Radio Guide

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Digital Issue Now On-Line

March-April 2014 – Vol. 22, No. 2

Cover Story: What Your Console Wants You to Know

Wheatstone's Gary Snow and Andy Calvanese – Brainstorming New Ideas in Studio Control

POWER & LOGIC CONTROL

SUPERELAY
An interface for control of "On The Air" warning lights and utility switching from tally circuit of a broadcast console or switcher.

LOGICONVERTER
A utility control interface provides isolation and compatibility between logic and control circuits. 4 opto-isolated inputs control 4 isolated SPDT relay outputs. Great for TV camera tally lights.

MIXING

SIXMIX
The SixMix USB Broadcast Console is a full-featured professional radio station audio mixer. Its 10 inputs accommodate 2 mics, plus 7 stereo Line sources, and include an integral A/D + D/A digital audio codec with a USB computer interface.

STEREOMIXER
An 8-input, 2-output stereo mixer for line level signals. Operates in Stereo, mixing 4 stereo sources to stereo output, or in Mono, mixing all 8 inputs to mono output.

MICROMIXER
A 4-input, 2-output stereo mixer for line level signals. Micro-Assign switches permit routing any input to either Left, Right, or both outputs. Adjustable mix level for each input.

DISTRIBUTION, ANALOG & DIGITAL

DIGIMATCH 2X6
2-input, 6-output digital audio interface converts between AES/EBU and SPDIF signals. Also functions as a digital audio distribution amplifier, providing 3 AES/EBU and 3 SPDIF outputs from an AES/EBU and/or SPDIF input(s).

USDA 2X4
Utility Summing and Distribution Amplifier for line level signals has 2 inputs, 4 outputs (2 stereo pairs). Independent outputs can operate in stereo and/or mono. Adjustable output levels.

PATCHBOX II
Stereo Output Multiplier distributes the output of a stereo mixer to 6 balanced and 6 unbalanced loads. Feed DAT, cassette decks, processing gear, PA system, etc. without a distribution amp or patchbay.

AUDIO INTERFACE, ANALOG & DIGITAL

THE MATCHBOX HD
The industry's most used level and impedance converter. Converts unbalanced -10 dBv "consumer" audio to professional +4 dBm balanced lines. 4 channels for bi-directional conversion of inputs and outputs.

USB MATCHBOX II
An ultra high performance USB-to-XLR digital interface for analog and digital audio systems.

TWINMATCH
Dual-stereo (4 channel) level and impedance converter for 2 stereo "play only" sources. Converts -10 dBv outputs to professional +4 dBm balanced lines.

MULTIPORT
MultiPort is a multi-format digital and analog interface panel that provides convenient access to studio inputs and outputs.

TALENT & HEADPHONE SYSTEMS

TALENT POD
Gives talent control of their mic and headphones. Mic On/Off, Cough buttons, plus mixing for Local and Return headphone audio. Perfect for remotes and studios.

SPORTS POD
Like Talent Pod, but with dedicated Talkback output and remotely controllable Mic On/Off switching with Tally. Ideal for sports remotes and studio installations.

MULTIPHONES II
The MultiPhones Distributed Headphones System provides headphone listening facilities for multiple users. Use with Guest Pod and MiniPod listening stations or with Talent Pods/ Sports Pods.

MULTIPHONES MINI POD
A compact stereo headphone amplifier that can be used with MultiPhones II Master unit, or by itself as a "stand alone" headphone listening station.

SWITCHING

AUTOSWITCH
AutoSwitch is a silence sensor and automatic stereo switcher. It switches to Backup audio if Main audio fails or loses a channel.

STEREOSWITCH II
3-input, 1-output stereo audio switcher/router. Ideal as studio switcher or line selector. Can operate "in reverse" as a router, sending a source to 1 of 3 destinations. Relay switching adds no noise or distortion.

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Radio Guide

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Ray Topp *(publisher & editor)* – radio@rconnect.com
John Gutierres *(ad sales)* – sales@radio-guide.com

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"A good control surface today will be able to personalize access with presets that easily recall sources, bus assignments, mix-minus, input mode and pan and monitor configurations for your experienced operators, but can dial back to the minimum to keep the weekend ops from getting into trouble ..."

Audio Guide – *by Mike Callaghan (page 10)*

"I remember one time when a well-known personality was complaining that his phones wouldn't go loud enough. He was provided with a stereo amp rated 50 Watts per channel and he was happy. Shortly after the change, he was talking during a break and said, "Wow, man! Something's wrong. I smell smoke ..."

FCC Focus – *by Peter Gutmann (page 14)*

"You may recall a recent case that garnered much publicity, both because of the magnitude of the fines assessed ($1.9 million!) and the sheer recklessness of the situation. It involved a movie trailer for Olympus Has Fallen that prominently featured the attention signals intended to trigger a critical safety message on the Emergency Alert System ..."

Chief Engineer – *by Scott Schmeling (page 26)*

" It does make a difference which connector goes on which end of the cable. Because of the conductor twisting, the conductor orientation at one end will usually better match the orientation of the connector pins you are connecting to. I've found this to be true for XLR's, Sub-D's, and even 110 volt power cords ..."

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Cover Story

What Your Console Wants You to Know

by Dee McVicker - Wheatstone

Audio networking gets a lot of attention these days, but the true unsung heroes in the radio station are the consoles that show up for work every day.

The console is still the single, most important link between your talent and your listeners. It's the window to your station, and it has seen a lot of change over the past few years – from more announcers sitting at its controls to iPhone and tablet-toting listeners who expect more out of their relationship with radio.

These changes are reflected in the console itself. In fact, we now call them control surfaces because the incidentals that might have cluttered up your old console are now on the network, along with all those sources and destinations you no longer have to hardwire into the console. Our WheatNet-IP networked control surfaces, for example, plug into BLADE access units that have built-in intelligence for router control, logic control, gain control, utility mixing, silence detection, and switching. This eliminates the need for a lot of the extras that you might otherwise need in a console, which in turn determines the size of your console (think smaller).

Today's control surface is different in ways that make it more reliable, too. There's no audio on board, which means there are no critical electronics beneath the modules. These days, the likelihood of an accidental coffee spill taking out a Wheatstone control surface is slim to none. DSP also makes it easier to design in more customized features, along with greater reliability. With all those audio circuits out of the control surface, much less heat is generated, improving the longevity of the components that remain.

All of which will affect how your next console, or control surface, will look, feel and act.

Today's networked audio consoles offer per channel options unheard of in the past.

Short-Loaded Boards Are So Yesterday

"One thing we don't see much of anymore is people ordering short-loaded consoles," commented Brad Harrison, one of our sales engineers at Wheatstone. The reason is networking. "The fact that you can put any source anywhere at anytime you want, negates the need for trying to think ahead in terms of getting a bigger frame and adding faders down the road," he explained. Today, scalability is a function of the network; just add I/Os for sources and destinations via network access units (or BLADEs, in the case of WheatNet-IP).

The Magic Number of Faders Is …

One of your biggest decision points is the number of faders, and these days, it's an easy decision to make. The magic number of faders seems be 12, with 16 faders a close second. Twelve is just enough faders for the mics – one for a main DJ and another for a guest if yours is a music station, and at least four for a talk or news station – plus four more for the playout server, one or two additional for remote gear, one or two more for an Internet computer, and a couple of spares. At 12 faders, you have some decent leeway should you want to bring up Skype or YouTube on a fader, for example, or for those occasional sportscasts that need a few more channels. You will notice that console manufacturers, including Wheatstone and Audioarts, give you a lot of choices in the 12- to 16-channel range.

Control surfaces are able to pass event or show presets for sources, bus assignments and settings between them, so you can easily reconfigure the console in Studio A exactly like that in Studio B, for instance. Any networked control surface or console these days should be able to shake hands with the popular automation systems, too – generally through an audio driver, and in many cases will hand off signals to the STL.

More Production On-Board

There's more production on-board today, and our sales engineers suggest you take advantage of this for your on-air control surfaces – if only for maintenance purposes. With today's control surfaces your jocks, who might be dangerous with those extra controls, don't even have to know about them. Plus, these additional features don't add that much to the cost but can add immeasurably to time and dollars saved later on when you need to shift things around in a pinch. We felt so strongly about this that we recently added EQ, filtering and processing to our E-1, a very popular console in countries where they very rarely make the distinction between on-air and production. A control surface that has tiered controls and access protection for production is going to give you a lot more serviceable years than one that has everything out front where anyone with fingers can get to it.

By the way, on-board speakers and headphone jacks for cue were left out of the first generation of control surfaces and put on the network for technical reasons. But you can get this capability now, and you probably should. For example, we reintroduced speakers and added a headphone jack to our flagship LX-24 and Audioarts IP-12 on-air control surfaces (and headphone jacks in our Talent Stations and SideBoards).

More Individualized Access

A good control surface today will be able to personalize access with presets that easily recall sources, bus assignments, mix-minus, input mode and pan and monitor configurations for your experienced operators, but can dial back to the minimum to keep the weekend ops from getting into trouble. For example, we put EQ and other sound processing functions on every fader of some of our consoles because this beats having to root around for an outboard unit or go through a software routine to get to it. But you can bet we give you the option to turn that on or off as needed. Controls like this can be dangerous in some hands; some announcers do best with a simple button that switches between "live" and automation.

Some of today's control surfaces also have talkback buttons above the faders. That's going to make it a lot easier for your jock to do what he does best, which is talk without having to figure out where his fingers are at all times.

Lots More Mix-Minus/Bus Minus

Modern control surfaces have stepped up to the demands of live broadcast with more mix-minus/bus minus assignments and ways to auto-switch between off-line mix and on-line mix-minus, in many cases by the channel. For example, Wheatstone control surfaces use per-channel bus-minus outputs with selectable reference mix and talkback interrupt. In today's real terms, this means a much easier, faster and flexible setup during the harried rush of a live show.

The network interface can be sized to fit the task at hand.

Quality counts more than ever, given the mechanical nature of radio consoles or control surfaces and the increased wear and tear they go through on a daily basis. As always, there are no shortcuts to good quality. Even something as seemingly insignificant as how a manufacturer sizes the control surface vent holes has a direct bearing on the electromagnetic interference created, which in turn determines standards compliance. Manufacturers who have been successfully making consoles and control surfaces a long time (try 35+ years in Wheatstone's case) will have quality down to a science.

DSP Conveys More Data

A good control surface today will have VU indicators with visibility from wherever you stand in the studio, and it will be easy to understand at a glance. We included large, bright eyebrow meters in the meter bridge of our LX-24 control surface, for example, plus additional circular LED displays for indicating auxiliary send levels that are helpful to jocks.

In addition, thanks to today's DSP, we can also monitor all kinds of things we didn't see before: EQ, processing, routing, and other information critical to engineers or power operators – like bus names, average/peak or PPM level meters, event timers and the like. Modern control surfaces offer this type of monitoring through software GUIs that are easy to use, and useful at the same time.

We hear it all the time. Broadcasters tell us that they started out looking for a replacement console that they could drop into the studio, and ended up with a new space and a new way of doing things. When you no longer have to keep two or three channels potted up at all times for the automation, for example, you no longer have to tie up one studio indefinitely for that purpose – and you're no longer restricted to one cookie-cutter surface layout. Innovative surfaces like our SideBoard rackmount, Talent Station and Glass-E virtual mixer all come to mind.

Because today's control surfaces are more flexible and feeds are now dynamically allocated anywhere in the network, you could even find yourself with fewer studios and fewer costs.

Dee McVicker started her fascination with radio when she received a shortwave radio as a kid. She has been following changes in broadcasting for more than 20 years, more recently as part of Wheatstone's marketing team to introduce new concepts in studio control as a result of audio over IP networking.

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Dude, Where Are My Features?

The Sometimes Unnerving Re-Introduction to Updated DAW Software

by George Zahn

Brace yourself as your company or plant moves on to Windows 8 or other new operating systems. If you're a PC user, as I am in my workplace, you may well be finding out that old versions of digital editing software that you've "broken in" like a comfy slipper may no longer play well with newer operating systems. If you've been happily tooling along with a version of software that's several years old, keep an open mind as you read further. You can survive the quantum jump to the latest, and supposedly greatest, version of your software. I'm citing one experience here, but it is entirely possible that significant changes in my example may span different brands of software.

Cloud or Disc?

My case in point came as my parent company began switching old computers running XP to the Windows 7 or 8 platforms. At the same time, my old dependable XP was starting to show signs of wear and undependability. What a great time to upgrade my audio editing software as I bumped up from my old Adobe Audition 2.0 to the newest Adobe Audition. It was an ideal opportunity to try the newest Adobe Creative Cloud CC, so we grabbed a one-month free trial.

The Adobe CC allows you to run the program, in effect, from "the cloud," although you can keep your files and data on your local hard drive. The idea is basically that you in effect use the software on a monthly basis, with year-long agreements available. Working for a non-profit public station, I was concerned about budgeting for ongoing software costs, for something I had owned a license for when I had Adobe 2.0.

After working through some transition to the Adobe CC, we looked into Adobe CS6, the latest installation of Adobe Audition. We ordered the licensed disc and when it came, we immediately installed the CS6 version. My Ops Director also had to do some magic SATA modifications on the new Dell i7, with which I was supplied, just to get either new Audition to see the CD burner.

Burn Baby Burn

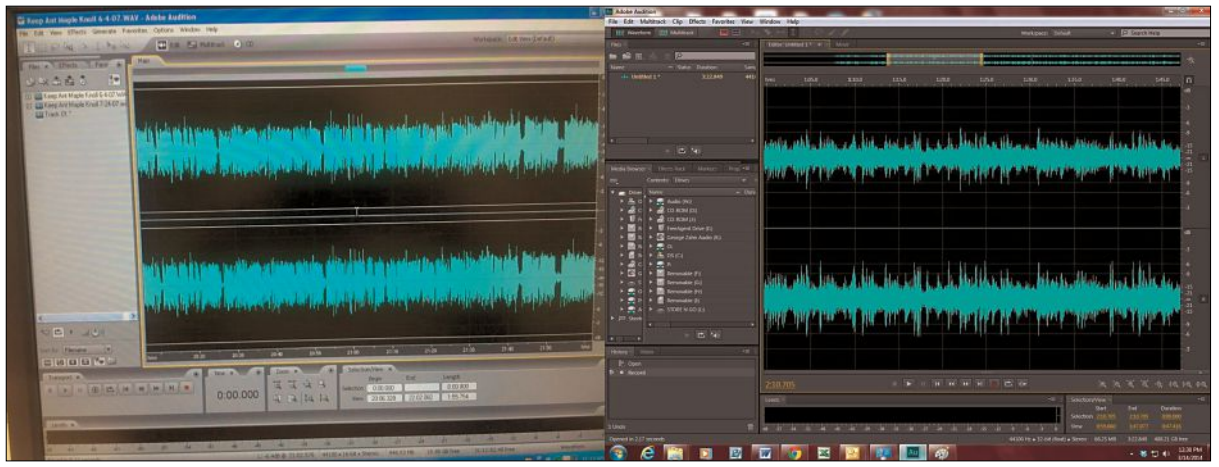
According to Adobe, there was no Adobe-based CD burning on some iterations of Audition before the newest versions. Somewhere between 2.0 and the new CS6 or CC versions, there was a point at which you could burn audio CDs only through someone else's software (Nero, Windows Media Player, Roxio or the like). That's not a terrible inconvenience unless you were used to using Adobe's old convenient track markers, which would allow you to burn multiple tracks from one audio file. Instead, you'd have to save each audio track as a separate file.

In all honesty, Adobe Audition is really part of the incredibly popular Adobe Suite of video and media editing tools. I have to remind myself that the software that was based in the Syntrillium Cool Edit Pro is really not solely for radio editing any more. On the other hand, I hope Adobe keeps in mind that a significant number of us are using their product for audio-only editing. I have been working on an interview with Adobe as of this writing and hope to have feedback from them in a future issue.

Even though the cloud software Adobe CC, and the disc based Audition CS6 are very, very similar in performance, there are subtle differences that may affect your choice of software. For example, in CS6, you can "export" an audio file, complete with track markers, to a CD to have it burned – but just *one* file at a time. In the CC version, you have full CD burning functionality that you may have known from version 2.0. Check features before buying one version or the other, with any software that offers license versus cloud software.

Patience Is the Key

There are trade-offs as with any change of software. Just as there's a learning curve with any new version, allow yourself ample time to explore and learn the new features.



Adobe Audition old (L) and new CS6 (R) screen shots.

Some new things will likely blow your mind and some small changes may have you rethinking basics of how you used the software before. In the best of all circumstances, *do not* try to learn the new features of the software while working a time critical or major project. In fact, I'd heartily suggest "transitioning" by using your old computer for the "must have now" projects and experiment simultaneously on the new software and new computer.

Simple crutches such as left-to-right and right-to-left scrolling features you had on the older version may be different, or non-existent, on the new version of some software. Now several weeks into a sudden transition which had me swearing at, instead of swearing by, my long-time favorite and dependable audio software, I have survived and I'm adapting to the changes. What I was able to do in ten minutes on 2.0 initially took me longer on CS6 or CC as I learned new pathways and navigated updated options. I'm getting closer to the same efficiency I once had.

Test New Features

Adobe promises some new improvements in the future, and I have to give them credit with the new CC and CS6 versions offering a classic look that gives users the "comfort" of looking at a very similar screen layout. I also have to add that one of the improvements, that I was pressed to use early in my trial with the new Audition, was the DeClipper. Our station had some slightly distorted press conference audio and what the de-clipper did to restore the audio was nothing short of amazing. Adobe had some special audio restoration and cleanup features before, but this was a new addition to the toolkit from old Version 2.0.

The challenge with any new software is to find the special surprises by poking and exploring, or at least spend some time with the manual or searching any knowledge base the software manufacturer may have at your disposal. Also, make your voice heard, about what you like and what you miss, to the software manufacturer. Something they felt was an expendable or frilly extra feature may be something that made life easier for many of their users.

As we have covered in previous articles, there are many options for digital audio workstation (DAW) software, and even the smallest of operations can increase efficiency and productivity by at least exploring the options – be it open source or free software, or a number of feature-laden software options that are available for a cost to broadcasters. For those among us using commercial software in public broadcasting settings at a true non-profit facility, I urge you to check for non-commercial licenses or rates.

As I learn more from Adobe on some of the issues here, I hope to pass it along, and I always look forward to hearing feedback on other digital audio software. This is not an indictment, nor a profound endorsement, of Adobe Audition, but rather a simple snapshot of one person's take on making a major software transition.

NAB "Cool Stuff" Feedback

A final note for this issue: I have to admit that some of the most profoundly changing moments in my career have come from exposure to new technology at the NAB Las Vegas show. I remember one year (long ago) seeing a wooden and plastic glued-together mock up of a very early digital workstation controller, only to be using the working model of that device within months and doing the first digital editing of a long career.

Whether you're at your first NAB or you're a veteran of the show, you undoubtedly have seen technology that seemed as if it were a decade or more away, just to see it get here faster than we could ever predict. New software and devices that are financially out of reach one year, quickly become commonplace and attainable.

For those at this year's NAB, or following from a budget-restrained distance, please share with me the new studio technologies that have grabbed you and piqued your interest. What are the needs being met at this year's NAB and what are the studio needs that still need to be addressed from your perspective as a manager or engineer. Please share your comments at my WMKV address: gzahn@mkcommunities.org.

George Zahn is a Peabody Award winning radio producer and Station Manager for WMKV-FM at Maple Knoll Communities in Springdale, Ohio. He is a regular contributor to ***Radio Guide*** *and welcomes your feedback. Share your stories with others by sending ideas and comments to gzahn@mkcommunities.org*

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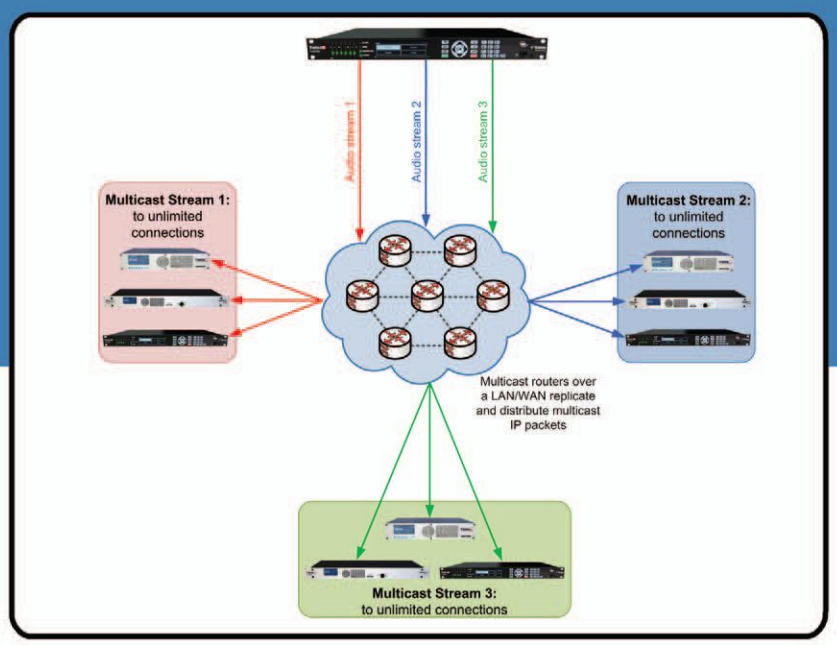

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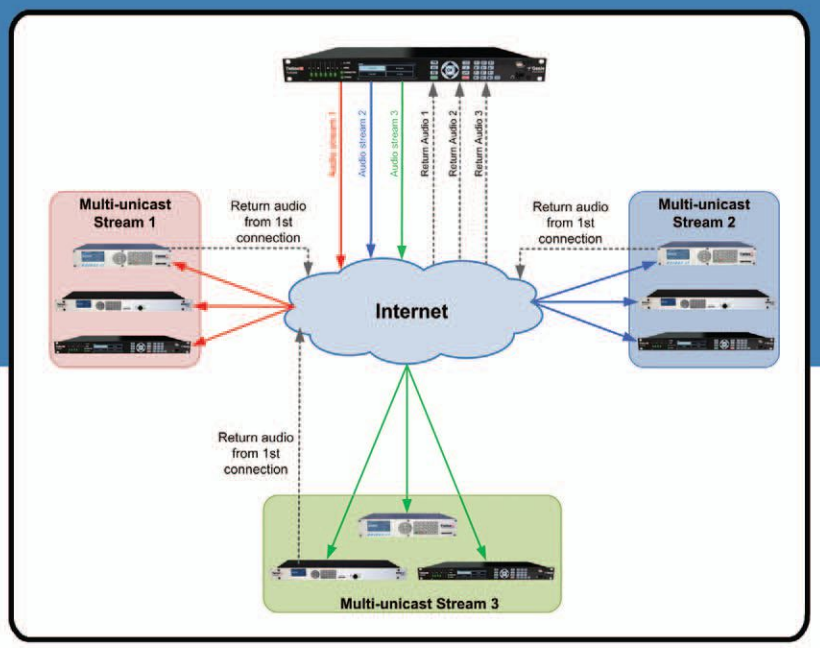

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Audio Guide

Dangerous Decibels: How Loud is too Loud?

by Mike Callaghan (KIIS Radio - Retired)

Working in Radio, we make our living with sound. Lots of it.

It's an unusual D.J. that doesn't crank it up now and then to get the feel of the music. And a lot of music really wants to be played loud. High-energy radio takes big speakers and big amplifiers to set the mood in the studio.

A problem arises when we set the mood and the music level too high – our ears aren't meant to be assaulted in this way. Show me a top jock from the era of top 40 radio and I'll show you someone that can't hear very well.

Hearing loss is an occupational hazard in radio. Want an example? Think about the monitor level knob in a production studio. When the production guru first shows up in the morning, chances are the knob is set about 10 or 11 o'clock. His ears are fresh and he doesn't need a lot of volume. But when he leaves for lunch about 1 o'clock, the knob is also up to about 1. And at the end of the day, it's closer to 4 or 5. You can just about tell the time by using the monitor knob as an hour hand.

In the air studio, there's an even larger issue. The personality wears headphones, and these fit tight against the head and seal the audio drivers right up against the eardrums – no sound can get out. We do this on purpose to stop feedback when the mike's open. But even someone else in the same room can't tell when the jock's got it cranked up to the so-called "threshold of pain." And this level really isn't all that loud. If you've been in the front rows at a moving rock concert, where the band is really into it and the crowd is too, you've heard the 120 db SPL this requires. It's very easy for headphones to reach and even exceed this level.

I remember one time when a well-known personality was complaining that his phones wouldn't go loud enough. He was provided with a stereo amp rated 50 Watts a channel and he was happy. Shortly after the change, he was talking during a break and said, "Wow, man! Something's wrong. I smell smoke, but I don't see any fire." Looking in the studio window, there was smoke pouring out both sides of his headphones. He's passed away now, but he couldn't carry on a conversation with you, no matter what kind of hearing aids he bought.

Even with modern sound isolation, must studio walls will pass enough sound to let passersby know when the speakers are too loud. Typically, the personality inside is aware when the walls are rattling and dust is sprinkling down from the ceiling, and they'll avoid really extreme speaker levels.

Many years ago, when KIIS was in Hollywood, the City of Los Angeles came through with a Sound Level Meter and measured how loud the speakers in our air studio would go. After they had measured all the stations in the city, we got a special award because we were doing such a good job of protecting the hearing of the personalities that worked for us. How nice! In reality, the reason we won this dubious distinction was because we were using old RCA consoles with really anemic monitor amps built into them. I think the maximum they'd produce was 10 Watts or some such.

So, what can we do, as engineers, to protect our air staff from acoustical trauma? The obvious answer is to limit the sound pressure levels they're exposed to. This can be as simple as controlling the gain on the speaker and headphone amplifers.

Once these are set, you can use security covers on the front to keep them safe from roaming hands. Of course there may still be some unhappy staffers that like their music loud and primal.

You can get an inexpensive digital Sound Level Meter on Ebay or from Radio Shack on-line for under $40. There are also apps for Smartphones that measure sound levels, but their accuracy is unreliable – especially at levels above about 80 db. (Some smartphones have microphones that seem to saturate and flatten out above this volume.) If you can borrow a real meter and then successfully calibrate the smartphone against it, the resulting offset will give you a reasonable indication of what levels are underway. *(See the photo of the Smartphone Level Meter.)*

Audio Levels and Hearing Damage

Environment	SPL	Interval for Damage*
Threshold of hearing	0	Infinite
Normal Conversation	60	Infinite
School Cafeteria	85	8 hours
Band Class	90	2 hours
Power Tools, Metal Workshop	100	15 min.
Personal Stereo MP3 Player (loud)	105	5 min.
Chainsaw, Loud Rock Concert	110	1.5 min.
Front Rows, Loud Rock Concert	120	9 sec.
Firearms, cannon, Firecrackers	140-160	Instantaneous & Permanent

* Repeated exposures over long duration.

Measure the speaker levels at the same location where the jock's head will be, aiming the meter directly at the speakers, one at a time.

The loudest you'll want the studio speakers to run on dense, highly modulated music is about 90 dB SPL. This is a good compromise between hearing the music well enough to be moved by it, and possible hearing damage. Studies show this level can be tolerated for 2 hours repeatedly and still be safe.

Make it louder at your own risk; 100 dB SPL is 10 times as loud, and just 15 minutes of this on a regular basis will cause hearing damage. Some studies show that even a high school cafeteria, at 85 dB, can affect your hearing if you work in one. So 90 dB should do the job effectively, given that the music is intermittent during an air shift.

One way to make it sound louder without increasing the danger is to add a subwoofer. This will "boost the beat" because low frequencies are less harmful than medium and high ones for a given level. Human ears are most sensitive around 3-4 kHz, because of the natural resonance of the auditory canal.

Smartphone Level Meter

Headphones can be tempered by using the Sound Meter to measure the level inside the ear muffs, and working with the headphone amplifier level controls.

Don't overlook yourself while you strive to protect people working in the studios. Protect yourself as well. Generator sets enclosed in your transmitter building can create massive roaring audio levels. Hopefully, these will be in a separate and well-isolated room from the other equipment, and they'll have at least one set of industrial hearing protectors hanging next to the door.

Even working in your shop can be dangerous; using a saber saw to lop the end off a rack panel or trimming something with a bench grinder can make your ears ring afterwards. You know it's loud, and your ears are going to ring when you're done, but somehow it just doesn't seem worth finding the hearing protectors beforehand. Don't fall into this trap – be aware and protect yourself. Keep the hearing protectors next to the safety glasses and use them both together.

Avoid the little in-the-ear hearing devices. These can develop pressure levels so extreme you can do serious damage without realizing what's happening. And if you use these with an Ipod, MP3 player or Smartphone, be especially careful not to have them too loud. Like tequila, you don't realize how much you're having until it's too late!

Hearing loss due to sound exposure is accumulative; it adds up the longer it happens. So while you may feel your hearing is just fine and you needn't worry, the truth is that you won't notice the damage right away while it's taking place. After months or years of accumulated assault, you'll discover yourself asking people to repeat themselves, you'll start missing soft noises, and eventually you'll realize you're not hearing as well as you should. By then the damage will have been done. And there is no hearing aid that can restore normal hearing.

It isn't just hearing sensitivity that causes problems. Loud sounds for too long will cause tinnitus; a constant hissing or ringing sound that's always present. This aggravating noise will cover up, or mask, the sounds you should be hearing so they'll be buried underneath it.

It would be nice if there was a way to correct deficient hearing. But once it's gone, it doesn't come back. You have to live with it forever. For this reason, you should pay careful attention to what you expose your ears to. You may never have too much money, but you can certainly have too much audio in your life.

Mike Callaghan was formerly the Chief Engineer at KIIS-FM in Los Angeles, CA. His email is: rg@mike.fm

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In the Field

You Gotta Be There!

by Steve Callahan

Every radio station engineer wishes there were 25 hours in a day. With computer- related responsibilities also on your plate, and the ever increasing numbers of stations in your cluster, the total hours in a day are just not enough to get to the bottom of your "to do" list. However, there are things you just have to make time to do, or at least, observe.

Just recently, I visited a radio station's tower site and found my favorite tower crew there on a job – they were there to check the work done previously by an out-of-town tower crew. The job that was supposed to be performed was the installation of a two-bay FM antenna at the top of a 400-foot tower, and a run of 1-5/8" air line coax from the antenna into the transmitter building. You'd think this is a job that any competent tower crew could accomplish. However, when I got there, my tower crew told me that the 1-5/8" air line had split near the entrance to the transmitter building. The split was due to the line having a fair amount of water in it which later froze with the extreme cold weather we've had this winter.

My tower crew checked the line all the way to the top and found that the out-of-town crew didn't connect the coax to the antenna, but had just left the top of the air line open to the elements and that's how the water got in. But the fun didn't stop here. They pointed out something to me that was mounted about halfway up the tower and partially obscured by a torque arm mount. It was the antenna's matching transformer! Rather than being mounted on the lower end of the two bays, it was 200 feet away from the antenna. Obviously, the out-of-town tower crew was not properly supervised by the station, and they wanted to do the bare minimum to get paid and get out of town.

Correcting that problem was going to take a lot more money than the station owner saved by using the out-of-town crew. I'm not pointing an accusing finger at all crews that work far away from home, but there are some that have to work fast, and have to get a lot of jobs done, to make the trip financially feasible and, unfortunately, sometimes corners are cut.

Where's the Paint?

I was at a station a few years ago that had contracted with an out-of-town, low-bidding, tower crew to paint a four tower AM array. It wasn't a tough job because the towers were in a wooded area away from houses and parked cars, and two of the four towers were relatively new. I met the crew at the site and learned that they had arrived without any paint! They were planning on going to the local paint store and buying some. I had to go with them to make sure that they bought the right quality of paint and the right color. I also spent the two days with them at the site while they accomplished the job.

I really didn't want to leave these guys unsupervised for a minute. If I hadn't been there, there's no telling what color of house paint would have gone on those towers.

We've all heard the stories of some tower painters who painted only the downward-facing parts of a tower so the job looks good from the ground. I've even seen crews that painted over everything on an AM tower, even the base insulator. There was one crew I saw where the foreman never left the front seat of his vehicle while his crew of mostly inexperienced college-age guys painted a self-supporting tower. This is not exactly a job that I would have let them learn about on their own, without some hands-on supervision by the foreman – especially on the horizontal braces.

I'm not ganging up on tower crews, but I am asking why anyone would turn over the keys to a tower site, to an unknown entity, to perform unsupervised work that could cost the station thousands of dollars to correct if done improperly? Yes, we are all way too busy these days, and if you are a contract engineer, it was probably a strain to get the station manager or owner to agree to pay for the work after deferring it for too long.

Another project I got called into after the fact was a tower re-guying project of a 1000 watt daytime station. Seems the owner didn't want to call in his contract engineer to supervise the work so he just handed the keys to the crew and pointed in the general direction of his tower site. The crew got there and started to replace the guy wires. Unfortunately, the inexperienced crew didn't know that the old guys just couldn't be laid over the RF feed loop and then over the top of the chain link fence surrounding the tower base while the station was still on the air. The station manager's savings were eaten up real fast with the subsequent transmitter repairs.

Rolling, Rolling ... Gone

Several years ago, I learned of an FM station that had received a large spool of 3-inch air line coax at their tower site. The delivery crew showed up and just rolled the six foot spool off of the truck and onto the ground in front of the transmitter building. Chances are good that the delivery didn't include the use of a truck with lift gate, because no one from the station was there to supervise or receive the delivery.

Not surprisingly, that coax didn't stay there for too long because even though the spool landed on its side, someone stole it, and the only sign that it had ever been there was the outline of the spool on the ground.

It's all too easy to just let someone, whether it's a landscaper, HVAC, telephone, delivery , tower, or other crew, to just take the keys and work unsupervised at your tower site. I know you're thinking that it's hard to justify taking a full day of your time to just stand around at your tower site while someone else is working. However, I look at it a different way. I'm representing the interests of the station by my presence and I have the opportunity to save my employer or client money by that presence.

If the crew has any questions, I can answer them immediately if I'm there, so the project doesn't get delayed waiting for an answer. I always try to get as much done as possible if I have to be out supervising a crew. Why not schedule your landscaper to come in and clean up the outside of your site while you're waiting for the HVAC guys to finish their work? An afternoon at the tower is the perfect time to clean up the inside of the transmitter building and change the air handler's filters while you're waiting for that emergency generator fuel delivery.

If you spend some quality time at your tower with your contractors while they are there, you just might learn some new tips and techniques from them, and that will pay dividends to you and your station in the future. Don't look at it as a waste of time, but rather, consider it time well spent and invested in the appearance and operation of your transmitter site.

Steve Callahan, CBRE, AMD, is the owner of WVBF, Middleboro, Mass.

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FCC Focus

Creative Production – Within the Rules

by Peter Gutmann

Let's face it – far too many radio spots are informative but dull. To attract the notice they deserve requires all the creativity that production staffs can muster. Yet, as with many things in life, there's danger in going too far.

Since this is a legal column, we won't presume to judge the effectiveness of ads that tend to annoy in order to draw attention. Rather, our purpose is to highlight some considerations that may expose you to unwanted legal consequences.

You may recall a recent case that garnered much publicity, both because of the magnitude of the fines assessed ($1.9 million!) and the sheer recklessness of the situation. It involved a movie trailer for *Olympus Has Fallen* that prominently featured the attention signals intended to trigger a critical safety message on the Emergency Alert System. Whether or not it boosted the fortunes of the movie, it succeeded in attracting the attention of the FCC.

As the *New York Times* noted, the EAS tones were "intended to summon viewers not to shelters but to movie screens" where they would thrill to scenes of "the White House surrounded by terrorists, landmarks in flames in the nation's capital and military convoys patrolling the city." (Sitting in my office a half-mile from the White House, I sincerely hope you don't share the producers' fantasies!)

Actually, the trailer was not broadcast but rather ran dozens of times on various cable networks distributed by Viacom, NBC Universal and ESPN. Even so, the FCC accompanied its decision with a stern lecture on the significance of its prohibition on the misuse of EAS alerts, which applies across all platforms.

That ban is found in the Communications Act itself – section 325(a) prohibits the transmission of "any false or fraudulent signal of distress or any communication relating thereto." The FCC rules are more specific, banning the transmission of "the EAS codes or Attention Signal, or a recording or simulation thereof, in any circumstance other than in an actual National, State or Local Area emergency or authorized test of the EAS."

In their defense, the cable networks asserted that they did not produce the spot but rather it had been supplied by the distributor or its ad agency without adequate notice. They further argued that they pulled the spot as soon as they were alerted to its content. The FCC rejected the defenses on the ground that the statute and rule are absolute and do not require proof of an intent to deceive viewers or listeners.

Admittedly, the cable spot all but begged for a hefty fine, as it clearly used the EAS tones in a way that the FCC rule specifically forbids. But another, less publicized, case suggests that less egregious uses of emergency triggers can be troublesome as well.

In a recent radio case, a car dealer had launched a May sale promotion with the word "Mayday." Although voiced by the dealer, the spot was created by its ad agency, whose creative folks tried to add a hint of urgency to the notion of a May sale by invoking the beginning of the international maritime distress signal. The local sheriff complained to the FCC, claiming that this was a false report of an emergency.

In response, the licensee noted that, in order to trigger a response and to prevent mistaking it for an innocuous use, the distress protocol used by ships and aircraft requires that the word "Mayday" be used three times in quick succession and then followed by specific location information. It further noted that the only mention of the word in the spot was in a context and using a relaxed tone that could not possibly be mistaken for an urgent call for help. Ultimately, the Commission staff agreed, but only after subjecting the licensee to significant expense and delay in obtaining grant of its license renewal and approval of a court-ordered pending sale. Often, as in that instance, the cost in money and time to defend a complaint can be more severe than the potential penalty itself.

So what's the lesson to be drawn from all this?

First and foremost, never, ever, use the EAS attention signal except for its intended purpose. But beyond that, any broadcast that could be mistaken for an actual emergency deserves particular scrutiny.

The statute is phrased broadly, and has led the FCC to adopt a more general rule as well the specific one addressing EAS. Section 73.1217 forbids the broadcast of hoaxes. Even so, that rule is triggered only when the licensee knows the broadcast information is false, when it foreseeably will cause substantial public harm and when it actually causes such harm.

Perhaps with an eye to the famous "War of the Worlds" hoax, the rule further exempts programming accompanied by a disclaimer that "clearly characterizes the program as a fiction and is presented in a way that is reasonable under the circumstances." It further defines "public harm" as beginning immediately and causing direct and actual damage to property or the health or safety of the general public, or diverting public authorities from their duties.

What type of scheme might run afoul of this rule? How about a contest in which listeners are encouraged to scavenge a public park to find clues for a treasure hunt? Or a promotion that causes a major traffic jam to get to a specified location and time? Or a claim that a DJ is in trouble and needs to be rescued? (I wish I could claim that these are mere products of my own fertile imagination, but they all actually occurred.)

It is essential to bear in mind that licensees are held fully responsible for everything broadcast over their stations. An excuse that a spot or promotion was created by an outside party, whether a time broker, an ad agency or a sponsor, is irrelevant. Similarly, prompt action to pull a problematic spot does not alter the fact that it was broadcast in the first place. Obviously you need to trust your staff – after being sure they understand the basic principles and are prepared to apply them.

Since the rule is so specific as to the scope and consequences of an actionable hoax, the FCC often determines that certain complaints did not violate its rule. However, even if a situation does not constitute an illegal hoax, it still can invoke violations of other rules.

Here's a quick quiz – which (if any) FCC rules apply to each of the following situations?

• A contest in which a station announced that it was giving away $1 million per hour (but obviously never did);

• A morning show's plea that listeners call a celebrity's room at a hotel, after which the station aired an anguished call by the hotel manager to complain that the phone lines had been flooded;

• Airing traffic reports as "live" when in fact they were sent from a reporter's home so he could sleep in;

• A claim that a DJ had been shot in the head during a break.

OK, time's up.

The bogus lucrative giveaway clearly violates the FCC's contest rule, which requires accurate disclosure of the material terms, including the extent, nature and value of prizes that can be won. So if you're tempted to scoop the competition by offering callers a million dollar reward for their efforts, you'd better have the funds available.

The celebrity calls turned into a problem only when the station aired the manager's telephone conversation without first obtaining his permission (which, of course, would have ruined its spontaneity, as well as any comedic value). Recall that all parties' consent must be obtained before airing a phone call, unless they are already aware or should be presumed to be aware under the circumstances that it is likely to be broadcast.

The "live" traffic reports, if pre-recorded, would have violated the FCC rule that requires recorded material to be identified as such. The applicable rule applies to material in which time is of special significance or where an affirmative attempt is made to create the impression that it occurring simultaneous with the broadcast. But if the reports in fact were live, albeit faked, that would not pose a problem.

As for the DJ shooting, it takes quite a lot for the FCC take action on a false news report that doesn't cause any damage other than upsetting emotions. In fact, it hasn't penalized a licensee for news distortion in decades. Yet in this case it admonished the licensee for failing to act in the public interest – not a fine, but something you still wouldn't want on your record if faced with a renewal challenge.

Even if specific FCC rules may not have been broken, had any of these cases caused a dangerous public disturbance or diverted authorities from legitimate duties, then they would have run afoul of the rule prohibiting hoaxes.

Beyond FCC matters, there also loom the issues of damage, privacy and public relations. Thus it may not violate any law to begin a spot with a loud siren or horns honking, but what if your devoted commuter reacts by swerving into a parked car or, far worse, into a pedestrian? A comedy routine intended as good-natured may not strike the subject as amusing. A station's apology may wind up creating far more negative publicity than the original broadcast.

Often it seems that creativity is the arch-enemy of good judgment. But with just a dab of common sense, hopefully you can spice up your ad copy with creative production without running afoul of the law.

Peter Gutmann is a partner in the Washington, DC office of the law firm of Womble Carlyle Sandridge & Rice, LLP. He specializes in broadcast regulation and transactions. His email is: pgutmann@wcsr.com

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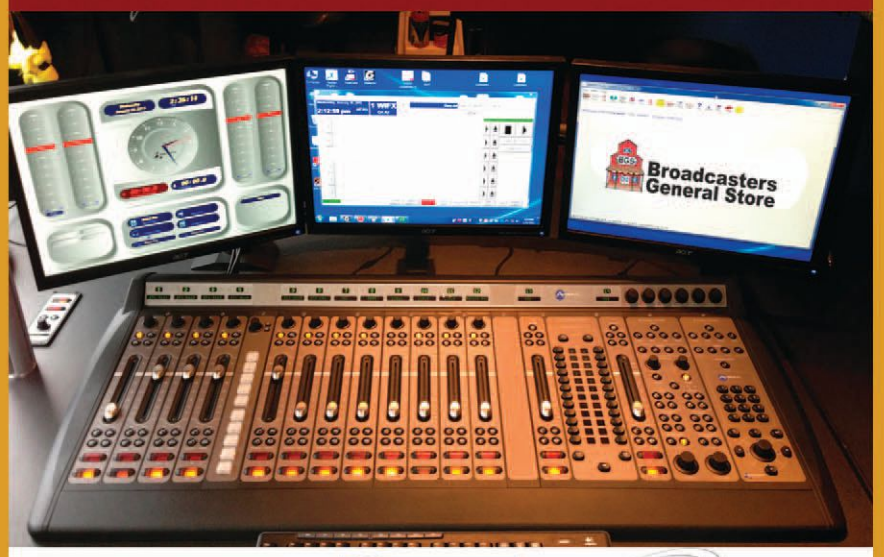

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Science of Sound

Acoustics and Radio – *Part 3*

Practical and Theory

by Jeff Johnson, CPBE

Have you ever been asked, "How do you know that?" And you reply, "Well, I've done this before – too many times!" Of course, truth-be-told, we've all learned throughout our life – the 'ah-ha!' moments. The author started engineering at a multi-station complex in Cincinnati. There were a number of very nice production studios with digital consoles. It was pointed out to me that they were *production* consoles, not broadcast consoles. Oh.

The *PRACTICAL* – Consoles

So, what is the difference? Why are there different types? Haven't we all been called to the studio urgently because we are *"Off The Air!"* only to discover the problem being a button not pushed. It is always a relief to find something simple, but that points to why production consoles do not belong in the on-air studio. Do we want jocks fussing with the EQ?

Simple Air console above, complex Production console below.

The difference is simply that an *Air Console* is reduced to the simple basics – input on/off, level sliders, cue, and output assignment. One important feature of an Air Console is the "tally" feature. Tally is simply a signal, probably a relay closure, which lights the "ON AIR" sign at the door, mutes the studio monitors or starts a "skimmer" recorder. Another tally may be used to start a player connected to that channel.

A *Production Console* will commonly have many more channels – an array of inputs and output busses per channel, equalization, effects, sub-mix channels, panning controls, auxiliary sends for side channel EQ or reverb, mono mix, and other complexities. If something is wrong on the air, it may take minutes to comb through a production console to find the problem. Was it the ashtray sitting on the knobs and buttons? Don't laugh.

The *THEORY* – Reverberant Halls

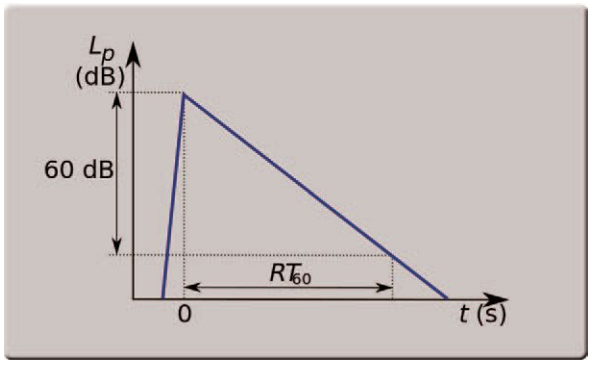
Before the broadcast of audio, speech or music, it must, of course, be converted into an electronic signal. Previously we have discussed anechoic studios where the environment must affect the sound a little as possible. This is accomplished with acoustic absorption, isolation and traps. Now, we shall consider the opposite – concert halls and studios where the environment is integral to the experience and the character of the sound.

The first thing many of us do when entering an unfamiliar hall is the clap our hands and listen to the reverb. We will move about clapping our hands or snapping our fingers,

RT – Reverberation Time

This noise making is to subjectively measure the RT (Reverberation Time), the EDT (Early Decay Times) and other parameters that affect the sound of the hall. An empty hall will sound different than will an occupied hall, and an acoustician, mix artist or performer will know to take this into account.

RT60 is the time required for reflections of a direct sound to decay 60 dB.



Sound Intensity vs. Time

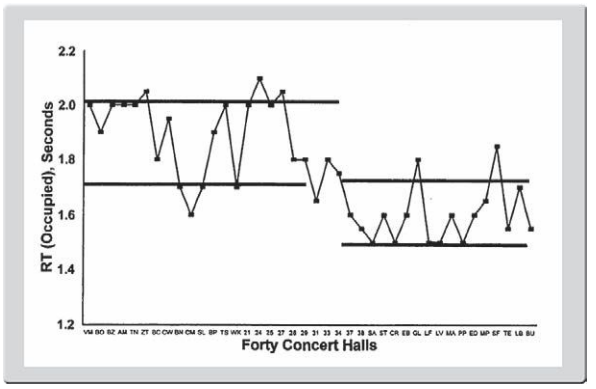
An acoustician, Leo Beranek, has published a fascinating paper found at: www.leoberanek.com/pages/eighteighthalls.pdf

Beranek rates many concert halls in this paper. In the top half of the rated halls, the reverberation times fall between 1.7 and 2.0 seconds, with the top six halls having reverberation times of about 2.0 seconds. In the bottom group of halls, the RTmid (mid-frequencies) lies between 1.5 and 1.7 seconds. It is apparent that the conductors and music critics prefer a hall with a reverberation time approaching 2.0 seconds, and are less enamored with those halls that have reverberation times less than 1.7 seconds.

The historic period, and composer of the music performed, is a factor affecting the suitability of a certain hall. "The music of Bach and the early composers sounds best in halls with moderate reverberation times. The late music of Beethoven and the music of Mahler and Bruckner, for example, sound best in halls with relatively high reverberation times," says Beranek. Pipe organ music can sound magnificent in a very long RT environment such as Cincinnati's Museum Center Rotunda (former Union Station), or the former Wanamaker's Grand Court, Philadelphia.

AS – Auditory Spaciousness

Beranek does not consider RT the most important parameter of a hall. According to Beranek, "It is generally agreed that in the best halls, a sound source on the stage seems broadened, owing to early lateral reflections from the sidewalls. This is the explanation why the majority of the best halls are rectangular, which is the easiest shape for the production of lateral reflections. The phenomenon of source broadening is often called auditory spaciousness (AS), or apparent source width ASW.



Preferred concert halls have longer RTs.

SDI – Surface Diffusivity Index

Veteran concertgoers certainly notice that the most satisfying halls have not only a rectangular form enhancing Auditory Spaciousness, but irregular surfaces – ceiling and walls. A deeply coffered ceiling is found, for example, in the superb Cincinnati Music Hall – the walls are highly decorative plaster. Music Hall is, however, a very large hall and may be considered as having too long a reverberation time to be considered acoustically optimum. SDI is determined visually using the guidelines of Haan and Fricke of Australia. (See References in Beranek.) The fancier the better, no doubt. That may be why Baroque halls may sound better than modern halls modeled on Internal Style architectural norms.

BQI – Binaural Quality Index

Auditory Spaciousness relates to the BQI, or Binaural Quality Index. The Binaural Quality Index equals the quantity called interaural cross-correlation coefficient. Note that when a lateral reflection reaches a listener, it impinges on the closest ear without change. After it travels around the head, it will be decreased in amplitude and will be delayed in time. The BQI takes into account all of the lateral reflections impinging on both sides of the head within a stated time, including the differences in their amplitudes and time differences at the two ears.

EDT – Early Decay Time

"Only the early 10 decibels of the sound decay (Early Decay Time) is heard most of the time because successive notes in most symphonic compositions follow one another rapidly. Of course, when there is a slow passage or a stop chord, a greater part of the decay or the full RT is heard," according to Beranek.

SABINE – Sabine Equation

Sabine's reverberation equation was developed in the late 1890s in an empirical fashion. He established a relationship between the RT60 of a room, its volume, and its total absorption (in sabins).

- See: www.sengpielaudio.com/calculator-RT60.htm
- Reverberation time RT60 = 0.049 x V/A (V=room volume in cubic feet, A=attenuation coefficient)
- The attenuation coefficient calculator can be found at the listed URL.

Next time at a concert, forget all of these acronyms and equations. Just enjoy the music. But if the acoustics are not right, you will now know why!

Jeff Johnson can be reached at: jeff@rfproof.com

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Tower Topics

The Truth of Towers

Part 3 – Towers Meet Mathematics

by Leonard Weenou, P.E.

In this series, we have been discussing the selection and design concepts of towers in general, and using the information to start planning a "fantasy" tower. Last time we considered the principle specifications and loads, and identified the limitations of our location for our theoretical project.

Although we promised last time to start pinning down some specific details, on reflection I think in our discussion today we should make sure we define and understand some of the important terms.

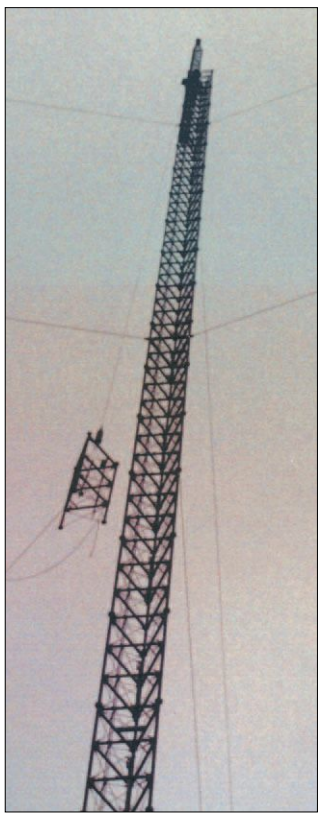
What Is the Tower's Purpose?

Among the most important things we need to answer: exactly what does this fantasy tower – or your real tower – really have to do for us?

At the most basic level, we can reduce the criteria to these areas:

1. Hold up the station antennas.
(or *be* the antenna if it is for an AM station)
2. Hold itself up.
3. Survive duress.

Now there are tower "builders" who are the people who put up structures by rote to accomplish these goals, and they just replicate what others have done in non-critical applications. There are tower designers who just use tables and basic GEP (Good Engineering Practice) to tailor installations.



A tower is a mass of triangles.

Then there are the engineers who know the physics and mathematics of what they are dictating to be erected, and can speak with authority about the structure. These latter talents are especially needed in purpose-built, near one-of-a-kind, or highly customized structures. So how do they do this?

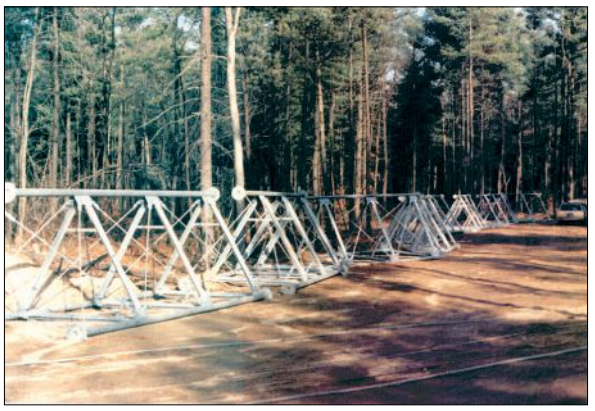
Engineers Love Trig!

The fruits of trigonometry are all over and around us – and most of the world we know. Trig helps define and evaluate many of the forces that we encounter. Trig is so ubiquitous, it has become part of our lexicon.

1. Hollywood writers refer to the story "arc."
2. We all know people who are "off on a tangent."
3. And all through the sixties, everyone wanted to know "hey baby, what's your sine?"

Seriously though, for design and evaluation purposes, towers, in the main, can be divided into a large series of triangles, and trig is for triangles.

Why this love affair with triangles? Because the triangle is the strongest form in nature. Even without physics training, a study of nature – even human nature – would show you this. For example, when challenged, most people move into a triangular support stance – legs out, forming a triangle with the ground and leaning forward, creating another vector triangle with the ground.



A closer look at a "mass of triangles." Recently assembled seven foot face, by twenty foot high, triangular sections await stacking."

A study of a well-designed tower through field glasses or a spotting scope will reveal that it is a mass of triangles. Even four legged self-supporting towers achieve rigidity and strength through using face diagonals and gussets or wedges in the corners making triangles.

The Triangle and the Guy Wire

In a guyed tower, a most important diagonal (or hypotenuse) of that triangle is quite often a guy line.

It is worth noting that a guy line has no strength in compression and so contributes its supporting capability only when in tension. Even so, only when in extreme tension does the line take on the characteristic of a straight element. For the most part, the guy line geometry is a catenary – an arc. By the way, trig works for arcs as well because what is an arc for evaluation purposes but a long series of very tiny triangles?

The purest catenaries are unilateral with even elevation high points at the ends and the maximum sag in the middle such as you see on power lines in southern New Jersey, the flattest land space on earth. The even elevation of the end points and the uniform weight of the wire create this symmetry.

Since the guy line connections on our guyed tower are uneven in elevation (low earth point at ground level at the anchor and a higher connection point at some elevation on the tower), the arc is uneven with the maximum deflection (sort of a sag) not normally at the midpoint of length.

Now I mention this catenary circumstance for three reasons:

• One, the use of straight-line calculations for stress analysis is a fiction – however it is a fiction close enough to be accurate.

• Two, because of the catenary, cable length, the varying tension, etc., the phenomena of line resonance and period harmonics becomes of interest and possibly some concern. We will get back to this – I promise.

• Three, deflection (the differential value of sag from a theoretical straight line between the two connection points) and period of oscillation can be used then as secondary indicators of cable tension and guy tension balance.

Next time we will delve further into tower fabrication and define some more terms we have or will encounter, so we are all on the same page so to speak. Please bring your calculator.

Guy wires have no strength in compression – only in tension.

• To be precise, trigonometry is only that portion of mathematics that deals with the special properties of a right triangle. However we will include here much of geometry and some other small sections of helpful related math elements and throw them into what most of us think of as "trig."

A legendary consulting engineer, Leonard Weenou has overseen many tower projects. So far as we can tell, all have stayed erect! Contact him at editor@radioguide.com

Engineers and Towers Erectors

In a gross simplification, the difference between engineers and riggers is that the former have a strong knowledge of concepts and a workable knowledge of materials. Conversely and complimentary, riggers have a workable knowledge of concepts and a strong knowledge of materials.

If these two groups work together and harmoniously, your tower has the greatest chance of being as close to perfect as possible. Even on the simplest of projects, riggers should never be allowed to do their work without ready access to the design engineer.

In the case of a new tower, the execution of its construction is normally straightforward, and unless erection limitations are noted on the drawings, the riggers can normally just follow good construction practice and mandatory regulations to safely and expeditiously proceed to conclusion.

Retrofits, especially in the current tower sharing enthusiasm, represent the greatest danger to the rigging crew with the real possibility of exceeding the design limits of the structure. The static loads of the final installation may be well within capability, *but* the dynamic forces during the retrofit may exceed safe limits unless precautions are taken.

In the above circumstance, the engineer should dictate a detailed CPM (critical path method) schedule of exactly how the work should proceed (sequence, manner, means, limitations, hazards, etc.).

On the other hand, riggers should neither feel free to vary from this CPM, nor should they feel that they could not question the plan. We are all human (with those feet of clay) and we do make mistakes. Good riggers understand that when your life is on the line, you have the right to ask questions to ensure if what is written is really what is needed to be done.

Clarity is everything in these instances and a good dialog and exchange of concerns between the different disciplines does nothing but lead to a safe, zero-defect project.

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State of the Station

"No Problem – We Have Backups"

by Chris Tarr

I believe I was dreaming about receiving the "Best Looking Engineer of the Year" award when my ringing phone woke me up.

"Hello?" I asked through my fog.

"Hi! This is (PD) of (station) – I'm sorry to call you so early in the morning. We're off the air, and I have no idea who to call. Our Engineer moved away and we haven't found anybody to take his place yet, but your name has come up a few times. We could really use your help!"

So, I got up and hit the road – I arrived on-site and found that they had a relatively minor problem. I got them squared away and they promptly paid the bill. A few weeks later, the station manager asked to meet with me.

The station manager said, "I know you aren't really looking for new work, but we have a guy here that I think can do much of what we need, with your guidance. We'd pay you to work with him over the phone and through email on the simple stuff, and maybe have you or someone else visit face-to-face to cover the big problems"

It sounded good to me. It's always nice to get some new blood in the industry, and the guy they wanted me to work with was pretty bright – I figured that it could work out well. I was a little concerned about the distance and what would happen if there was a major failure. "Oh, no problem!" He said. "We have backups at all of our sites."

So we moved forward and things were going well. I did want to get a look at the transmitter sites just to get the "lay of the land," and have an idea of what they had, just in case I had to help troubleshoot a problem.

When I got to site number one, the first thing I noticed was a fairly new transmitter – and next to it, a fairly old transmitter. I looked closer and saw that there was no antenna or coax switch connected to the old transmitter, the breakers were off and taped down, and there was no audio fed to the exciter. I looked at the install date on the main transmitter – 2002. My hunch was that the "backup" transmitter has been disconnected in 2002 and had not been powered up since. Oh boy.

Next up, site number two. I saw a fairly new main transmitter, but not much of anything else. Looking around, I saw an un-terminated flange connector coming down from the aux antenna, just hanging from the ceiling. I turned around and noticed a 1 kW rack-mount amp sitting in the rack. Same situation as the first site – nothing at all connected to it.

So, I needed to break the bad news to the station manager – he really didn't have "backups," just "dead, disconnected transmitters." He also had *zero* spares of anything.

That's a hard discussion to have with the manager of a small group of stations. The managers (unfortunately) have to worry about where the next ad buy is going to come from, not what's going on at the transmitter site. They really need to trust the information, good or bad, that they get from the Engineer.

I see it quite a bit. The Engineer either doesn't want to break the news to the manager, or assumes that they wouldn't have the money or desire to deal with the problem anyway. I've always taken a different approach. My feeling is that my job is to give the manager complete "situational awareness" about their facility, but assure them that the decision over what to do with that information is theirs. I'm not there to spend their money. I'm there to give them an accurate assessment of the situation, and they then decide if they want to spend the money or not. However, they go into this knowing the potential risks of not following my advice.

The line I use is my famous "doctor" line. A good doctor can give you an aspirin to get rid of your headache. A great doctor can give you the aspirin while recommending surgery to remove the tumor that's causing the headaches!

So, I sat down with the manager and discussed his options. I left knowing that I gave him all the information I thought he needed to make an informed decision. I also recommended that he should get a second opinion just in case I missed something. I don't mind being wrong on this stuff. Heavens knows that, not knowing the entire history of the site, I could have overlooked something.

(Continued on Page 22)

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"No Problem – We Have Backups"

– Continued from Page 20 –

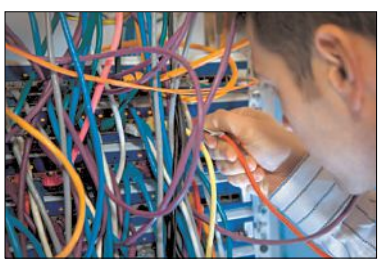
I knew that he wasn't happy about the news, but at least he was now aware of what was going on. He mentioned that he obviously couldn't spend the money to fix all the issues, but he wished he had known about the problems sooner so that he could at least be setting money aside to work on these things.

Believe it or not, that was not the first time I've gotten called to a station for a consult and was told that. Managers often tell me that they feel like the transmitter site is some magical, complicated place, that is impossible to understand. I don't think we make them feel that way on purpose, I think that we see it as easy and therefore don't do a very good job at explaining what's going on at a site.

I think that Engineers are our own worst enemy sometimes. We tend to give a lot of weight to what we do, while dismissing anyone who we think doesn't know better. We like to make what we do sound real important – down to resetting a breaker! It is hard to describe highly technical things to non-technical people, but it can be done.

We tend to use a lot of technical jargon, and forget that the person on the other side of the desk is trying to run a business. I've often hear of mistrust between managers and Engineers. I think that mistrust is simply based on poor communication. As the old saying goes: "If I don't understand it, it must be easy!" I often use simple drawings or give out links to websites that might take some of the mystery out of what I'm trying to say. You'd be surprised how well that can work.

Take the time out to really describe accurately and clearly what you're working on. If there's a problem, try to explain it in an easy to understand way that makes it clear what the problem is, why it's a problem, and what will happen if the problem isn't fixed. Also – and I can't stress this enough – admit when you simply don't know the answer to a problem, or when you just don't know how to fix what's broken. It's more important to know how to get an answer than automatically knowing it. The last thing you want is for the station manager to get a second opinion and find out you were bluffing about something. Your credibility will be shot. I always say "I have to ask someone above my pay grade!" when I'm asked something that I can't answer. I always come back with my findings, and it's never been a problem.



Today's Radio is IT Technology

Let's be honest, these days with digital consoles, StudioHub connectors, and solid state transmitters, 90% of what we do can probably be done by most IT people. It's that remaining 10%, that nobody other than a qualified broadcast Engineer can solve, that justifies our pay.

I often tell station managers that my goal is to teach my way out of the job. Some might think that's counter-intuitive, but as the years go by, there are fewer and fewer Engineers out there to get things done. Our time is getting stretched thin, and those "out of the blue" 5:00 a.m. calls are becoming more and more frequent. We can't afford to continue to be the "keeper of all knowledge" – we must find ways to help stations help themselves.

I don't want to sound like I'm minimizing the impact of what we do for the industry, in fact we're more important than ever. However, our role is starting to change significantly from one of a "fix-it" person, to a trusted advisor and partner. We drive the technology choices in the facility, ensure regulatory compliance, find ways to maximize the bottom line by better using technology to save money or increase efficiency.

I can often tell a manager how much money I've helped them save, right along with how much they've spent. I can tell them that replacing the $1,000 transmitter part before it failed saved them $500 in missed spots and kept a bunch of listeners happy. I can tell them how moving to newer technology can save them lots of maintenance expenses and lost productivity. I can give them tips on how to save money on their phone and Internet service.

I am one of very few Engineers left in the area that can do "free-lance" work. In fact, I often have to turn down non-emergencies because I don't have the time. I really do see a future where I earn my living by "managing" a region of individual stations, helping the new tech guys learn radio tech, while assisting them and their managers with the more critical transmitter work and technology planning.

I'll be something more resembling a "consultant" than a contractor, getting my hands dirty on the bigger problems. It may not completely move in that direction before I'm ready to retire, but it is certainly heading that way whether we like it or not. There isn't a crop of "new" Engineers waiting to take our place. Either we start to teach these people to fish, or they're going to starve!

Christopher Tarr CSRE, CBNE, DRB is the Director of Radio Operations/Engineering for 88Nine, Radio Milwaukee. He can be reached at chris@radiomilwaukee.org

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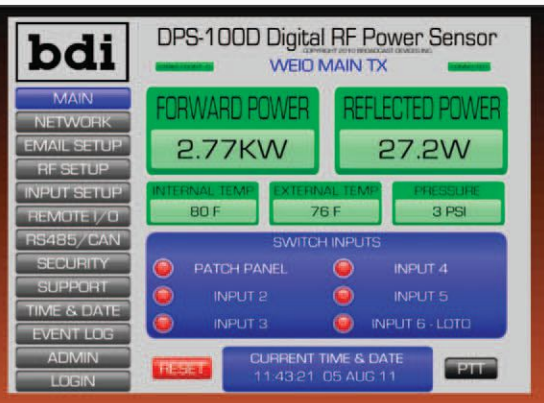

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Chief Engineer

Some of What I Know, I Learned by Accident!

by Scott Schmeling

Well, it looks like we're coming out of what many are calling the *"Worst Winter EVER!"* There's no question, parts of the country experienced near record cold temperatures along with near record snow amounts. Here in Minnesota, all schools in the state were closed a number of days because of the extremely cold temperatures. So many days, that some school districts will be adding days to make up what time was lost. But now, the snow is melting and soon the grass will be green again. Happy Spring, everybody!

In this issue I'd like to share with you some tips that I have discovered along the way. Some I learned by observation, some through desperation, and some I'll admit I learned "by accident."

If you are like me, much of the time you work alone. The first couple tips are for those times when you could really use a second set of hands – someone just to hold something for you. For instance, when you are putting a piece of equipment in a rack. If it's lightweight enough, you can balance the equipment with one hand while you hold the screw and screwdriver with the other hand, and very carefully get the screw to the hole as you line up the equipment. But if the piece is heavy that method won't work.

For this, I have two "helpers," one of which you already have.

Most of the time, I put rack screws in the top holes (both sides) of the rack space immediately *below* where I want to mount the equipment – I leave a half-inch or so of the screw exposed. Then I put the piece of equipment where I want it and let the bottom front rest on those two screws. Then it's fairly easy to lift one corner of the equipment at a time and put the bottom screws in place. This method works if the space below your equipment's destination is empty. Of course, if there's equipment in that space below, I can usually rest the new piece on it while I insert the screws.

I mentioned two helpers. The other one is a "headless" 10-32 screw that I insert into the *top* two holes of the equipment's destination. Then I put the equipment in place with the screws coming through the top two holes in the equipment's rack ears. Gravity will pull the back of the equipment down, but the front top will be held in place by those two screws.

You simply push the bottom front up to the rack rails and insert the two bottom screws. Then remove the headless screws and insert the regular rack screws. You can find the headless screws in most decent hardware stores. I've seen them for allen wrenches and with a straight slot on one end.

Another work-alone tip involves soldering – especially soldering connectors such as various audio or Sub-D connectors. I used to find that it was sometimes difficult to get the connectors to stop moving around as I tried to position the wire in the pin, heat it up, and apply the solder. This seemed especially true of XLR connectors. Holding a hot soldering iron in one hand and the solder in the other, leaves nothing left to hold the pieces I'm working on. *(Continued on Page 28)*

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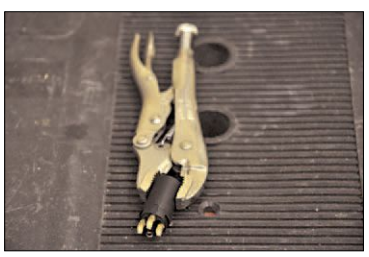
Chief Engineer

Some of What I Know ...

– Continued from Page 26 –

The technique I discovered here, was that I could adjust a small vise grip to hold the connector while I apply the heat and solder. Sometimes I need to lay something on the wire to hold it in place better, but the vise grip holds the connector in position very nicely. You don't want the vise grip to clamp down hard, just tight enough to grip the connector. With this method the connector stays put while the wire is soldered into place with relative ease. I could call it my "Third Hand," but I think there's already a tool by that name.



While we're talking about wire, here's something else. I've found that when pulling multiple runs of Belden 8723, for example, the cables will bundle together better if they are "going in the same direction." In other words, look at the printing on the cable. It should all be oriented the same. If you follow this method, you will find that the bundle will lay better, make turns better, tie better. In other words, they will "play well with others."

And here's something else I just recently discovered about cables and connectors. It *does* make a difference which connector goes on which end of the cable. Because of the conductor twisting, the conductor orientation at one end will usually better match the orientation of the connector pins you are connecting to. I've found this to be true for XLR's, Sub-D's, and even 110 volt power cords. It's so much nicer when the wires don't cross over each other to get to their respective pins.

Let's shift our attention from wiring to line pressurization fittings. Manufacturers frequently "improve" what they make – even simple things like the fittings used for transmission line pressurization. For as long as I can remember, the fitting has been the same. A brass fitting screws into either the line connector or the regulator or dehydrator. The nylon tubing slides over a shaft on that piece. There is a compression ring on the tubing, and a knurled nut secures the tubing to the fitting.

Legris Air Fittings From Grainger

A couple years ago I installed a multi-port manifold so I could pressurize two lines with one tank. Though the fittings included with the manifold looked the same, on closer observation I could see a ridge of sorts going around the inner shaft – that ridge grips the tubing. This makes for a tight, leak-free connection. It also makes it nearly impossible to pull the tubing off. This is not a good thing, since there are times you *want* to pull the tubing off.

I recently installed a new dehydrator. It included more tubing and *another* type of fitting. This one has no knurled nut and no compression ring. Instead, with this fitting, you simply cut the tubing and *push* it into the fitting. If you need to remove it, there is a release ring – just push the ring in and the tubing is released. Some improvements really *are* improvements!

This fitting is made by Legris (pronounced Le Gray – it's French). It's comes straight or right-angle and available at Granger. Part numbers are 3109 60 11 for the right angle and 3175 60 11 for the straight fitting. So far I have found these fittings easy to use and I have not had a leak. I like 'em!

My last tip today involves storage. We eat quite a bit of peanut butter in our house, and I have found that empty peanut butter jars are wonderful for storing and organizing. I use them for things like punchblock bridging clips and box nuts, among other things. I like peanut butter jars because they are clear plastic so you can see what's inside. They are mostly unbreakable, so if you drop them they don't shatter like glass would. I've been using them for years and seem to have a renewable supply.

That's it for this issue. I hope you will find something here useful to you. Until next time ... keep it between 90 and 105!

Scott Schmeling is the Chief Engineer for Minnesota Valley Broadcasting. You may email him at: scottschmeling@radiomankato.com

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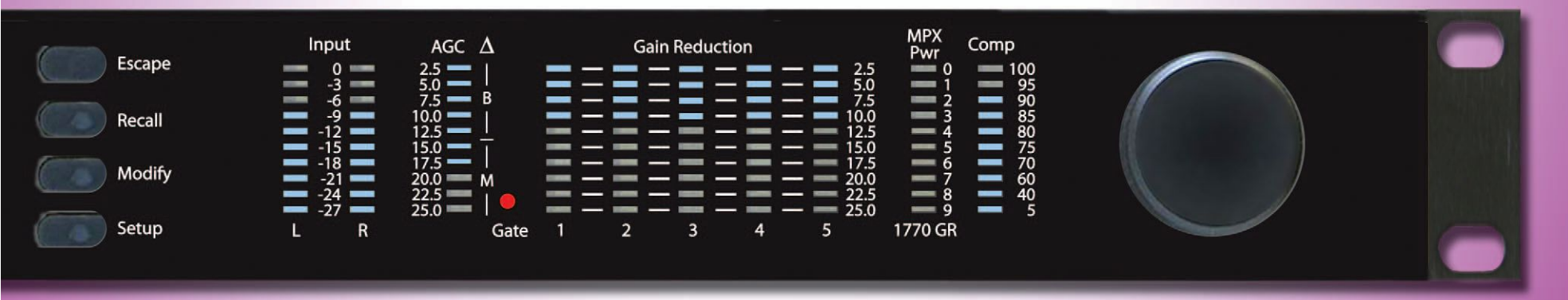

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Practical Engineering

Switching IFB Sources the Easy Way

by Mike Callaghan (KIIS Radio - Retired)

If you aren't careful, sometimes you can really outsmart yourself. You know, like when you come up with a brilliant idea and it comes back to bite you – hard.

KIIS had a traffic helicopter and pilot/reporter for years. He went on the air with traffic reports every 15 minutes during drive time. The costs of pulling this off rose every year. It finally got to the point where the expenses made it look as if we'd have to stop. Then we came up with the idea of sharing the sky-high reports with other stations and also sharing the cost.

We ultimately ended up doing reports for three different stations – two radio and one TV. Because all the stations used profanity delays, we had to provide pre-delay IFB audio to the pilot so he could chat with the radio and TV hosts in real time.

This meant we had three different sources of pre-delay audio to send to the helicopter, and we had to switch between them ,depending on who was lined up for the next live report. I recall the meeting where we talked about this ...

Our program director: *"So, it looks as if someone from engineering will have to go into the equipment room four times an hour and switch the helicopter IFB to the next station. That shouldn't be a problem."*

Me: *"I beg your pardon? You want an engineer to stop what he's doing and walk down the hall to flip a switch – every 15 minutes?"*

Him: *"Right! Is that some kind of problem?"*

Me: *"Here's a brainstorm. Why don't we get someone from PROGRAMMING to wander in there four times an hour?"*

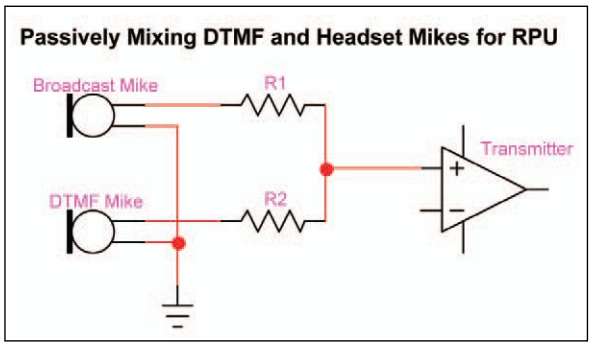
Him: *"You can't be serious! We're much too busy for that!"*

Clearly, we had an issue. Who could be expected to drop what they were doing four times an hour and detour into the equipment room to change a switch? It looked as if the idea to save money was going to be a major pain for someone – I mean, it was all on a schedule so it shouldn't be hard. But I knew absolutely that people would forget, and the pilot would start squawking about the wrong feed. So, we could put in a complicated timer and program it to send the right feeds. But what about special events, or weekends, or other changes in the schedule?

Then the light dawned. Rather than studio staffers, why not let "flyboy" switch it himself? He knew precisely who was coming up next and was, by far, the best qualified person to make any changes.

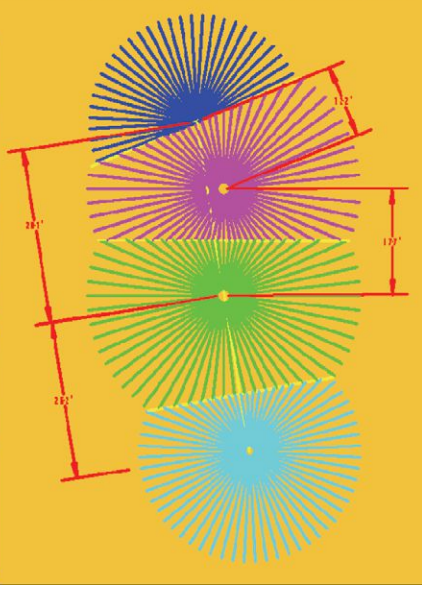
Touch Tone Technique

We could give him an amateur radio mike with a DTMF (touch-tone) encoder. He'd just push a different touch-tone button to choose who he needed to hear. The tones would be sent out and received on the regular RPU channel between the reports.



At the station, we'd decode the touch tones and let them select the different IFB feeds. That meant we'd never have to worry about the right feed getting sent.

(Continued on Page 32)



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Practical Engineering

by Mike Callaghan

Switching IFB Sources

– Continued from Page 30 –

Mr. Jet Ranger would be totally in control and could do back-to-back reports just as quickly as he wanted.

Installing the equipment in the helicopter involved mixing the new touch-tone mike output with the headset mike the pilot used to get broadcast-quality audio.

Depending on the RPU transmitter you use, this can be done passively with resistors, or you may need a small mixer to get the levels just right. While the pilot/reporter can use the hand-held mike as a backup to the broadcast mike, it is mostly just for changing the IFB feed.

Broadcast Tools DTD-16 Decoder

At the studio, we fed the RPU audio into a Broadcast Tools DTD-16 DTMF decoder. The closures from that go to a Broadcast Tools SS8.1-II 8 input switcher.

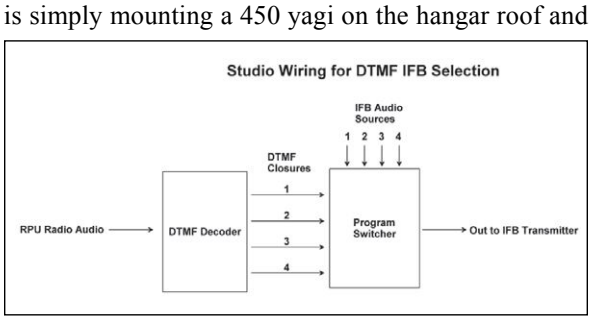
The 8 inputs gave room for expansion in case more stations signed up for our Skywatch traffic service.

The finishing touches involved balancing the levels from the different stations going into the switcher. For the RPU audio, the TV station wanted a totally

Broadcast Tools SS 8.1 II Switcher

unequalized feed from the helicopter, while the radio outlets preferred the audio to peak in the voice ranges and not have so much rotor and machine noise.

When the chopper is grounded for maintenance or the weather's too bad to fly, the pilot still uses the same radio system; he has an RPU transmitter in the hangar with a broadcast mike and a touch-tone mike as well. Even though he's on the ground, he still uses the touch-tones to change who he's hearing in his headphones. If having two different radios is too costly, an alternative is simply mounting a 450 yagi on the hangar roof and



running coax down to plug into the helicopter radio when he's not flying. Then he sits in the chopper and does reports just as if he's in the air.

As for the studio end, it's entirely passive for us. The IFB changes are entirely automatic and require nothing on our part. When a new station comes on board, all we need to do is wire in another pre-delay feed, assign another touch-tone, and provide them with a feed from the RPU receiver output DA.

Good for Weekend Remotes

Another advantage is using the system to switch IFB's when we're doing weekend "drop-in" remotes for different stations from the same location. We can switch the feed between them without bothering anyone at the studios.

The system has served us for years and keeps all our traffic clients happy. And no one has to stop what they're doing and go switch anything!

Mike Callaghan was formerly the Chief Engineer at KIIS-FM in Los Angeles, CA. His email is: rg@mike.fm

Transmission Topics

Can They Do That?

by Jim Turvaville

So you find a new FM signal on the air in your market, where one has not been before. Best you can tell it's a low power – like a translator – but all of the programming is commercial based, live and locally originated. Something seems odd; you wonder what is going on and is it above board?

It's happening a lot, especially in the larger markets, and there is a bit of mystery behind the new FM signals popping up on the dial. Some of them are AM-on-FM translators, and some are licensed as HD-Fill-In signals. Some of them can really cover some huge territory like a full class FM signal, causing thoughts of illegal or over-power operations. Let's try to de-mystify some of what may be going on in your area.

We are all well aware that FM translators have had a love-hate relationship with broadcasters for decades – none more than the past several years since the 2003 filing window came and went. Those who have them and know how to use them to their advantage, love what a translator can do; while those who do not have them, are ineligible to own them, or do not understand the service benefits and restrictions, find it easy to despise their existence.

Like any other service or industry, there are those who abuse or find loopholes in the laws that give them an unfair advantage. I'm not here to weigh in on that argument, only to remind us that the opinions of translators vary as much as the opinions on radio formats. So here is a summary of the technical and legal basis on which these facilities exist.

AM on FM Signals

The FCC began allowing AM stations to use FM translators several years ago. As early as 2007, a few AM stations got their audio on an FM translator via STA (Special Temporary Authority) requests from the AM licensee. These were accomplished most often by AM owners who also had a separately programmed FM signal to which the translator could be legally licensed, as the rules did not permit any other designation at the time. In some cases, the AM licensee would negotiate with a third party who owned the translator to accomplish legal standing for the translator and file for the STA to use it for the AM signal. After nearly 2 years, these processes were finally codified into Part 74 Rules, and AM-on-FM Translators received formal legal recognition.

There are technical limitations for this service which restrict location and coverage from an AM-on-FM translator facility. First, all AM-on-FM translators must meet the "fill-in" requirements for the service, and the translator is licensed as a fill-in signal for the primary station. This specifically means that the 60 dBu (50,50) contour of the FM translator must fall completely within *both* the 2 mV/m AM daytime contour, as well as a 25-mile (40 km) circle from the AM transmitter site, or the center of the AM directional array. For a non-directional AM, this gives some leeway locating the FM signal for better market coverage; many AM stations are located for maximum ground conductivity (lowlands, river banks, swamp lands, etc) while FM needs height for clean line-of-site to the desired receiver location.

For a Directional AM, this may mean the FM has to mimic the AM daytime pattern in order to meet the 2 mV/m restriction. I've seen some really ugly AM patterns that require real creative FM antenna design, but only the day pattern is used as a guide for this purpose. Fortunately, unlike the full power counterparts, FM translators can use off-the-shelf directional antennas and rely on stock manufacturer patterns – avoiding the expense of range testing, certification, surveyors, etc.

FM HD Translators

The FCC also began allowing FM stations which are authorized to broadcast in HD to have FM analog fill-in translators to repeat the audio of the HD channel entirely. Originally intended to increase the consumer awareness of HD radio and its alternate program streams, it has come to be a source for creating a unique program channel in a market. Like the AM-on-FM signals, the HD-on-FM translator must

(Continued on Page 36)

Transmission Topics

Can They Do That?

– Continued from Page 34 –

have its 60 dBu (50,50) contour fully within the licensed 60 dBu (50,50) contour of the primary FM main-channel analog contour. While co-locating the HD-on-FM signal with the primary station is common, for some market rim-shot signals it becomes viable to have the translator near the edge of the primary main channel contour in order to maximize population coverage. As already noted, these HD-on-FM signals can also use single or composite off-the-shelf directional antennas to maximize the possible coverage from the signal while meeting the primary contour requirements, as well as any required co and adjacent channel contour constraints.

What Fill-In Means

While the technical definition of "fill-in" involves the contours of the translator versus the relevant contour of the primary station (AM, FM or HD), there are other things this designation can mean for the station owner. First of all, translator fill-in signals have a slightly different set of technical rules that apply and are an advantage. Of most importance is the power versus height restrictions set out in 47CFR 74.1235(1) and (2). Under the charts in that Rule section, maximum power of 250 Watts on a non-fill-in translator would be at a height of 32 meters AAT (calculated on 12 radials, not the typical 8 of full power signals) in Zone 1-A, and 107 meters AAT in all other zones.

As a fill-in signal, those charts are ignored, and an effective radiated power (ERP) of 250 Watts at any height above average terrain is permitted, as long as the contour protections for the translator are met. In some unique cases of mountainous terrain or very tall towers being available, one can have 250 Watts at a height that creates a coverage area which exceeds that of a full Class-A 6 kW equivalence.

Fill-in status also means direct program source feed to the translator – usually STL microwave or IP delivery, instead of a terrestrial signal feed as is required for non-reserved band (92.1-107.9) translators. Since most of the new AM-on-FM and HD-on-FM translators are a result of the 2003 commercial translator filing window and recent final settlement thereof, they fall in the non-reserved FM band. This means audio quality can be maximized for the translator, in spite of the sound that may be heard on the primary AM or HD channel, and be fully within the scope of the FCC rules and regulations.

The AM-on-FM translators are permitted to operate even when the primary AM station is off the air (a rule specifically written for AM daytime facilities) as long as the primary AM has operated in the past 24 hours; effectively allowing local origination on the translator licensed for that purpose. All translators are further required to air their own legal ID three times a day – 7-9 a.m., 12:55-1:05 p.m. and 4-6 p.m. – or have it subaudibly encoded in the program stream.

Ironically, it is not required that the AM-on-FM translator give up its identity to the primary AM station – there are no restriction on promoting and positioning the FM translator as a stand-alone full power FM signal, as long as the Top of the Hour Legal Station ID still is that of the primary AM station. I'm aware of many AM-on-FM translators which never mention the primary AM station except at that time, and are imaged as a regular FM signal – all of which meet the letter of the FCC Rules and Regulations.

The HD-on-FM translators must wholly duplicate the audio on the HD channel, which must also include a proper Top of the Hour Legal Station ID as "KXXX-HD2, Yourtown." All HD program streams are permitted to be fully locally produced and originated, but also must meet main channel program requirements regarding EAS monitoring and transmission, regardless of the program source or content. While the HD program stream meets these requirements, the act of repeating them onto an FM translator gives the appearance of local origination on the translator. When HD radios increase their penetration into the consumer market, some of this mystery will disappear, as the HD signal typically covers an exponentially larger service area than the fill-in translator signal.

It is really a rare event for a signal to be operating in violation of FCC Rules, but if you have questions about a new signal in your market, use the available FCC CDBS resources to see what has been authorized, and your Engineer can likely confirm the legitimacy of the operation.

Jim "Turbo" Turvaville has been Director of Engineering and I.T. for WAY Media (www.wayfm.com) since 1999 and currently works in their Corporate Office in Colorado Springs, CO.

He also maintains a small clientele of stations under his Turbo Technical Services (www.jimturbo.net) operation providing FCC application preparation and field work.

Audio Guide

The Microphone: It Can Make or Break Your Station

by Aaron Scott

The microphone is probably the most recognizable part of any studio – and the most overlooked. It is the beginning of a long and complex audio chain that goes all the way to the speakers of the receiver that the listener is using.

Just as a house or a building needs a good foundation, so does a good audio chain. This is why careful attention should be paid to the environment in which a microphone is being placed, and the type of voice and frequency range it is to capture.

In this day and age of modern and affordable audio processors, it is easy to put just any old microphone in line and attempt to EQ and process the sound you want into existence. This will work, but it is not the right way, and the discerning ear can tell what is going on.

I have found that most stations like to go with those "tried and true, built like a tank" microphones like the Electro Voice RE-20 or the Shure SM-7B. These microphones are tough, and have a long life with relatively few maintenance issues, and sound very good when recreating the human voice.

Electro Voice RE-20

The Electro Voice RE-20 is pretty much the industry standard as far as broadcast microphones go. The RE-20 is a large diaphragm, cardioid microphone and has great rejection 180 degrees off axis. With its internal wind screen and a high SPL tolerance, it is able to handle "plosives" and other load noises with minimal distortion.

Electro-Voice RE-20

The RE-20 has a useable frequency range of 45 Hz to 18 kHz, and has a fairly flat response across this audio range with a slight boost from 10 kHz to 18 kHz. For these reasons it has become the "go to" microphone for many broadcasters.

Shure SM-7B

The Shure SM-7B is, in my opinion, is a more versatile microphone than the Electro Voice RE-20. Like the RE-20, the SM-7B is a large diaphragm, cardioid microphone and has great off axis rejection. The SM-7B has a slightly broader frequency range than the RE-20, beginning at 50 Hz and ending at 20 kHz. The Shure SM-7B has a removable external wind screen and is more than capable of handling any plosives or high SPL's you may throw at it.

What sets the SM-7B apart from the RE-20 is its warm rich tone. This is very helpful for those of us who have voices with a less than desirable lower end. The SM-7B also has a bass roll-off function just in case you happened to be blessed with one of those Don Lafontaine type voices.

Shure SM-7B

For those announcers that have a flat sound, this microphone has an answer – just flip a switch on the back and you get an instant "bump" in the mid-range frequencies. The Shure SM-7B is truly an amazing microphone. It was even used to record all of the vocals on Michael Jackson's Thriller album. One thing to note about the SM-7B is that it takes a very healthy amount of amplification. A good quality preamp that can deliver 60 dB is a must for this microphone.

Sennheiser MD 421-II

Another microphone that is common in broadcast facilities is the Sennheiser MD 421-II. The MD 421is dynamic microphone that is short on looks, but delivers on audio. It looks plain, but it has a crisp colorful sound if matched with the right voice.

(Continued on Page 40)

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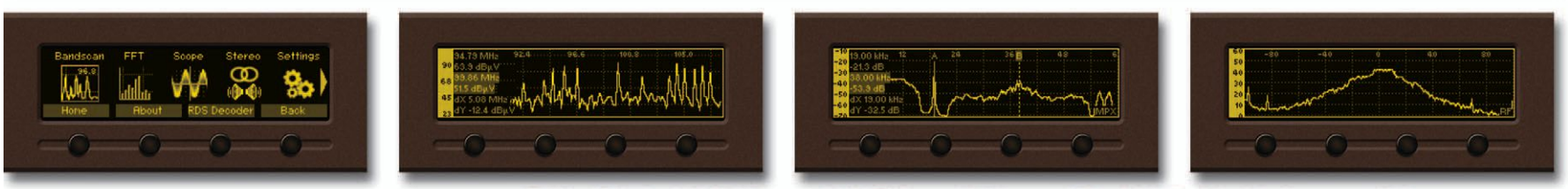

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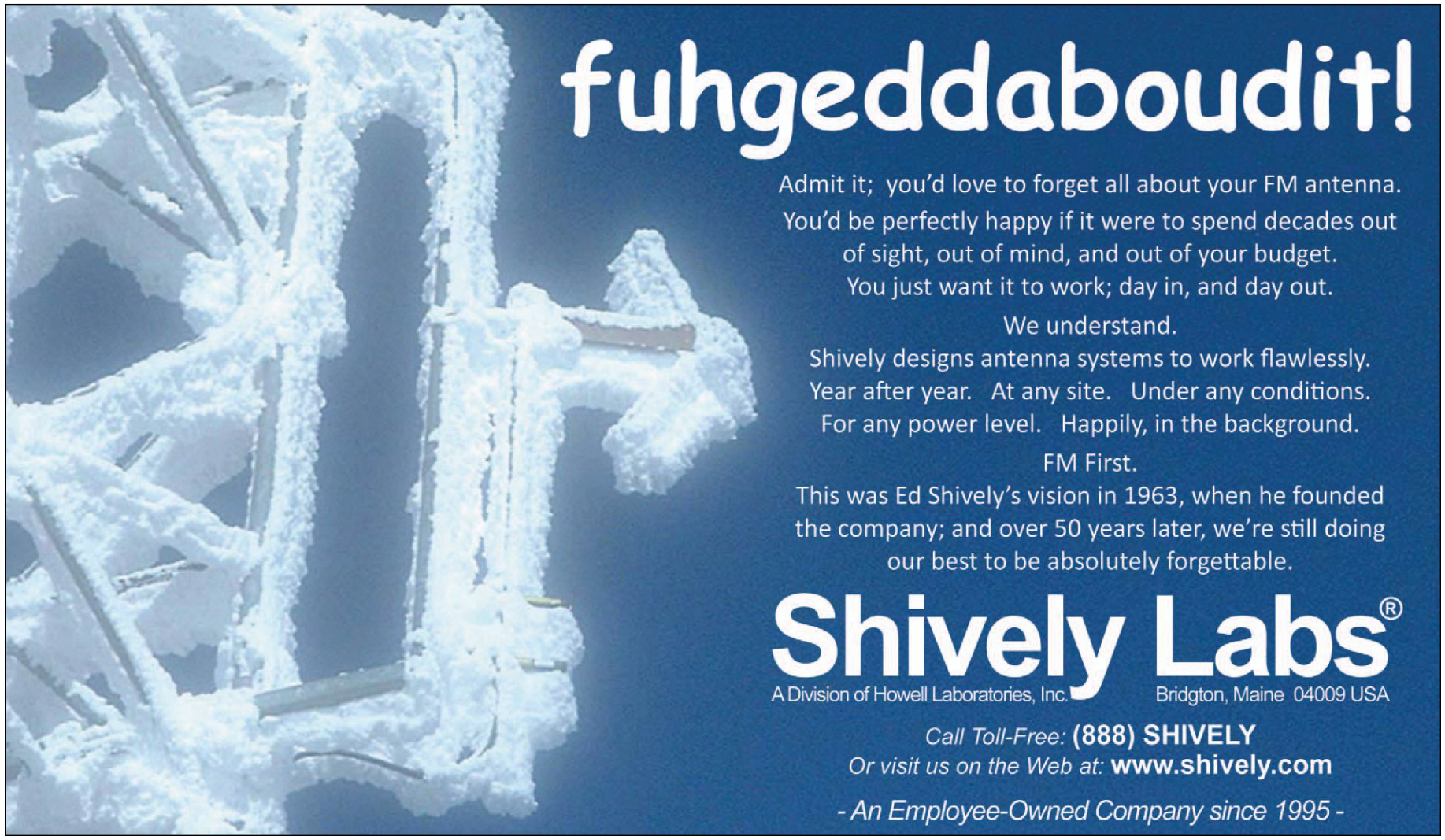

Audio Guide

– Continued from Page 38 –

There are other good dynamic microphones to choose from like the Rode Procaster, the Electro Voice RE-27, and many, many more. Like I said earlier, the secret is to match the microphone to the voice and environment.

Sennheiser MD-421-II

What Is a Condenser Mic?

In recent times, condenser microphones, like the Audio-Technica AT 4040, pictured at the right, have become more economical, and have started finding their way out of the recording studio and into the broadcasting realm. These microphones vary in price from $99 to upwards of $15,000 for the cream of the crop. But don't let that price fool you. You can pick up a very nice sounding condenser microphone for as little as $150 from manufactures such as MXL and many others.

Condenser microphones have the ability to add color and depth to almost any voice, and different makes and models tend to accentuate different parts of the audio frequency spectrum. In my experience, it seems that audio being produced by a condenser microphone is much easier to manipulate and process than that from a dynamic microphone.

Condenser microphones are the ideal choice for capturing vocals and acoustic instruments. They're the primary type of microphone used in recording studios and radio stations. They are capable of capturing much more detail than dynamic microphones because of their wider, flatter frequency response.

Audio Technica AT 4040

The condenser microphone does require 48 Volt phantom power, which now comes as a standard feature on most mixers, preamps, and rack mount processors. As a general rule, condenser microphones are not as tough as dynamic microphones, and need to be mounted in a good quality shock mount. Also, care must be taken to make sure that the microphone is in a climate-controlled environment, because the elements are sensitive to temperature and humidity.

One down side of condenser microphones is their diminished ability to handle high SPL – a pop filter is almost always a must have.

The Behringer B-2 Pro

The B doesn't stand for "budget," but at only $149 it could. The Behringer B-2 is an affordable, high-quality way to put this essential studio tool to work for you. Thanks to its pressure gradient transducer and shock-mounted 1.0" gold-sputtered dual-diaphragm capsule, the B-2 delivers an open, transparent sound with excellent transient response. It boasts a frequency response from 20 Hz to 20 kHz with just a slight boost in the presence range. It has two selectable pickup patterns: omni for capturing sound in all directions, and cardioid for picking up your source signal while rejecting off-axis sound. With its excellent transducer and gold-plated XLR output, the B-2 is very neutral sounding, and truly delivers on the promise of noise-free transmission.

Behringer B2 Pro

The B-2 also gives you a switchable -10 dB attenuator to capture high-volume signal sources without distorting, as well as a low-cut filter to eliminate infrasonics caused by floor rumble and other turbulence.

But That's Not All …

The B-2 is built to be your go-to condenser microphone for years to come. Its tough, nickel-plate brass body can withstand all the rigors of those late-night recording marathons. And with its aluminum foam-padded carrying case, it travels in safety and style. There is also a heavy-duty suspension mount and windscreen included.

This condenser microphone is an excellent choice for live and studio applications and it's available at a price that will leave you with enough cash left over to secure other recording essentials.

This is just basic stuff, but it is often over looked. Just remember the basics that were mentioned in this article, the next time you are in the market for a microphone, and I assure you that your task will be much less stressful.

Aaron Scott, is head of Technical Services at Nexus Broadcast, and brings many years engineering experience to Nexus. More information at LPFMStore.com or 800-83-NEXUS extension 120.

Small Market Guide

Free Heliax

Well Just About, If You Modify Connectors

by Roger Paskvan

In small market, local revenues come from local sports. Our Marti remote pick up system needed to have more range, which usually means "go higher." The 70-foot tower at the station just wasn't doing the job, so relocating the Marti antenna to 250 feet on our FM tower should greatly improve coverage. With the price of copper on the rise, the cost of 7/8-inch Heliax has really gone through the roof. Our station was facing an $1,800 bill, plus connectors, just for cable. I set out to find an economical solution.

While driving by the local cable TV office, I noticed many large diameter cable reels just sitting in storage. Each reel had several hundred feet of cable left on the spool. Visiting the manager, I learned that most cable outfits end up with what they term "end of the spool" lengths that are of no use in their business – this is what is left over at the end of a city block.

Most cable companies will almost pay you to take the reel ends, since the aluminum scrap price is not worth the hauling costs. The cable company said we could have all we wanted and even TDR'd the reels for length. I found several 300-foot runs to use for our project. With more cable companies going to fiber, a lot of surplus 3/4-inch coax cable will become available. CATV P3 connectors are all over Ebay at $3.00 prices.

This cable comes in 3/4-inch and 1/2-inch diameter sizes, with an aluminum sheath and a copper center, presenting 75 Ohms impedance. The Commspec P3 cable has a loss of 0.7 dB/100 feet at 200 MHz, with 1.0 dB for the 1/2-inch. The 75/50 Ohm transition will give a 1.5:1 reflected power which isn't worth worrying about, but for those that like to see the wattmeter come down to zero, a future article will outline a coax balun to deal with the impedance problem.

In order to use this cable in the broadcast RF environment, we have to convert the CATV connectors to our world. After some thought, I came up with some modifications that worked out real well. This modification works on 1/2- and 3/4-inch CATV P3 connectors. So here is the procedure. You can follow the process just from the pictures.

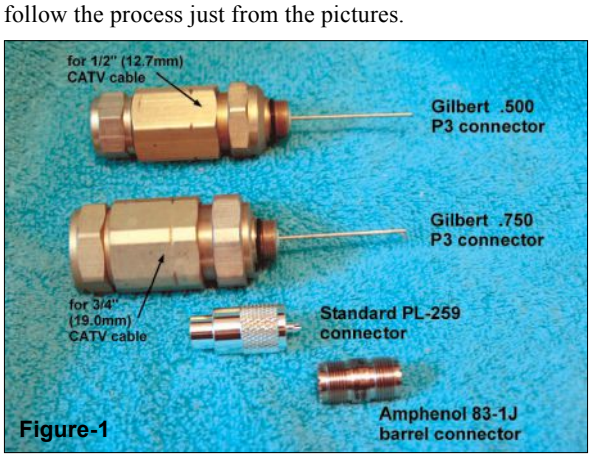

Figure-1

1. Referring to **Figure 1**, these are the CATV connectors and the UHF RF connectors that we are going to marry. The CATV P3 variety connectors come in two sizes, 1/2- and 3/4-inch, matching the diameter of the cable. First we will install the standard P3 connector onto the cable. Then, we will modify the pin end with a standard UHF variety connector.

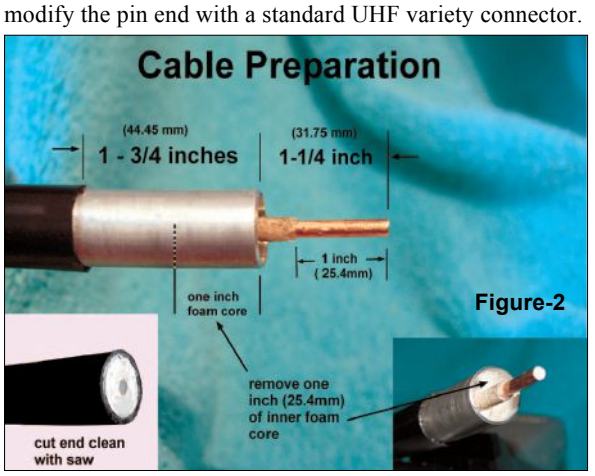

Figure-2

2. If you have never worked with CATV P3 connectors, cut off a chunk of cable, put it in a vice and follow the procedure until you feel confident to work on the main cable. Referring to **Figure 2**, cut the end off the cable with a hack saw. Remove the black sheath for 3 inches and clean off the aluminum with acetone. Now measure 1-1/4 inches in from the end and cut around the aluminum just deep enough to remove the sheath only. Using a knife or coring tool, remove the foam down to the center conductor leaving 1-1/4 inches of copper exposed as shown in the picture.

3. Still referring to **Figure 2**, clean out one inch of foam back into the sleeve for the P3 connector to slide into. In the cable industry, this is done with a coring tool. This tool has a hollow drill bit that drills out the inner foam to one inch. If you're only going to do two of these mods, you can use a small knife and dig out one inch of inner foam as displayed in the corner cut away.

(Continued on Page 46)

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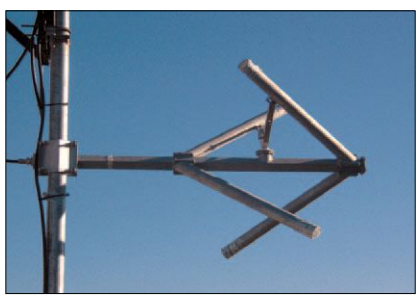

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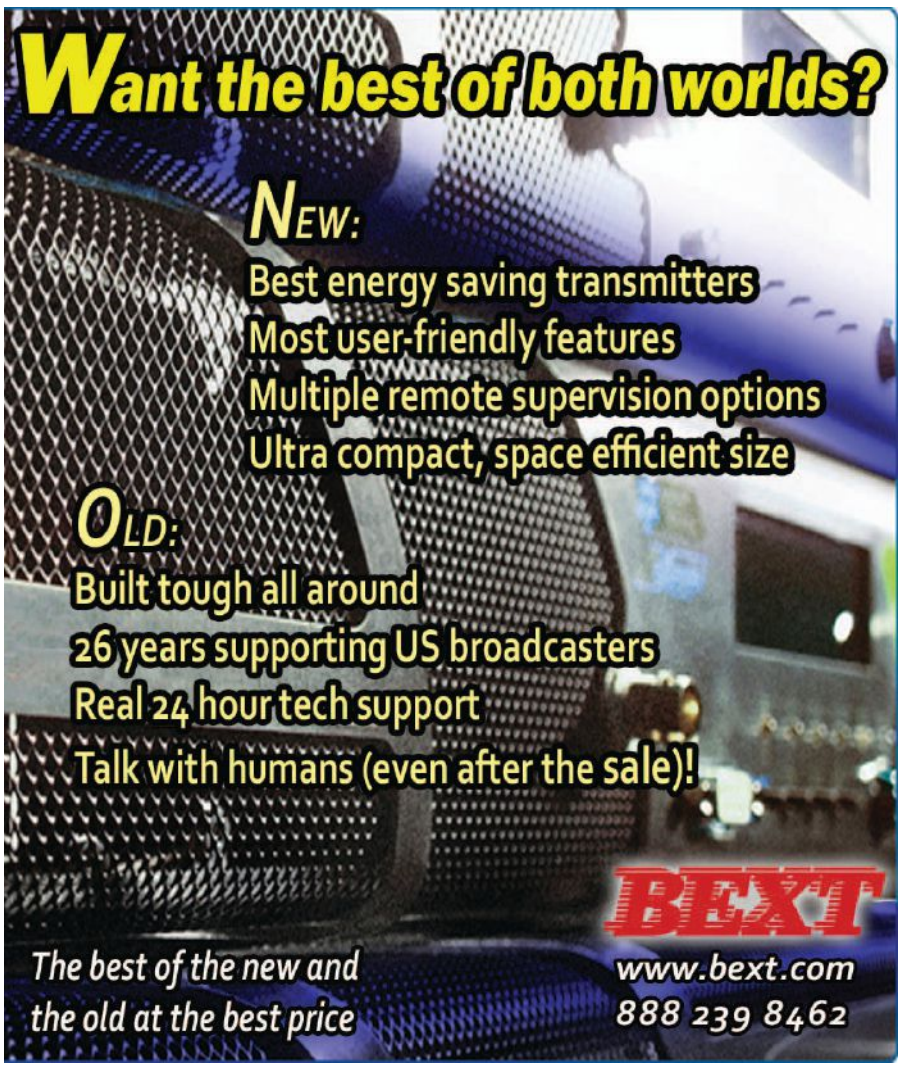

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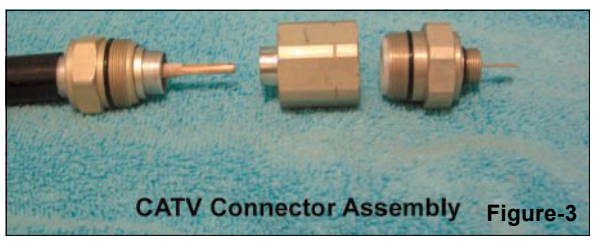
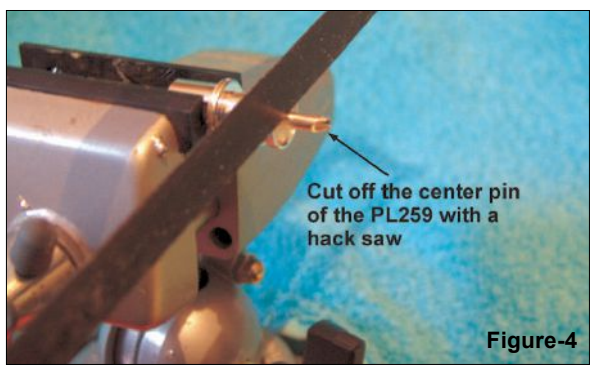
Small Market Guide

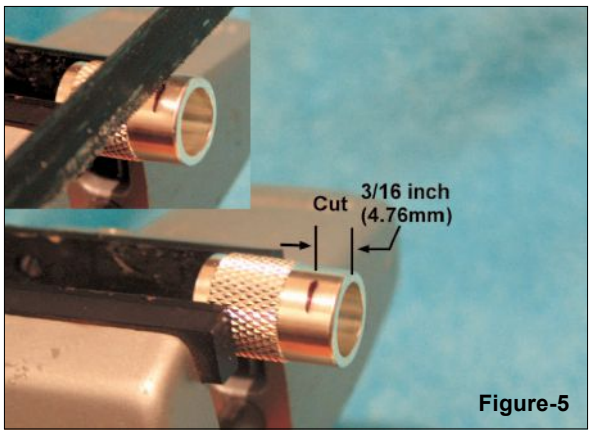
– Continued from Page 42 –

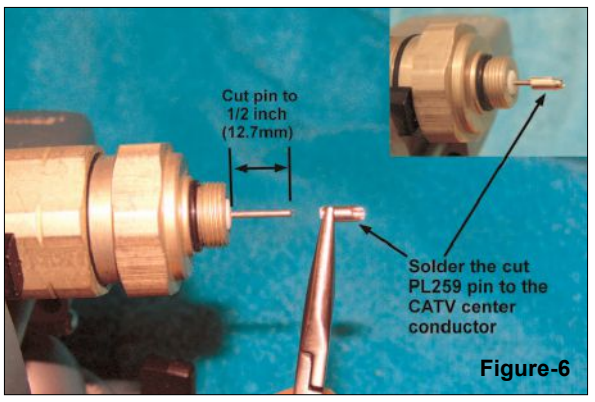
4. Referring to **Figure 3**, assemble the P3 connector as shown. Everything should fit together, and then trim the 3-inch pin to 1/2 inch. All connections should be snug onto the cable. Now it's time to modify the pin end to accept the standard UHF connector.



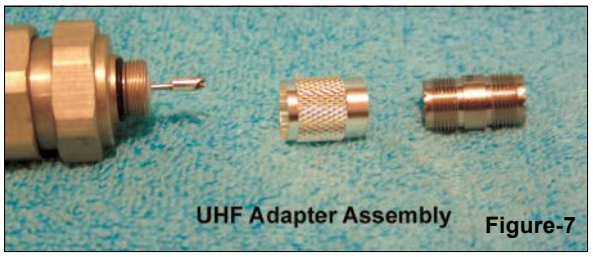


5. With the UHF male connector in a vise, refer to **Figure 4**, cutting off the center pin, saving it for later soldering. Referring to **Figure 5**, put the UHF connector sleeve into a vise and carefully cut off 3/16 inch from the back end as shown. This will later be screwed onto the P3 connector.





6. Locate the UHF cut-off center pin and solder it onto the end of the 1/2 inch P3 connector pin as shown in **Figure 6**. Referring to **Figure 7**, push-on the 83-1J barrel over the soldered center pin of your new connector. Take the cut off UHF male sleeve and thread it over the barrel onto the P3 connector. The threads match up and you now have a nice clean interface to the RF world utilizing CATV connectors and their cable.



7. Your finished product should look like **Figure 8**.

Figure 9 shows the coring tool, a professional tool that will core out the foam in your connectors. (Ripley CST750 #32110 for 3/4-inch cable or CST500 #31910 for the 1/2-inch cable). You don't need this tool if you're just doing two of these connectors. Many CATV companies will let you borrow a coring tool.

So now perform the same modification to the other end of the cable, and you have a low loss cable run for next to nothing in cost. In our next issue of *Radio Guide*, I will outline a simple coaxial device that will address the 50/75 Ohm question.

Roger Paskvan is an Associate Professor of Mass Communications at Bemidji State University, Bemidji, MN. You may contact him at: rpaskvan@bemidjistate.edu

Final Stage

RADIO ROUNDUP

The Radio Guide Event Register

Email your dates and info to: ***radio@rconnect.com***

NAB 2014 Spring Convention - Las Vegas, Nevada
Show: April 5-10, 2014
Exhibits: April 7-10, 2014
www.nabshow.com

Texas Association of Broadcasters (TAB)
August 6-7, 2014
Renaissance Austin Hotel
www.tab.org/convention-and-trade-show

WBA Broadcasters Clinic
September 10-12, 2014
Indianapolis, Indiana
www.radioshowweb.com

2014 NAB Radio Show
September 10-12, 2014
Indianapolis, Indiana
www.radioshowweb.com

SBE 22 Broadcast and Technology Expo
October 8, 2014
Tuning Stone Resort and Casino, Verona, New York
www.sbe22expo.org

Ohio Association of Broadcasters (OAB)
October 29-30, 2014
Columbus, Ohio
www.oab.org

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Phasetek - 47	www.phasetekinc.com
ProAudio.com - 28	www.proaudio.com
Progressive Concepts - 27	www.progressive-concepts.com
PSI (Propagation Systems) - 22	www.psibroadcast.com
Radio Systems - 40	www.radiosystems.com
RF Software - 45	www.rfsoftware.com
Studio Items - 37	www.studioitems.com
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