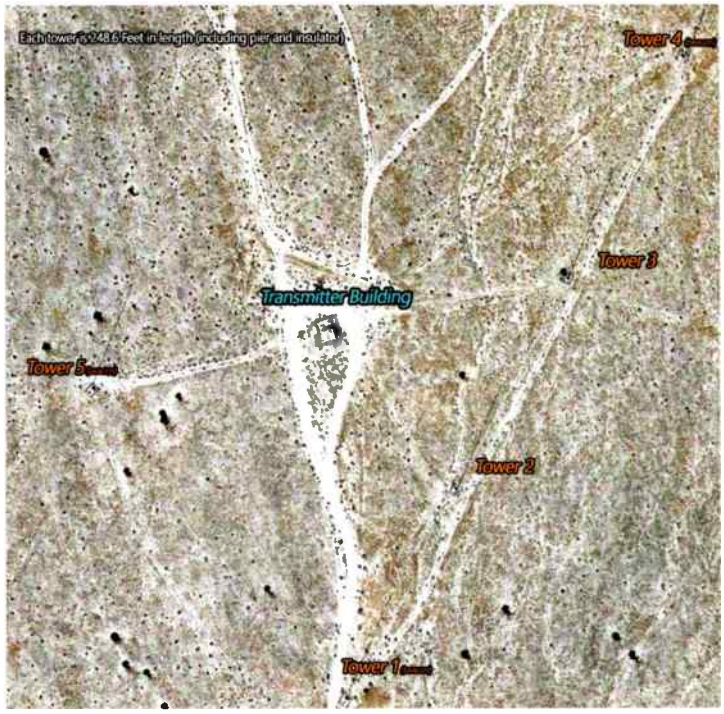

Figure 1

Figure 2

scheduling on-site, managing cleanup of the ATUs, repairing copper radials and lending assistance where I could to the engineers, who understood all this far better than me.

I don't feel I've ever taken engineers for granted in my 18-year career; but I certainly grew to appreciate them all the more after this incident.

CASCADES

As you see in Fig. 1, our Towers 1-4 run northeast up the hill while Tower 5 sits west of the transmitter building. About 1,200 feet or so south of the building is Varner Road, a two-lane used mostly for construction, with no commercial offices or useable electrical power. It runs west of Bob Hope Drive and east of Date Palm. The road is designed so that through traffic — trucks headed for the trash facility at the west end, utility trucks servicing electrical lines — can pass through.

Intense amounts of rain in a short period of time essentially caused a collapse of mud and debris from near the top of the mountain in what many locals called a "100-year storm." Cascades started about 1,000 feet higher and by the time they washed past inside the guy wires west of Tower 3, the widest stream was 14 feet across.

Much of the water accumulated to meet at our Tower 2 with an 8-foot swell about 10 feet wide. If you look again at the map in Fig. 1, taken before the storm, you may notice that a tiny water runoff had trailed to Tower 2 over the years, though it had never caused damage. In the September storm, water followed this best path down the hill.

When the rain and mudslides were done, two miles of nearby Varner Road were covered with 4 to 6 feet of mud. Fig. 2 represents a view from Varner Road after the storm removed all shrubbery. Fig. 3 shows a 26-inch long pipe where water has taken out part of the road.

Immediately after the storm, Bill Watson walked up from I-10 to the site to assess the damage. He could bring nothing but a basic set of tools with him.

Figure 3

THE DAMAGE

He realized quickly that Tower 2 would be out of service for a while. Thinking quickly, he noticed that Tower 5, on high ground, was unharmed. He put us on a temporary broadcast for both stations using that tower alone.

But the erosion around the entire area had created massive problems at the site.

About 12 inches of ground cover had washed away, exposing radials and large pieces of copper strap.

Flood waters had caused mini "ravines," pulling and stressing the buried transmission lines serving KXPS and running from to four of the towers. The conduit used to create a basic cover for transmission and sample lines had been pulled out of the ground in almost every position and whipped around as if it were nothing.

Figure 4

Figure 5

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Figure 6

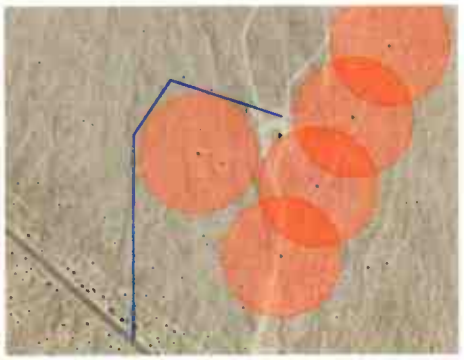

Figure 7

Figure 8

Further, the flood waters that collected coming down within the guy radius of Tower 3 had created a path that cut straight through the deeply buried 7/8-inch coax, 3/8-inch sample line and control cable running to Tower 4. The path where the cut occurred was 13 feet across at that point and about 4-5 feet deep.

Fig. 4 shows copper strap that connected ground radials between Towers 2 and 3. Fig. 5 shows the "Y" split for transmission lines that ran to Towers 3 and 4.

If you look closely at Fig. 6 you'll see the transmitter building to the north, just west of Tower 2. The area in the photo had been part of the transmitter access road into our facility, which was now washed out.

Figure 9

The water that had collected and crashed into Tower 2 submersed the ATU boxes and the filter box mounted to the side of KXPS's ATU in silt-type sand, very fine in texture.

Figure 10

CAN-DO ATTITUDE

The first major hurdle was to get fuel up the hill to our tank, because tankers were unable to drive in.

Our engineers sought an alternate route that could be created quickly within our leased property area. This would have to be created without new soil and placed clear of any ground radials. They decided to start a road from Varner about 400 feet west of the first road, then head up the hill around the west side of Tower 5. The earthmoving team was Maco Engineering based in Cathedral City.

Within four days we had a serviceable path on which fuel trucks could resume driving. Fig. 7 shows the new road, represented by the blue line, with radial estimates in orange.

Once the new road was taken care of, we needed to pull up the transmission line, sample line and control cables that had moved around. We had to dig them up and retest them before repair could proceed further.

Notice the red arrow in Fig. 8; it points to a rectangular metal object. At first we thought this was the "guts" of the ATU box serving KXPS; but after several hours spent extracting it from underneath, we discovered that this was in fact an old window air conditioner unit that had been dumped up the hill and used for several years as target practice. It had washed down in the storm and ended up under this ATU. It thankfully had been able to stand up to enormous direct pressure. This box quite possibly was the only reason the tower itself wasn't nudged or damaged.

But this had all been underwater during the flood, as you can see from the dirt and soil atop the ATU box, Fig. 9.

The KXPS ATUs had been mounted on a concrete base with two pieces of thick angle iron. Those were bent backward and pressed all the way up until about 6 inches from the actual tower.

Fig. 10 also is revealing. Notice that sand

and soil underneath the ATU's concrete base is washed away; you can see the bases for the chain link fence supports. The gray conduit is KPSF transmission line for Towers 1 and 2.

Internal damage to the ATUs was massive. Fig. 11 shows the outer door open, exposing the inside metal panel that protects the contents from the elements and protects users against electrical shock. To the right side of that picture, note the space separating the structure from the filter box that serves both stations. The sheer force of the water and mud that flowed over it had not only bent back the entire box but nearly sheared the screws that mounted the filter box to it. The KPSF ATU is out of the frame.

Fig. 12 is the lower right side opening of Tower 2's ATU. The dirt is more of the caked-on silt type sand that had washed into a fairly well sealed box. You can see the day/night contactor switch mounted on the back wall. Fig. 13 is the filter box for the two stations. Around the northeast corner of this tower was Fig. 14, the ATU for KXPS, filled with sand and mud but structurally intact.

Figure 11

Figure 12

Figure 13

Figure 14

CLEANUP

Once we'd assessed the damage we began the cleanup process.

I went out and dug out the components in the ATUs by hand. Not knowing what was within, I had to proceed slowly and deliberately over several days to avoid damaging components. The back of the cabinet showed that

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Figure 15

mud had reached 17 inches from the base; see Figs. 15 and 16.

Most of the coaxial transmission lines tested very well. Sand had blocked the gates of all our fences so we dug those out. All of the new lines that went to Towers 1, 2, 3 and 4 showed stress at the junction points, but a team of four men with shovels managed to get those lines set properly. We had to replace a contactor in KPSF's Tower 2 ATU, and a component failed after the first test in the Tower 2 filter box.

After repairing and/or replacing lines to Towers 4 and 2, we re-buried all of the line runs, repaired the fence at Tower 2, repaired many copper radials and moved hundreds of tons of earth back over exposed copper. Then we tested all lines and were back to full strength.

In review, because we'd been facing substantial expense and had no flood insurance coverage we split our project into four parts:

Basic recovery. This was mostly Bill Watson getting us the early reports before we could get vehicles on site. During this time we had the earthmovers come in and create a new road to resume fuel deliveries.

I coordinated a team of guys to dig up the conduit for inspection. We then scheduled our consultant Mark Mueller, who assessed damage, did some basic repairs and got us to a reasonable operational status. We left at this point to test components that had simply been cleaned rather than replaced.

Before we had our consultant on site again, we experienced a failure at our Tower 2 filter box and replaced a Jennings UCSXHF-450-35S vacuum capacitor that had sustained damage. With that repaired, Mark came back on site, repaired remaining components and ran successful tests.

Re-burying lines, repairing copper, moving lots of earth, repairing the fence line around Tower 2, and installing a cattle gate to restrict entrance were the last few steps.

So it took about 12 hours to get back on the air, two months to improve the signal and about five months before we were fully "back to normal." Amazingly, in spite of the ordeal and damage, once we got everything cleaned up and put back together, both systems came back up and are operating normally, requiring only minor adjustments.

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Figure 16

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Martinsville, NJ

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The microphone was in the street light fixture next to the bulb at the upper left corner outside NPR headquarters. Herb adds: "Bright idea for the mic location ..."

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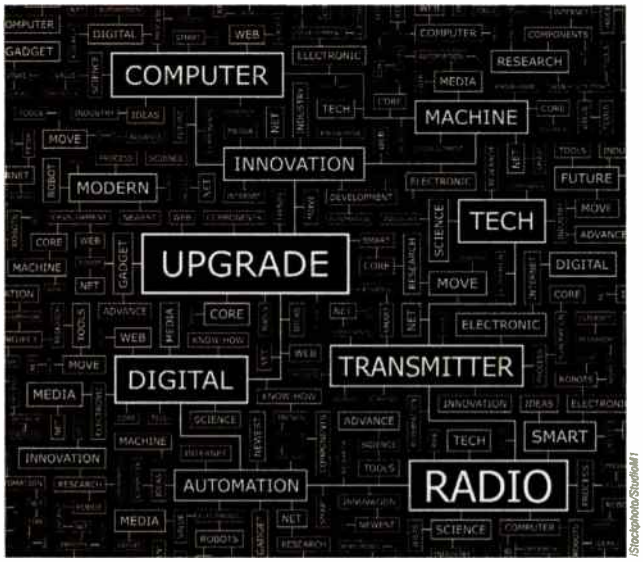
The Price Goes Down; The Cost Skyrockets

by the Wandering Engineer



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Broadcast business departments have come a long way. Not so long ago, engineering outranked finance. If engineers don't like to be thought of as janitors, business managers struggle to break away from being seen as "bean counters."

Their task is to reduce expenses through oversight. For a long time, the goal was to spend money "as if it were your own." Over time this has shifted to reducing waste and increasing leverage though centralized buying. It's been a long time since we've heard someone say "to make money, you need to spend money."

Stations I work with use a simple credit card-based system, with a monthly report to complete; or a more "advanced" IT-based purchasing system. One brand in particular seems to pop up (especially just before companies fail). Such systems are sold to business managers based on a record of "reducing costs." But economists teach us that often, real costs are not in the purchase price. For example, cigarettes are a few bucks a pack but their social and medical expenses are enormous.

When leadership buys such a system, it believes savings will come from leveraged buying power: "All our stations are buying the same things from vendors who grant savings based on getting all or most of our business." The real cost is almost invisible … unless you are a broadcast engineer.

Unfortunately, the responsible engineer, confronted with a system that is frustrating and time-consuming — one that forces him or her to purchase not from e-Bay and discount houses but from selected vendors at higher costs —will defer spending … which is to say, maintenance. An equipment fan might cost a few bucks at a discount house, a purchase that takes a few minutes with a credit card. This purchase — now grossly overpriced, for a product with perhaps not quite the right fit — may require several hours over several days via a vendor that happens to do business with your purchasing system.

Where once an engineer could obtain supplies at Walmart on his way to work, now he must spend hours to order inferior products at inflated prices. And he can't touch or see them until they are delivered a week later.

Yes, engineering cash costs drop dramatically — at first. Managers believe everything in the catalog is at bargain prices; they may get rebates. Vendors make their price points by cutting support and service. Resellers used to have to know products and guide you to best choices; now purchase decisions tend to be uninformed and we throw mistakes on a "cash-saving" pile. If something is wrong with a product, there's no reseller who stands behind it with the manufacturer. The choice is simple: Try to get your money's worth, and spend the time and brain damage; or toss this too on the "cost-saving" pile. There's no penalty for waste, no incentive to get it right.

Of course, the effects of deferred maintenance may never be felt; and for a while, the station becomes a charity; engineers will bring parts and tools from home; we'll stay late and take tasks home to stem the massive bleeding created by the purchasing system.

Broadcast engineers tend to be frugal, proud of a good deal. They are creative and may buy little things that make for a better product, cleaner workplace or more efficient process. They love to play Santa Claus, surprising the staff with odds and ends that make them and the product better.

Now the business department doles out such things — without oversight. Business managers sometimes are steeped in the notion that engineers spend money poorly: "the thrill of technology, the agony of expense." For example, the unnamed software company paints engineers as spendthrifts and incompetents, incapable of managing a budget or making a rational decision.

Well, maybe. Last week I ordered transmission line bullets; I already know I'm not going to get them; they think I was going to shoot a hole in the line. That line is going to burn up. No one in the business department or at the purchasing software company will connect the dots. And maybe it's not so bad; the business folks saved money; the software company made more money by "saving" money; and the engineer will get to save the day when a preventable "act of God" crisis eventually hits.

Yes, engineering is a cost center. But making it harder for engineers to obtain supplies or seek values is the wrong thing to do. Everything I know about how broadcast engineers think says so. When management buys into this form of insanity, the price goes down — but the cost skyrockets.

The Wandering Engineer is an industry stalwart who has been in broadcasting since the days of Marconi and Tesla. He gives his thoughts on the current state of broadcast engineering and the broadcast engineer.

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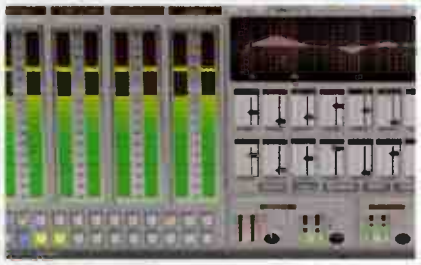
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