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Welton Is More Than Just "Tips n Tricks"

NAB Engineering Achievement honoree is all about customer service, support and training

BY RANDY J. STINE

Jeff Welton says he was lucky enough to find his dream job not far from where he grew up in Nova Scotia, Canada.

This year's recipient of the NAB Radio Engineering Achievement Award joined Nautel nearly 30 years ago and has served the broadcast transmitter manufacturer in several roles.

Welton, 55, regional sales manager Central U.S. for Nautel, is a frequent lecturer and expert on digital radio, radio technology and radio engineering. He has written numerous articles and three chapters in the 11th edition of the NAB Engineering Handbook, and even finds time to volunteer at a local community radio station not far from his home, where he provides some engineering assistance. Many know him for his "Tips n Tricks" presentations, delivered with his

(continued on page 10)

NAB: FCC Should Act Now to Allow All-Digital on AM

Association favors simple notification process, opposes a carrier frequency tolerance standard

BY PAUL McLANE

The NAB says there's no need for further industry testing before the FCC can allow AM stations individually to switch to all-digital operation on a voluntary basis.

It also opposes any notification period, instead favoring a simple immediate approach. It sees no need to put a carrier frequency tolerance standard in place. And it hopes the FCC will re-commit to IBOC rather than reopen any discussion of other formats.

In comments filed with the FCC in April, the broadcast association reiterated its support for allowing all-digital

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Survey Finds Radio Is Still Not Taking Full Advantage of All Its Digital Tools — Page 6

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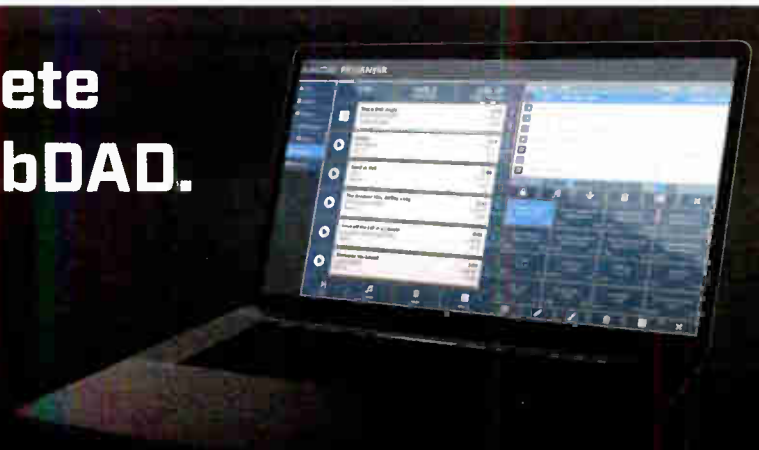

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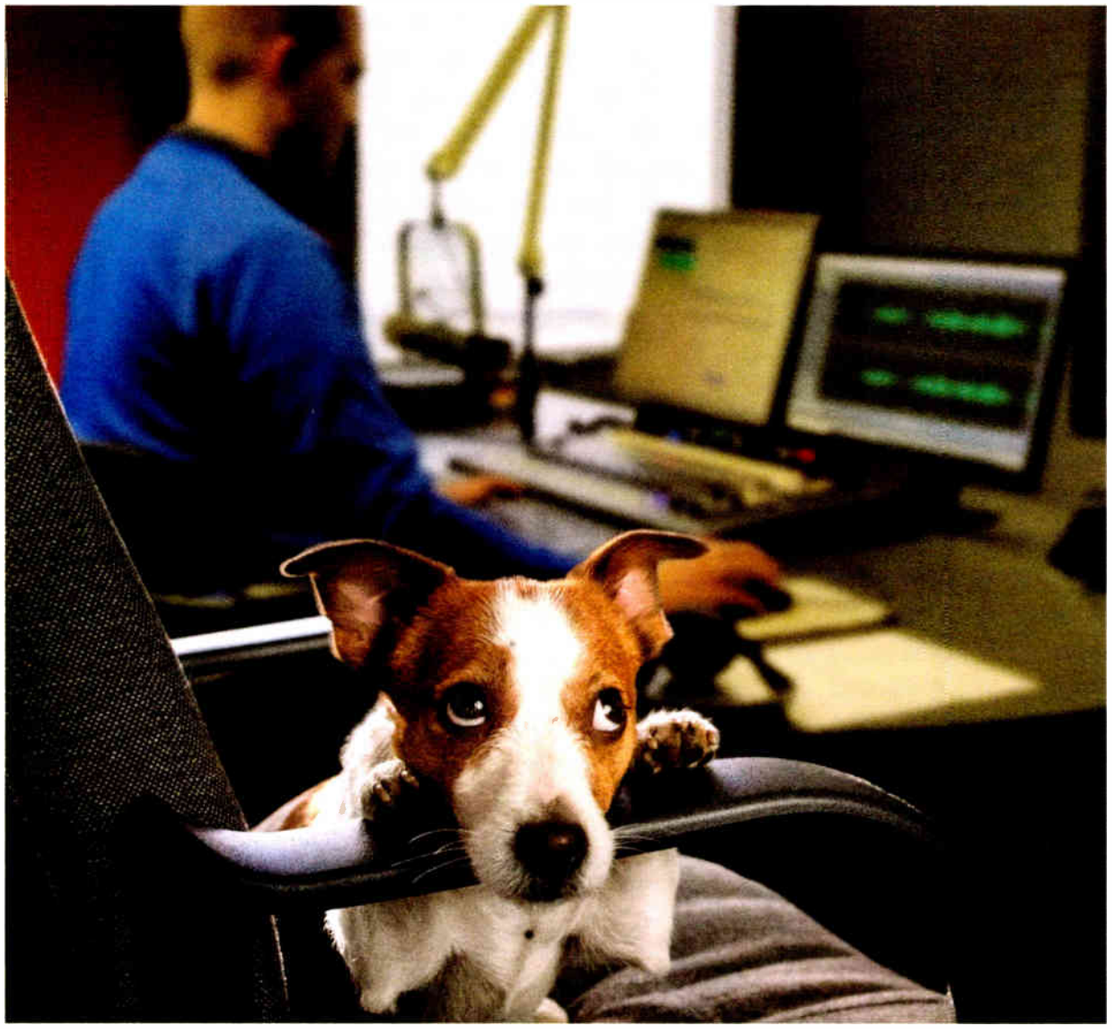

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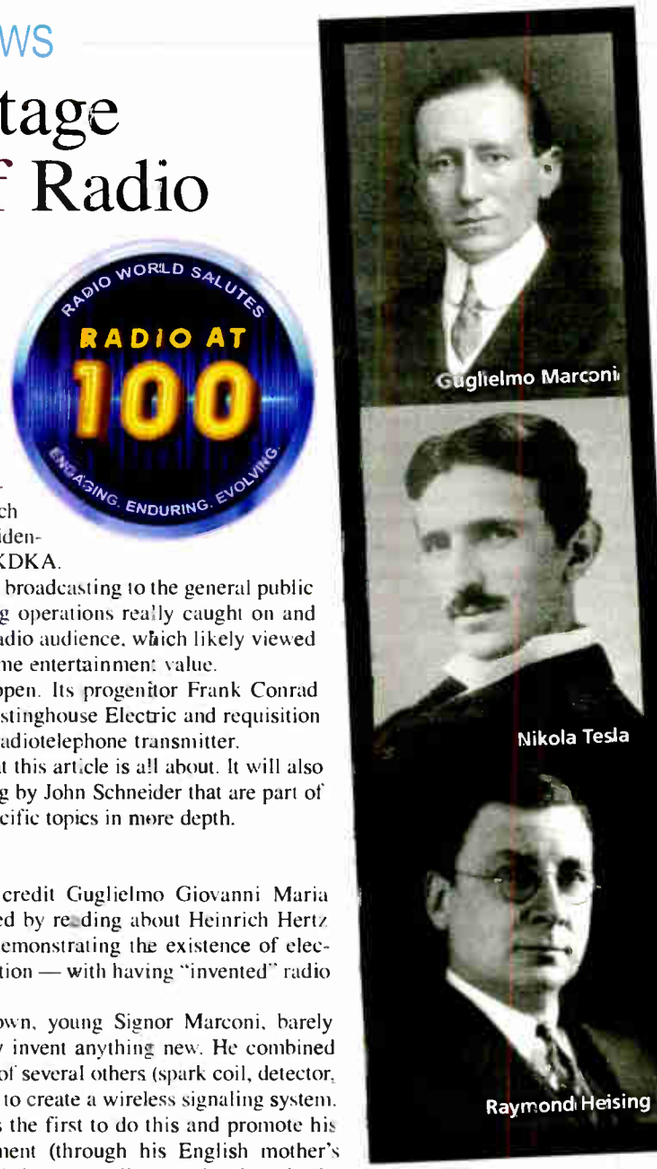
NEWS

They Set the Stage for the Birth of Radio

A look at the technology innovations that helped to launch radio broadcasting

BY JAMES E. O'NEAL



Later this year we celebrate the 100th anniversary of radio broadcasting as we know it, which came into being with the transmission of U.S. presidential election returns in the fall of 1920 by station KDKA.

There are a number of documented attempts at broadcasting to the general public prior to this date; none of these other pioneering operations really caught on and captivated much attention, save for the amateur radio audience, which likely viewed them as just an experimental curiosity having some entertainment value.

Obviously, the KDKA project didn't just happen. Its progenitor Frank Conrad didn't stop by the stockroom of his employer Westinghouse Electric and requisition a pile of parts that, on a whim, he turned into a radiotelephone transmitter.

A lot more had to happen prior, and that is what this article is all about. It will also serve as a reference to articles you've been reading by John Schneider that are part of this "Radio at 100" series and are focusing on specific topics in more depth.

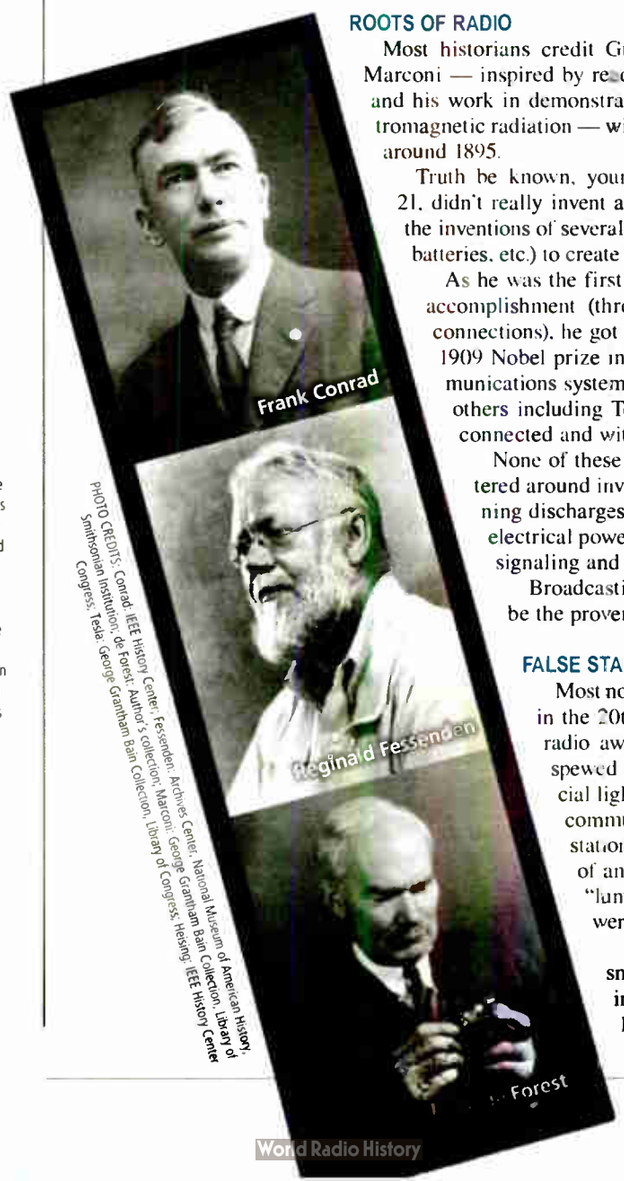


PHOTO CREDITS: Conrad: IEEE History Center; Fessenden: Archives Center, National Museum of American History, Smithsonian Institution; de Forest: Author's collection; Marconi: George Grantham Bain Collection, Library of Congress; Tesla: George Grantham Bain Collection, Library of Congress; Heising: IEEE History Center

ROOTS OF RADIO

Most historians credit Guglielmo Giovanni Maria Marconi — inspired by reading about Heinrich Hertz and his work in demonstrating the existence of electromagnetic radiation — with having "invented" radio around 1895.

Truth be known, young Signor Marconi, barely 21, didn't really invent anything new. He combined the inventions of several others (spark coil, detector, batteries, etc.) to create a wireless signaling system.

As he was the first to do this and promote his accomplishment (through his English mother's connections), he got credit — and a share in the 1909 Nobel prize in physics — for putting together this rudimentary communications system. Later, claims to priority were made by or on behalf of others including Tesla, Popov, Lodge and Bose. But they were less well-connected and without the support and machinations of a doting mother.

None of these individuals invented broadcasting. Their concerns centered around investigations of electromagnetic radiation, detecting lightning discharges, remotely igniting gunpowder, wireless transmission of electrical power, or in the case of Marconi creating a means of wireless signaling and communication.

Broadcasting of speech and music to the masses wirelessly would be the provenance of others and would have to wait a decade or so.

FALSE STARTS

Most notable of these was Reginald Aubrey Fessenden who, early in the 20th century, was driven by an obsession of sorts to move radio away from the endless streams of "dits and dahs" being spewed out by gigantic high voltage spark coils — really artificial lightning machines — and used more or less exclusively for communication between ships and corresponding land-based stations. (By that time, there was also a sizable community of amateurs of all ages who were interested in provoking the "luminiferous Ether" through which these "Hertzian waves" were thought to travel.)

Fessenden was the first to realize the requirement for a smoothly changing (sinusoidal) carrier wave upon which to impress speech and music, and also the potential for wirelessly transmitting such intelligence to the masses untrained

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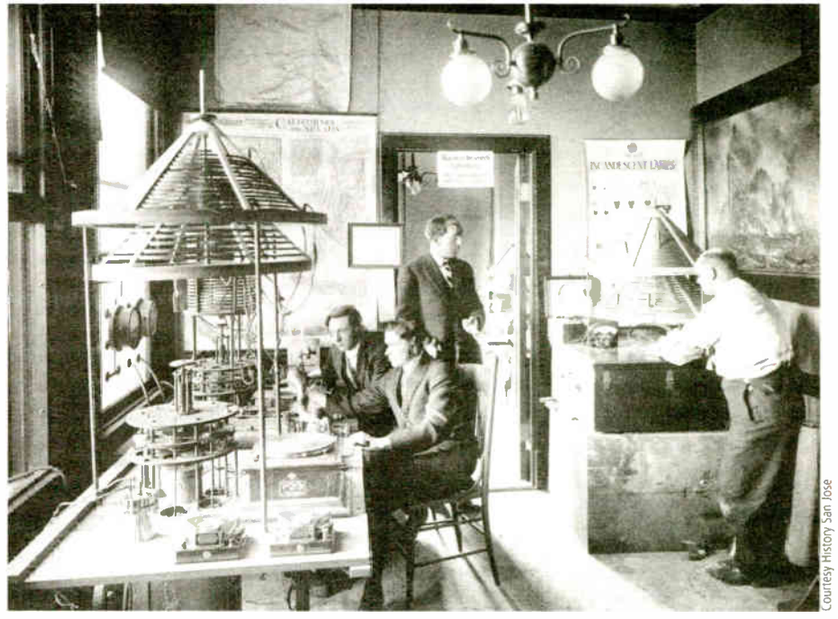
in the art of copying Morse code.

He succeeded well enough in his efforts in late 1906 to demonstrate "radiotelephony" to a handful of witnesses, including a couple of Associated Press reporters, late in the afternoon of Friday, Dec. 21, that year. (Fessenden would much later in his life claim to have put together a real "broadcast" a couple of days later to entertain shipboard and land station wireless operators, but this wonderful Christmas Eve event has never been substantiated.)

While Fessenden certainly had the dream — even providing a typed "handout" about the potential to transmit news and entertainment to large numbers of "listeners-in" to attendees at his Dec. 21 demonstration — he lacked the drive to follow through on this initiative, leaving it to others.

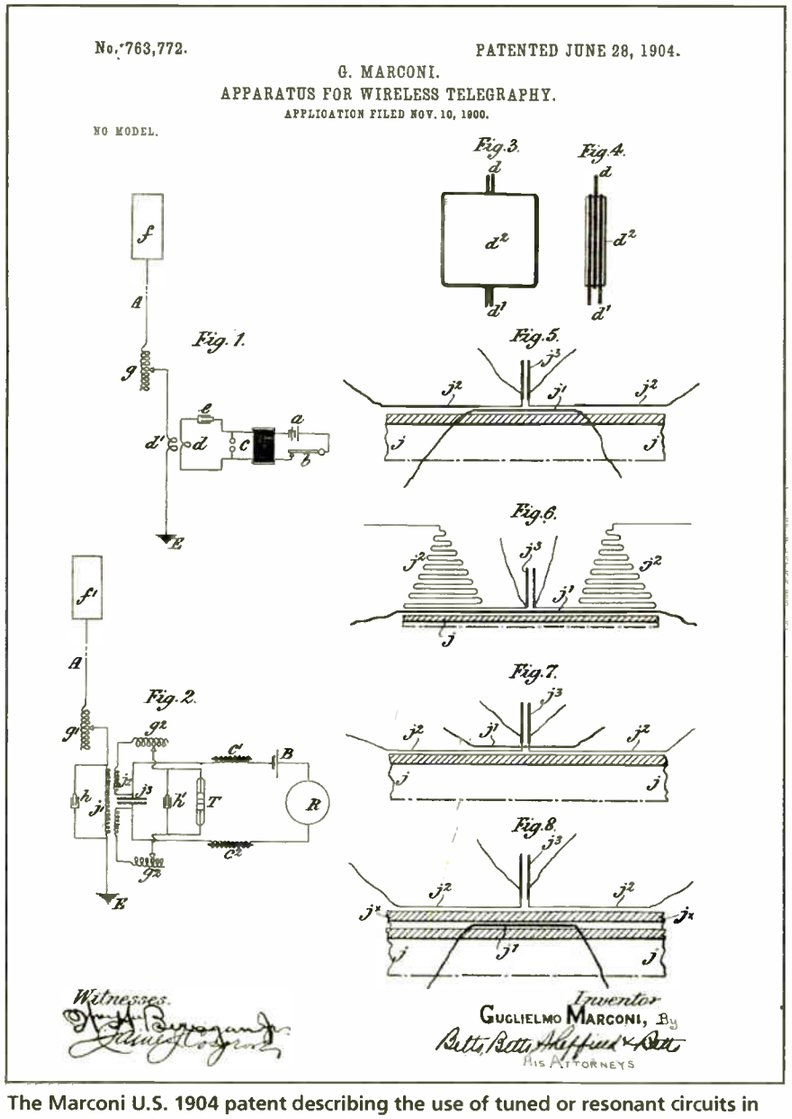
One of these, Lee de Forest — who invented the first really useful electronic amplifying device and would later assume the title of "father of radio" — did follow through a few days after Fessenden's demo by putting speech and music on the air in and around New York City in late December 1906, and carrying this work on into 1907 and beyond. De Forest even broadcast music created by a primitive keyboard synthesizer, the Telharmonium, and live performances from the stage of the New York Metropolitan Opera House.

In San Jose, Calif., and a bit later out of the gate, Charles "Doc" Herrold was smitten by the concept of providing entertainment wirelessly to the masses, first experimenting around 1909 with a system of wireless telephony similar to that used by de Forest and starting up a regular broadcasting initiative in 1912.

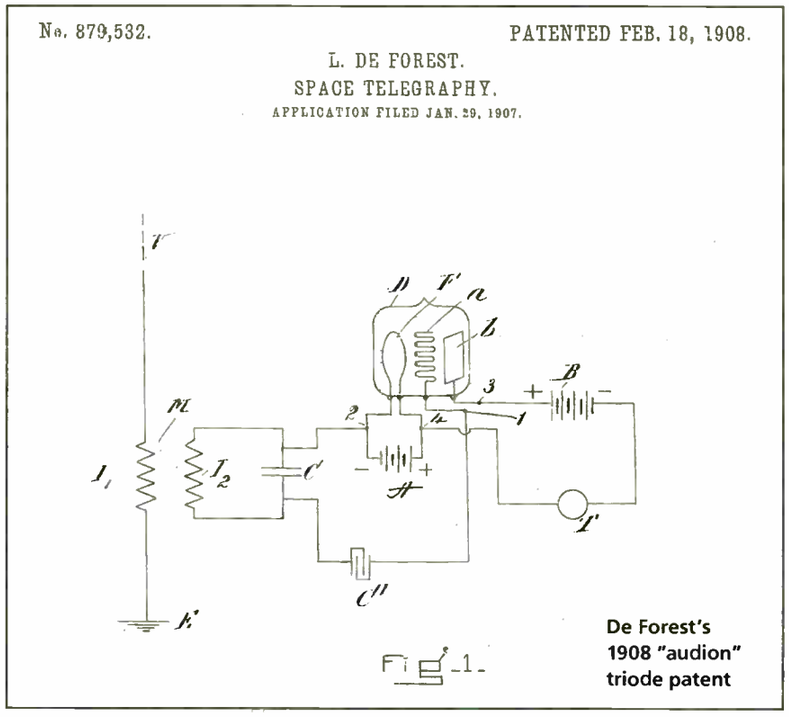


Courtesy History San Jose

Charles "Doc" Herrold (standing, center) at his San Jose, Calif., combination radio school and broadcast station. The turntable (phonograph) and microphone (telephone carbon "transmitter") are clearly visible on the table at the left.



The Marconi U.S. 1904 patent describing the use of tuned or resonant circuits in transmitter and receiver circuitry. It followed the issuance of the famous "four sevens" U.K. patent in England in 1901; however, this was challenged by former Marconi employee Oliver Lodge, and the U.S. patent was later ruled invalid, with the court citing the prior art of Nikola Tesla.



De Forest's 1908 "audion" triode patent

However, in both cases (and on both coasts), outside of the amateur radio community and a few members of the professional ship-to-shore users of radio, there wasn't really much of a listening audience, and apparently neither de Forest nor Herrold was sufficiently interested in promoting their broadcasting efforts to achieve "buy-in" from the general public.

They preferred instead to focus on the creation of radio-related inventions and patents and, in the case of Herrold, operating a school to train prospective "radiomen" in the fundamentals of the art.

Truth be told, due to the rather poor audio fidelity that was achievable via the transmission and modulation technology used by de Forest and Herrold — they both employed transmitters driven by a hissing electric arc — it is doubtful that even with a lot of money spent on promotion, the masses would have been attracted much beyond the initial novelty of the thing.

INVENTING THE TECHNOLOGY

So, assuming that Westinghouse's Dr. Frank Conrad did possess the requisite technical savvy and imagination to envision and bring into being radio broadcasting, it's obvious that several things had to happen to move from the high-frequency alternator of Fessenden and the "arcphone" technology employed by de Forest and Herrold.

There was no quantum leap here. A number of principles had to be established, discoveries made and inventions perfected before a satisfactory means

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for transmitting speech and music burst upon the global scene in the early 1920s.

Foremost was the setting down of the fundamental equations and relationships governing all electromagnetic radiation by James Clerk Maxwell, and the experimentation and proof positive of the existence of this invisible energy a few years later by Hertz.

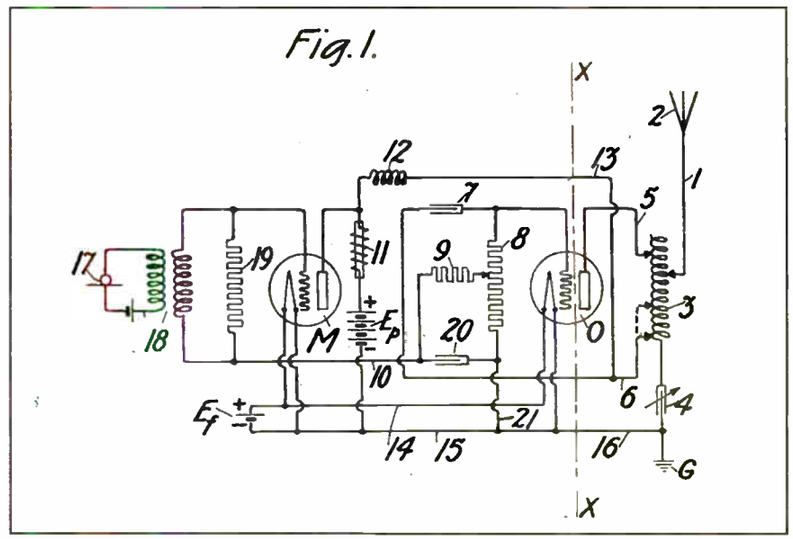
Both of these milestone events were necessary for radio of any sort to move forward; however, in themselves, they did not lead directly to a system for broadcasting.

One of the seminal inventions, or principles, was that of resonant, or tuned, circuits. For this, the Marconi company has to be given some amount of credit, as a rather famous British patent (no. 7,777 and referred to as "the four sevens") was awarded to that firm in 1901.

This patent ("Improvements in Apparatus for Wireless Telegraphy") and its U.S. counterpart no. 763,772, issued in 1904, describe the use of tuned circuitry and the transmitter and receiver to allow them to "syntonize" or operate on the same frequency.

This invention was driven by the need to reduce interference between spark radiotelegraph stations, which, prior to the introduction of such technology, radiated very broad signals (spread-spectrum?) with tuning set only by whatever stray capacitance to ground and antenna/transmission line inductance existed at a particular installation.

(Interestingly, Oliver Lodge, who had been employed by Marconi and experimented along these lines, challenged Marconi's priority in making such a discovery. Also, the U.S. version of the patent was declared invalid in 1943, with credit being given to Tesla for prior art.)



Heising's patent for achieving amplitude modulation. This development marked a quantum jump of sorts in methodology for effectively impressing audio on a carrier wave.

Regardless of who invented tuned circuity achieved through use of discrete components, it was a fundamental step on the path to broadcasting.

Another key component was something that Marconi and his company couldn't provide: a means for generation of a continuous high-frequency oscillation to serve as a "carrier wave" for transmission of speech and music. (Marconi's spark-driven wireless telegraphy operated in bursts of electromagnetic energy, referred to as a "damped wave" or an oscillation that trailed off in intensity over time.)

Fessenden appears to have been first to recognize the unsuitability of damped waves for transmission of speech and music, initially working to perfect a spark transmitter with an extremely fast "make-and-break" interval so as to try and ameliorate this shortcoming. He did build a working model and demonstrated it in late 1900, transmitting a raspy, but intelligible, representation of human speech for a distance of about a mile.

Fessenden quickly realized that spark was a dead-end technology for his application and experimented for a while with Poulsen's arc-driven oscillator before moving on the concept of using a high-frequency AC generator (alternator) to create a continuous wave without the "sizzle" associated with arc.

After several years, and a lot of pressure exerted on the General Electric Company to develop a high-frequency alternator, he did publicly demonstrate successful transmission of speech and recorded music on the afternoon of Dec. 21, 1906.

However, there is a limit as to how fast

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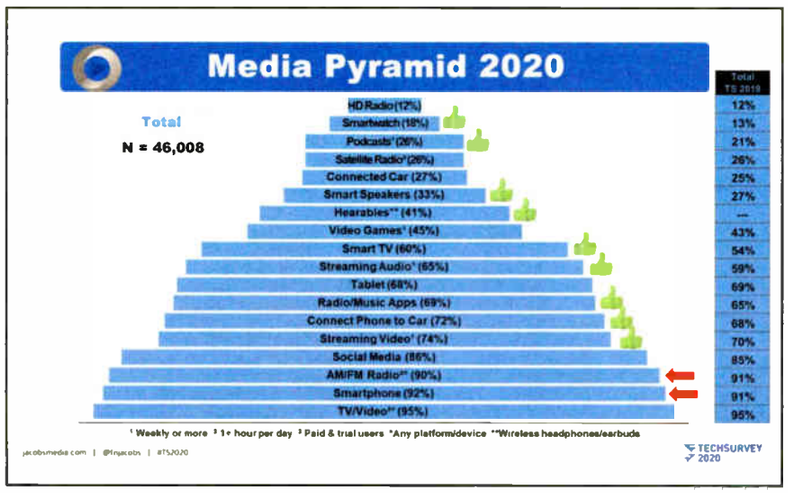
"Free" Is Important Differentiator for Radio

But Techsurvey also finds an industry still not taking full advantage of all its digital tools

BY PAUL McLANE

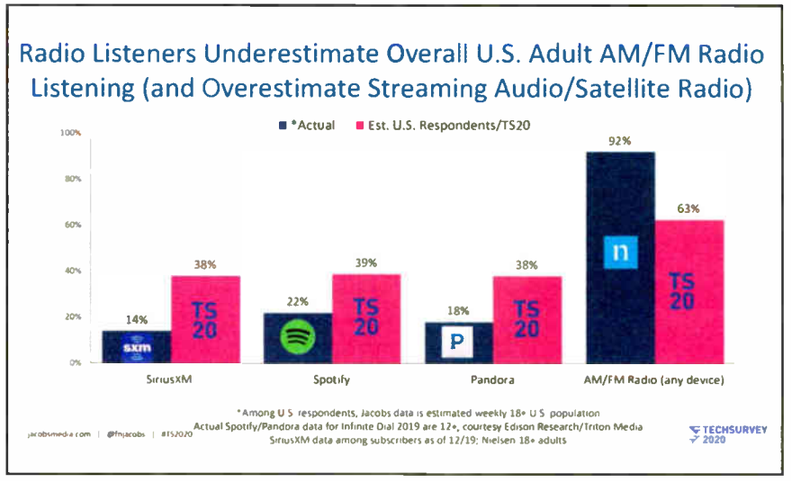
Jacobs Media recently published the 20th edition of its Techsurvey. It provides insight into how radio consumers, particularly in the United States, perceive and use radio, and what lessons can be learned for media managers.

Information was gathered from 46,000 respondents that Jacobs contacted using the databases and social media resources of about 500 commercial stations in the United States and Canada. It's a web survey that does not represent all consumers, all commercial radio listeners or even station audiences; but it provides useful insights into habits and perceptions of a lot of people who currently listen to commercial radio. (Jacobs conducts separate surveys focusing on listeners to Christian radio and to public radio.)

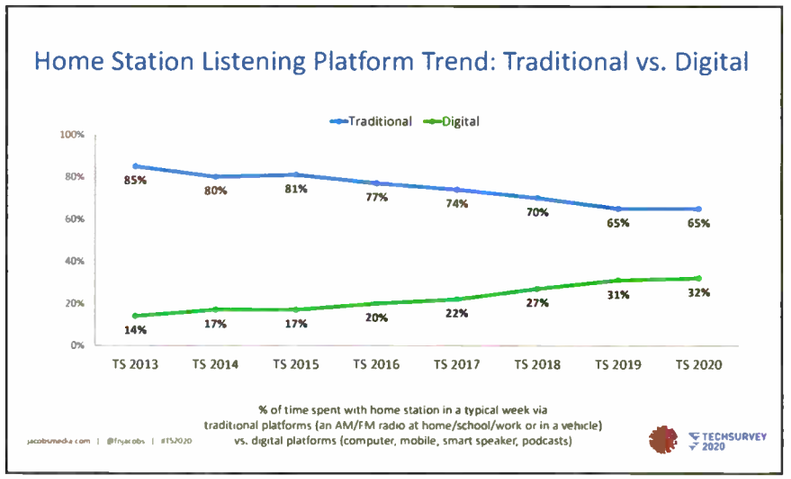


This is Jacobs' familiar Media Pyramid. "Hearables" is a new category; it refers to wireless headphones and earbuds. The green thumbs indicate areas of growth from last year. Compare percentages to last year's numbers at right. TS means Techsurvey.

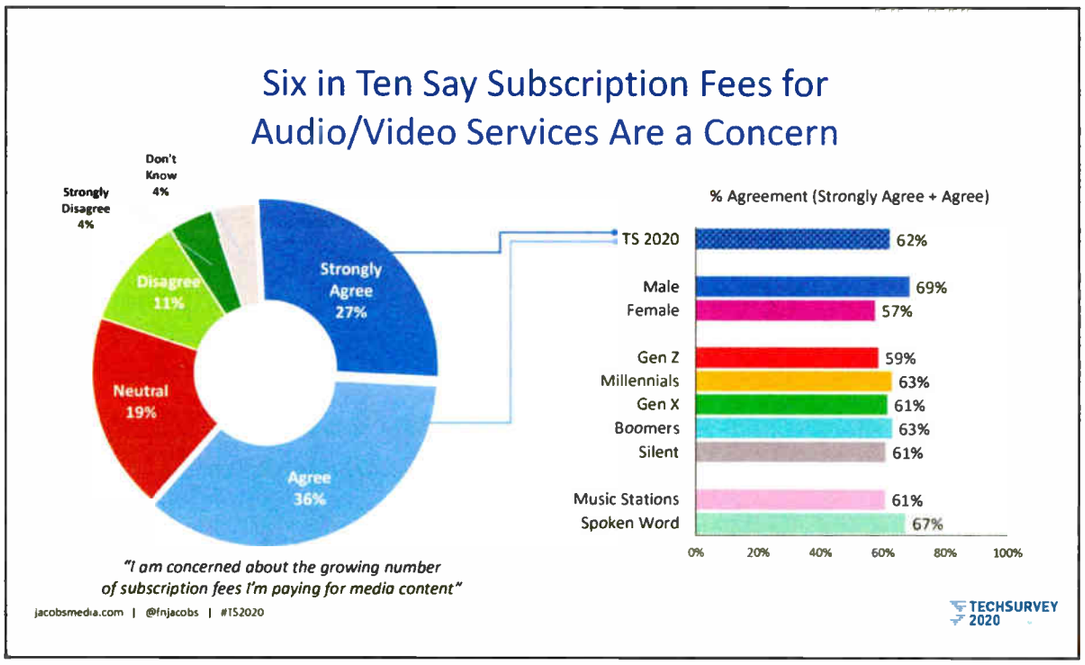
The survey suggests growing concern among commercial radio listeners about the various subscription fees people must pay for media content in 2020.



This suggests that many radio listeners underestimate overall AM/FM listening, and overestimate listening to streaming and satellite radio. As is so often the case, over-the-air radio seems not to get full credit for its own reach and appeal.



This shows the percentage of time spent with the person's "home" station in a typical week via traditional platforms (an AM/FM radio at home/school/work or in a vehicle) vs. digital platforms (computer, mobile, smart speaker, podcasts).



Fred Jacobs, the company's president, took note of the "skyrocketing" use of video streaming, even before coronavirus sent everyone home. Also, the voice segment continues to grow with the proliferation of smart speakers.

"We're learning about the value of subscription services — both audio and video — and given the strong possibility of rough economic waters ahead, what may happen when consumers are forced to make tough decisions about what they'll continue to pay for." Jacobs says the fact that broadcast radio is free may be a useful differentiator at a time when people are scrutinizing their monthly credit card bills.

Some other takeaways: Smart TVs are everywhere. Radio may rule in the car and at work, but has eroded in homes. Radio's digital consumption is still secondary. Station apps have become popular but many listeners still don't know they exist.

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an alternator's armature can spin without flying apart. This limited operation of such mechanical sources of RF to very long wavelengths that aren't really practical for general broadcasting purposes (VLF and LF portions of the spectrum).

Audio modulation is also very difficult to achieve with such rotating machine technology. (Fessenden simply inserted a specially designed carbon microphone in series with the transmission line feeding the antenna. The mic's resistance varied with the audio reaching it, and this in turn varied the transmission line current, achieving amplitude modulation of a sort. He admitted at his Dec. 21 demo that this scheme provided a modulation depth of no more than about 5 percent.)

Despite this rather large advance in technology, practical broadcasting had hit another dead end of sorts, awaiting a more practical means for generation of a continuous wave.

This came almost by accident in late 1906, about the time that Fessenden was performing his public demo of speech and music, when de Forest hit upon the idea of an electronic amplifying device when trying to develop a detector that didn't infringe on previous inventions. It was not long before de Forest and others discovered that his crude three-element vacuum tube could also function as an oscillator. This device, after a lot of refinement by licensees GE and AT&T, supplied another key ingredient essential for the birth of broadcasting.

Aside from a practical radio detector — which now existed in several forms (electrolytic, crystal and vacuum tube) — the only other missing ingredient was a reasonably efficient methodology for modulating audio onto a carrier wave. This was supplied by a Western Electric engineer, Raymond A Heising, in the form of his "constant current modulation technique.

While not perfect in terms of efficiency or modulation depth, it did provide a relatively simple way to impress audio intelligence onto a carrier, and was a quantum leap from the methodology employed by Fessenden and others in broadcasting's "pre-history."

While these elements — tuned circuitry, a practical source of continuous waves and an audio modulating scheme with reasonable efficiency — which were all available by the mid- or late-1910s, the world would still have to wait a little longer for the birth of broadcasting.

A major complicating factor had arisen: The Great War (1914-1918). With America's entry into the fighting in the spring of 1917, much of the work on radio research and development was halted, and an executive order in April from President Wilson led to the dismantling of private transmitting and receiving equipment.

Radio went to war for the first time, and research in this area was basically limited to the production of practical apparatus for use in battlefield communication.

Broadcasting would have to wait a little longer.

NEXT: Radio broadcasting takes to the air.

Eager for more history? Read James O'Neal's article on arc converters, "When Brute Force Transmitters Ruled the Air," in the April 22 issue of Radio World Engineering Extra, found at radioworld.com/digital-editions.

FOR FURTHER READING

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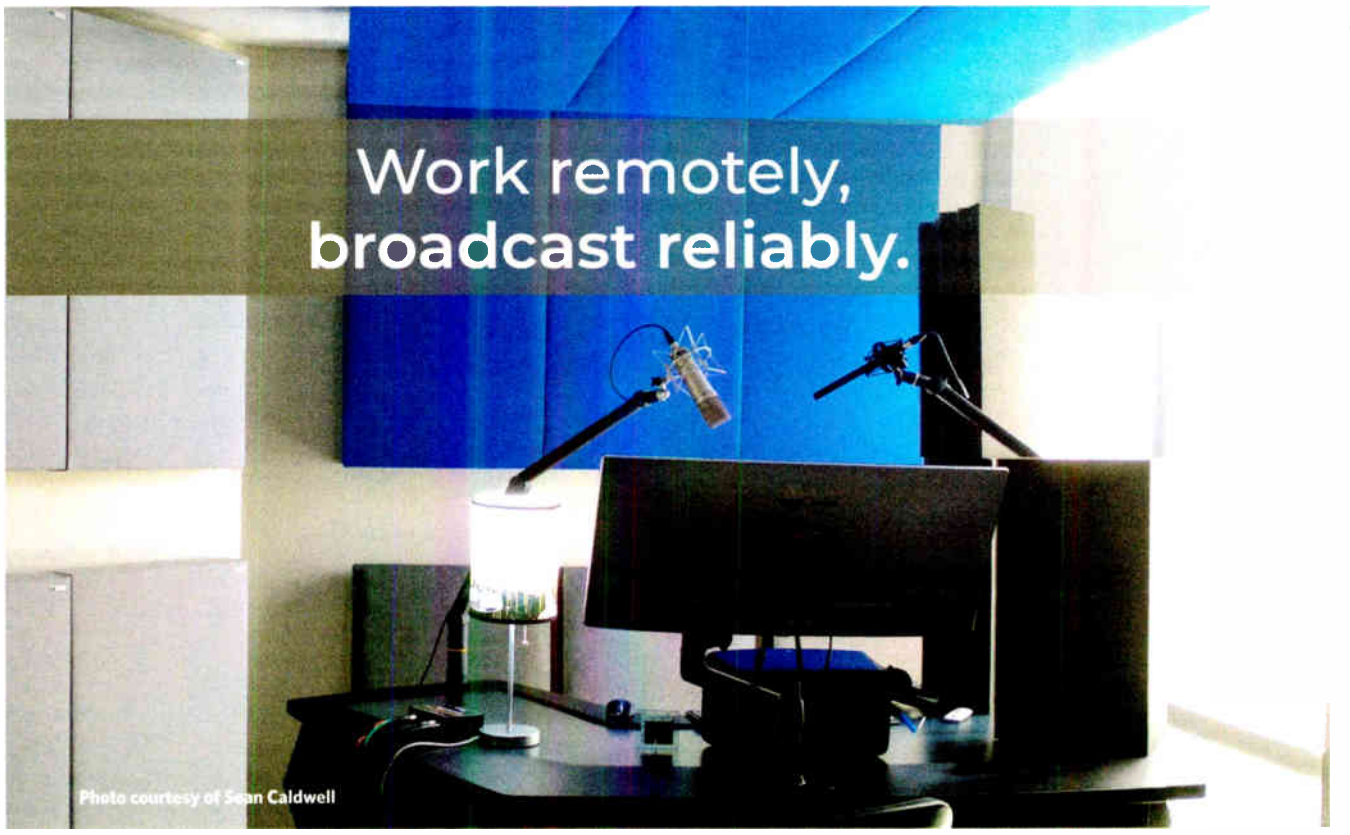

Photo courtesy of Sean Caldwell

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DIGITAL ON AM

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on the AM band in the United States for those stations that want to adopt it. The NAB said that nearly all others who have commented to the commission have supported the idea.

In addition to reviewing the various reasons it had listed earlier (reaching more listeners, improving signals, allowing additional programming), the association now has made some specific additional points:

- It argues that no additional testing is needed because it considers the all-digital MA3 mode as proven, based on field and lab tests as well as the experimental operation of a station in Frederick, Md.

- NAB disagrees with those who think additional testing is needed to determine potential interference to co-channels during nighttime hours. "The evidence shows that all-digital signals will cause fewer interference concerns than hybrid operations and eliminate any concerns about interference to adjacent channels. ... WWFD has been broadcasting all-digital nighttime service for 20 months without any problems. Also, the rollout of all-digital is expected to be fairly gradual, which will provide the FCC and industry time to monitor and address any interference problems, as NPR suggests."

- NAB agreed with Xperi, which told the FCC that although NAB Labs' tests may not have exhaustively tested every conceivable all-digital AM operational scenario, "the success of the WWFD experiment confirms that there is more than an adequate foundation for FCC action." The NAB said the FCC can simply address individual cases of interference as they arise, under current practice.

- The commission had asked whether to impose a carrier frequency tolerance standard on AM stations of 1 Hz as a way to improve all-digital reception. NAB says no, calling the idea "an unnecessary burden on AM broadcasters who will continue to operate in analog mode." It agreed that tightening the carrier frequency tolerance would benefit analog and all-digital operations by reducing the impact of co-channel interference. "However, given today's extremely challenging economic climate for radio broadcasting, especially AM service, such a new requirement would be a burden and counterproductive to the FCC's goal of AM radio revitalization." At most, it said, the FCC should table the idea for the time being.

- NAB supports a proposal from Nautel regarding the allowed operating power (nominal power) limits. Nautel wants the relevant section to be applied "to the average all-digital signal power including the digital signal power and the unmodulated analog carrier power" and not simply the "unmodulated analog carrier power" as proposed in the FCC notice. NAB called this "an important modification which makes good technical sense" and would make it easier for more AM stations to be switch to MA3.

- The broadcast association reiterated support for the plan to incorporate the NRSC-5-D standard by reference into the digital audio broadcasting rules — in other words, for the FCC to verify its commitment to IBOC. "Adopting NRSC-5-D as a formal technical standard will provide stakeholders the regulatory certainty needed to confidently invest in providing digital broadcasting service and products," NAB wrote. "Contrary to the requests of Dolby and a few others calling for the FCC to start over with a reevaluation of alternatives to IBOC as the standard for all-digital AM service, confirming IBOC as the single standard for digital audio broadcasting will avoid completely upending the long-standing and ongoing progress of digital radio in the United States."

- And NAB supports calls for the FCC to adopt a simple notification procedure for AM stations' conversion to all-digital service. It opposes the request from the Society of Broadcast Engineers for a much longer prior notification period (such as 60 days) for converting to all-digital service to allow co- and adjacent analog channel stations to determine certain baseline data before digital service starts. "NAB submits that NAB Labs' extensive testing and WWFD's real-world experience confirm that such a requirement is unnecessary."

iStockphoto / Rafa Irusta

TECHSURVEY

(continued from page 6)

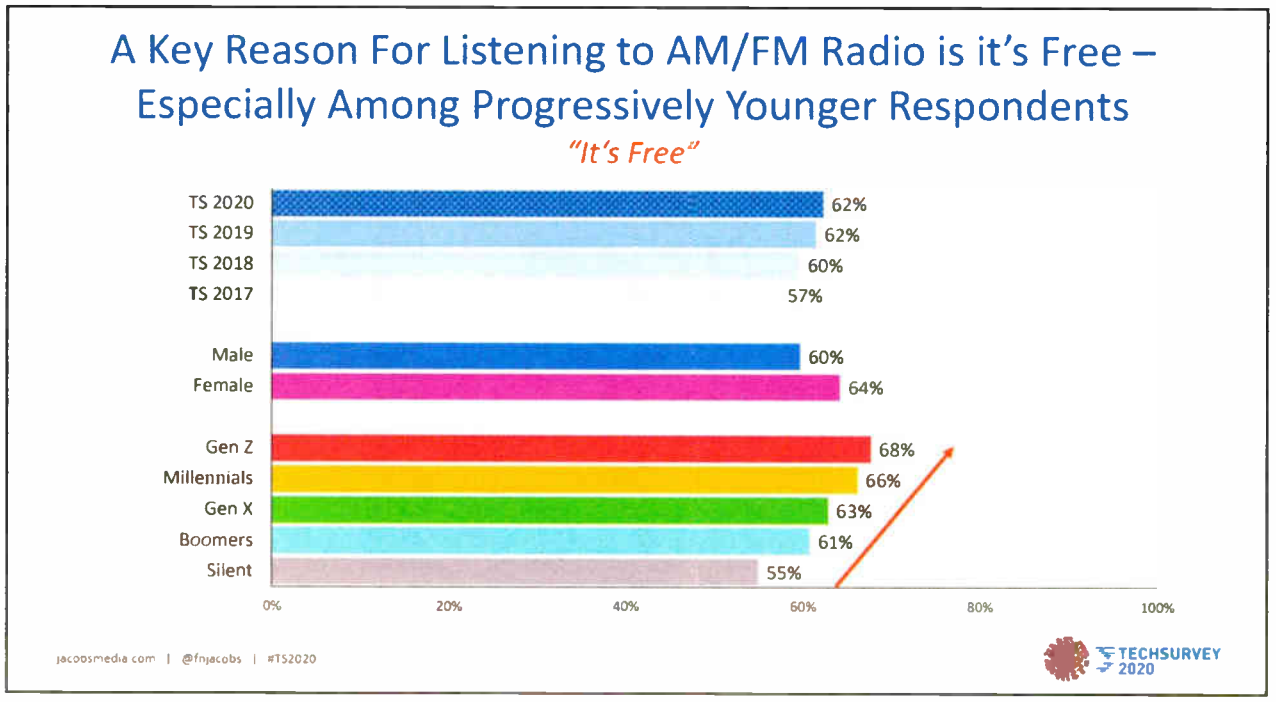
Smart speakers may be a powerful addition for radio but stations don't always promote them.

Also, "We learned a lot of radio fans would be willing to put their favorite station's bumper sticker on their cars — if these mini-logos were made available," Jacobs said. "Maybe that's not a breakthrough finding, but it is interesting in an industry that long stopped producing these inexpensive sticky logos."

Oh, and remember to clean up your stream. In the home it's the only way many people now can hear you.

Find more results on the Jacobs Media website under the "Research" tab.

Learn more about Techsurvey20 at radioworld.com *by searching for "Techsurvey."*



The importance of "free" to younger listeners is evident here.

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World Radio History

WELTON

(continued from page 1)

warm sense of humor — as captured in the title of one called "How Not to Blow Stuff Up."

The Canadian has been on a bit of a win streak. In 2018, the Society of Broadcast Engineers named Welton the James C. Wulliman Educator of the Year. In 2019 the Association of Public Radio Engineers handed him the APRE Engineering Achievement Award.

Radio World asked Welton his thoughts on trends in RF manufacturing and where digital radio is headed in the United States.

Radio World: *You spent your first 17 years at Nautel in field service and technical support positions. What is the most important current trend radio broadcasters need to know about?*
Jeff Welton: The biggest trend in transmitter manufacturing is IP connectivity. But most importantly for broadcast is the attendant need for IT security, which people are beginning to be made aware of; but it has been a very slow process.

RW: *How big of an issue is the security?*
Welton: You have seen all of the news of IT ransomware attacks. There are many more hacks and viruses that happen every day that no one ever hears about. Occasionally I will do an Internet of Things search looking for unprotected devices, and if I search audio codes and search a few of the bigger names in codecs, I will find thousands of units online, and half will be using default user names and passwords. That's the biggest thing right now for broadcasters to be aware of.

RW: *You're no longer on the design side of the transmitter business, but where does Nautel see RF design going next?*
Welton: You certainly see the trend toward smaller footprints. More power density, more watts per cubic inch, so to speak. That trend will continue, but eventually the laws of physics dictate we just can't get any smaller. Having said that, the laws of physics can always be challenged, and we will going forward.

RW: *Any move by Nautel toward a liquid-cooled design for FM/HD transmitter? Some of your competition, like GatesAir and R&S, have been active in that segment.*
Welton: I really can't answer that question. No comment. That said, we have looked at liquid-cooling repeatedly over the years, going back as far as at least 15 years ago, if not further. We did a 20 kW design in the late '90s/early 2000s that was liquid-cooled in the initial prototype.

Jeff Welton calibrates equipment during an AM HD upgrade at WNYC in 2005.

Ultimately, at that time, we did decide to abandon it for several reasons. Even today, with the advances in the technology, it's hard to justify the additional cost of liquid cooling in all but the highest power levels, and even then only in specific circumstances. Definitely there are advantages, but the flexibility and lower cost of an air-cooled system typically outweighs those advantages in most cases.

However, it certainly is situational. What may be the best cost benefit for a 30 kW station in one market may not apply equally to a similar station in a different market, climate or site situation.

My recommendation to radio broadcasters is to always get a couple of opinions, then try to sort out what provides the best long-term benefits for your station.

RW: *How about all-digital for the AM band. Does Nautel see promise in that market?*
Welton: Definitely, we are behind it and support it as a manufacturer. I think it will be good for the broadcast industry, but I'll qualify that with one thing. It really all comes down to the content, honestly. I think the technology is great and it has promise, but without the worthwhile content and good programming, it is not going to solve any problems for AM broadcasters in the United States.

RW: *You're known as the "go to" tech support guy at Nautel, yet your official title is regional sales manager. Tell us more about what you do and how much travel is involved.*
Welton: I travel anywhere from 100 to 200 days a year. It can vary quite a bit. I have the formal title of regional sales manager, but I pretty much focus on, as they say, "other duties as assigned." I do seven to 10 state association shows a year. I do NAB of course. I do a half-dozen SBE presentations and some Nautel-sponsored webinars. I even stop in on sight occasionally to help with HD system installs. So I do get to do some hands-on work still.

RW: *So you are out visiting facilities and meeting a lot of radio broadcast engineers. What is the most impressive thing you find about that group?*
Welton: I think more than anything you find people who willing to be helpful to others, even their competition. You can find people who are competitors but then willing to help others in an emergency and work together. I've found that to be the case even during my tech support days.

RW: *How do you think radio can navigate the problem of losing veteran engineers who have a deep knowledge of RF systems? Obviously this affects broadcasters and how they maintain their RF facilities.*
Welton: Well, there is a solution, and it's hard. We need to get young people bit by the bug. Once you get in this industry it really does get into your blood. You don't see many people leave the industry once they are in it. Where else can you have so much fun and make a living at it? [*chuckles*]

I think the pay scale is coming up a bit, but the big thing is tweaking the interest of young folks. That might be hosting an engineering table at a state

Welton inspects a newly installed V5 in Wisconsin in 2010.

World Radio History

At work in 2000.

show career fair. You have to get the exposure to draw interest. There are lots of opportunities for people to be mentored and work part time while being in school still. That's a great way into the profession.

RW: *You perform presentations every year on topics like lightning protection, grounding, transmitter site safety and various other subjects. Is there a topic out there you want to teach?*
Welton: One of the big ones for me is HD Radio, AM and FM, and the implementation. The technology has developed so that I would like to put together a booklet and really dig in how to install and what to look for rather than the theory of the operation of the technology. Really it would be a practical application of HD Radio. So now that it is out there, I'd better get to work on it.

RW: *Nautel has for some time thought about equipment beyond transmitters as a way to grow the business. Any new broadcast equipment coming down the pipe?*
Welton: Not much I can say on the broadcast side. Much of the work we do outside of broadcast is non-disclosure since we are dealing with the military. We find lots of ways to keep busy and we do a lot of things in RF above and beyond radio, which is cool.

RW: *Tell us something about yourself that surprises people when they learn it.*
Welton: That I have a fully functioning wood working shop at my home right outside my office. I haven't been able to work out in it much since I've been so busy with work. The last thing I built was a vanity for a bathroom remodel. I did all the cabinetry and built all of the drawers into it. That was cool. It's a far departure from electronics.

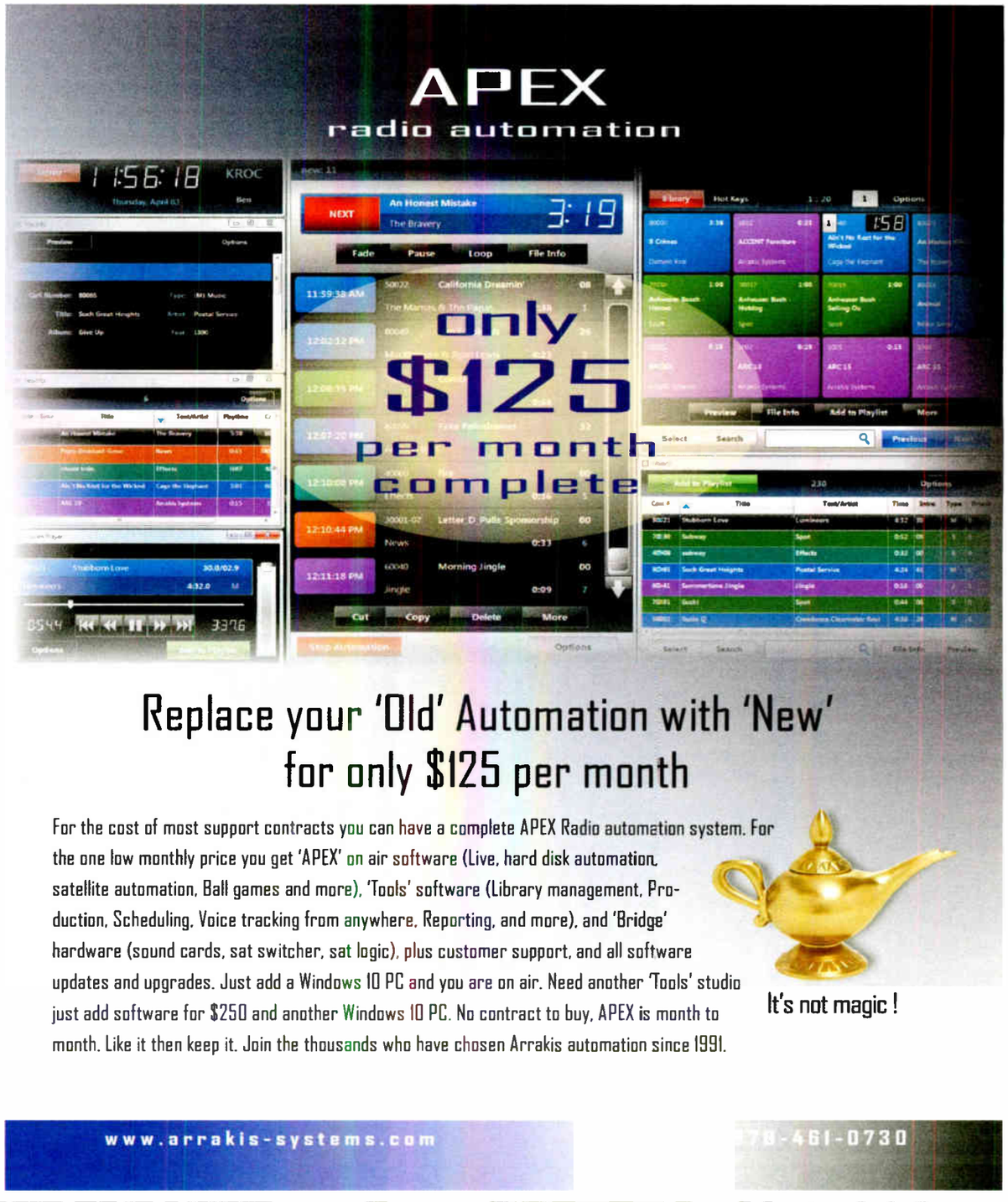
RW: *Anything else keep you busy at home?*
Welton: I love to cook. I spend a lot of time in the kitchen. I got a pressure cooker last year, and loved it so much I augmented that with a second one about a week later.

RW: *How did you get your start at Nautel?*
Welton: We had a speaker at my high school one day for career day talking about electronics school in Toronto. I grew up on a farm in Nova Scotia, so as soon as I heard the word "Toronto" I was hooked. He could have been talking about cosmetology school and I would have ended up being a hairdresser. So I went to Radio College of Canada (RCC) for electronics engineering.

Then I had a few jobs after that, including doing bench repair at Radio Shack. Then in 1990 Kevin Rodgers (now president and CEO of Nautel) was put in charge of building a customer service department for Nautel. By the luck of the draw I ended up there and have been ever since.

RW: *What were your first thoughts upon learning of the NAB engineering award?*
Welton: Really of all the people I need to thank for being where I am today. There have been so many people I've learned from. Jack Sellmeyer and Tom King come to mind if you are talking directional AM antennas. Gary Cavell has always been willing to answer my sometimes dumb questions. Mark Persons is always willing to share knowledge.

The one thing I always try to convey to people is that everybody everywhere knows something that somebody else doesn't. I've just been very fortunate to find a bunch of people willing to share the things they know that I don't. And there is a long list of things. The more I know the more I realize I don't know it all. Not even close.



World Radio History

Mother Nature Can Both Hinder and Help Your Station

Also, don't miss out on your free Swag Bag ... here's how to get yours

WORKBENCH

by John Bisset
Email Workbench tips to johnpbisset@gmail.com

Mother Nature is amazing. Vegetation will find a way to grow almost anywhere, including places at your transmitter site that can be problematic.

You can bet the satellite signal from the dish in Fig. 1 gets even worse when the leaves come out. The problem gets worse the closer you get to the dish. We can see in Fig. 2 that the sections of the dish have actually been deformed by the vines.

Yet another reason why site inspections need to occur regularly.

Fig. 1: One reason to inspect remote site equipment thoroughly.

Fig. 2: A close-up shows that the vines are growing right up through the dish.

We've gotten encouraging comments from engineers reading Frank Hertel's and Bill Ruck's suggestions on rodent control.

Bill pointed out that raptors provide "free" control, and offers this blog from the Cornell Lab of Ornithology to back up the claim: *https://tinyurl.com/raptor-food*. Here's an excerpt (edited for style):

"Nonbreeding adults eat about a quarter-pound of food daily, or a tenth of their body mass — that's about five small mammals. Nestlings start feeding themselves (swallowing lemmings whole) at about 16 days old. It's estimated that a brood of two nestlings requires 26 pounds of food during the 40 days between hatching to fledging."

Various vole and mouse species average about 1 oz. in weight (lemmings in the arctic weigh a little more), so, if you do the math, every adult Roughie eats four to five small mammals every day (about 1,460 annually), and two nestlings consume roughly 278 rodents in only their first 40 days. Clutch size is usually three to five eggs, so the actual number of rodents consumed by nestlings is often much larger.

Red-tailed hawks are more common and are around all year long. They have about the same eating habits. Can anybody trap 1,500 mice a year using another method?

Among the many "take-aways" from the NAB Show each year are various useful promotional items that vendors offer attendees.

Since this year's show was canceled, Inovonics Broadcast President and CEO Ben Barber is offering an Inovonics Radio Hero Swag Bag, pictured in Fig. 3, to broadcast engineers who request one by email to *sales@inovonicsbroadcast.com*. Just reference the Swag Bag mentioned in Workbench.

I won't spoil the surprise, but you will find the contents useful.

Fig. 3: Inovonics will send you a free Radio Hero Swag Bag (modeled here by Travis Tibbot of BGS). Just email sales@inovonicsbroadcast.com.

With so many station voices operating from remote locations, Rob Atkinson, K5UJ, reports on an inexpensive equipment rack from, of all places, IKEA.

It's called a Lack Rack: it's a short table, the legs of which are placed at the perfect distance for mounting rack equipment. The flat table top provides a shelf top. It's nothing fancy, but for 10 bucks, it might solve the question of how to mount several pieces of rack equipment for a temporary lash-up.

Find specifics at *https://tinyurl.com/ikealackrack*, and the IKEA product is here: *https://tinyurl.com/ikearack*.

James Potter owns Cutting Edge Engineering, which provides radio station technical service. James tried the free Paint.net software that we

(continued on page 14)

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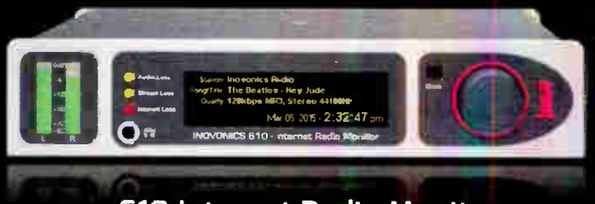

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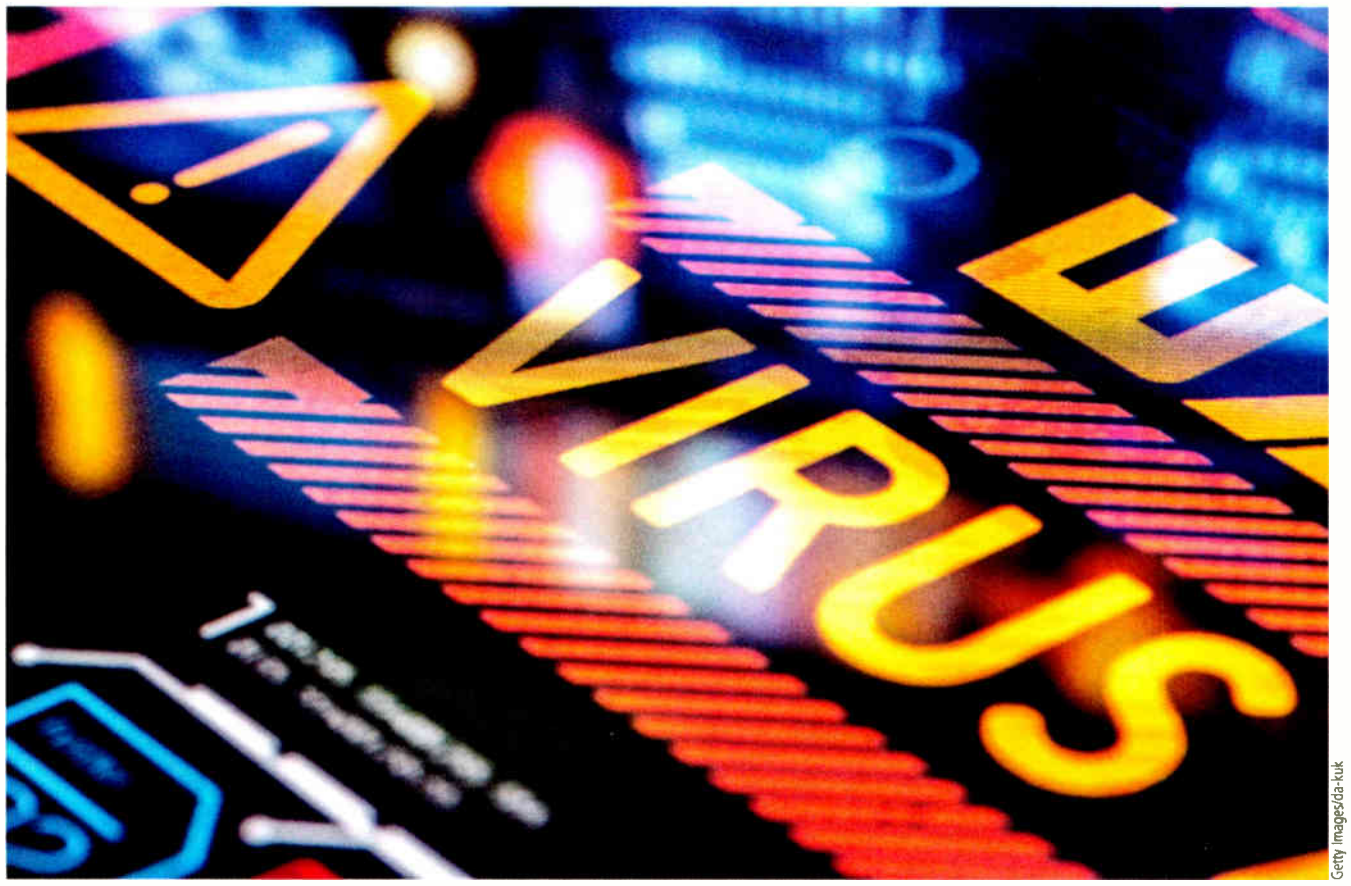
10 Cybersecurity Questions to Ask Yourself

OK, more than 10 ... here's a list to help you get started on your program



Getty Images/da-kuk

BY GARY KLINE

I wrote a list of cyber best practices that appeared in a Radio World ebook in November, before the current global crisis. RW asked me to revisit and update it given that broadcasters have rushed to find new ways of doing business centered around remote operations and heavy use of the internet.

There are thousands of announcers, accounting managers, inventory and scheduling staff, programming and music directors, operations directors, engineering managers and other station personnel operating from their homes. How are we handling the IT security and defenses of our operations?

Many of us had to scramble to facilitate multiple work-at-home solutions. Safe practices may have been ignored because the priority was saving businesses or informing our communities.

So now is a good time to assess and reassess. Remember, holes may exist now where they didn't before, because of emergency actions you took to allow for outside access to systems in your building or transmitter site.

As I wrote in the original version of this article, cybersecurity is a top priority for businesses of all sizes; a lack of readiness and defenses can lead to serious financial and operational consequences. Cyber extortion (ransomware) is big business and is not going away anytime soon. The following questions and thoughts are a place to start in hardening your broadcast organization's infrastructure and preparing for the worst case.

#1. Do you have a security-aware culture in your facility? In your organization? Be honest. Knowing that your IT staff or outside contractor installed a new firewall or virus program last year doesn't mean you are fully prepared. It does not necessarily mean you have a constant security-aware culture that involves regular routines such as:

a. Backing up crucial data to both a local machine and the cloud and ensuring at least one of the backups is *not* connected to the network source it is backing up.
b. Updates and patches are run regularly on all devices such as firewalls, switches, PCs, IOT, etc. We say this all the time but so many facilities do not do it.
c. An ongoing awareness and training program for all existing and new employees across all departments. Many attacks arrive via a simple email. Educate everyone about what to look for.
d. Anti-virus and anti-malware software installed on every machine — sounds like Security 101, right? I find machines all the time that are not running both and/or not updated recently with the latest security databases.
e. Implemented security restrictions and locked all outside access except where needed. Don't laugh. I find VPN and Remote Desktop active on machines often, and no one remembers who they were for or what the original purpose was.
f. Block all known malicious IP addresses and keep that list constantly updated.
g. Keep track of every employee or contractor to whom you gave outside access. Make sure you have a list of their names, systems given access to, and method (VPN, TeamViewer, VNC, public IP, etc.)

This is just a sample listing of key things a security-aware organization should be doing. There are many more. IT trained professionals in cyber-security know what to do. There are also many excellent sites online with guidelines that dig deeper than we can here.

#2. Along with #1 above, when was the last time you had a serious sit-down with your IT team, administrator or outside contractor to

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WORKBENCH

(continued from page 12)

described in the March 4 issue. He writes, "Super-duper! Much more functionality than MS Paint, and — best of all — it's free! Thanks!"

Thanks, James, for letting readers know. Dan Slentz, who told us about the free image and photo editing software for PCs, likes the innovative and intuitive user interface, which includes special effects. Glad the column could help.

In a previous Workbench column, I referred to transmission line "hot spots" detected by infrared camera inspection. Many of these hot spots occur at rigid line junctions, or 90-degree elbows where a bullet is overheating and ready to fail.

I received a message from an engineer wanting to know more about this — specifically, what is a "bullet"?

For those who need an explanation, simply put, a bullet joins the two center conductors of transmission line together (see Fig. 4 to get a better idea). Because of its cylindrical shape, it looks like a big piece of ammunition, hence its name.

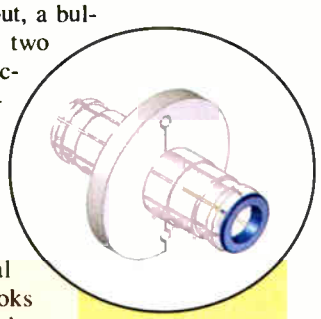

Fig. 4: Myat's 3 1/8 bullet. The blue ring shown on one end of the bullet is Myat's anti-split device.

Each end of a bullet fits inside the corresponding center or "inner" piece of transmission line. Improper bullet installation, wide temperature swings or movement of the line over time can cause the bullet to weaken and not make a good tight connection. The result is heat buildup and eventual failure.

Keep in mind, there's usually a lot of power passing through this center conductor. The whole point of periodically measuring the temperature of these junctions is to spot a potential failure before catastrophic damage occurs.

John Bisset has spent over 50 years in the broadcasting industry and is still learning. He handles western U.S. radio sales for the Telos Alliance. He holds CPBE certification with the Society of Broadcast Engineers and is a past recipient of the SBE's Educator of the Year Award.

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CYBER

(continued from page 14)

discuss cybersecurity? How often do you meet? In that meeting, did you know what specific questions to ask? If not, it is time to put together a list of questions. This article can help you get started.

Given the current COVID-19 situation and the fact that you've made changes internally to allow for remote access, now is the time for a video conference with the team to inform and discuss any weaknesses. As a team, you can decide what loopholes should be closed now — prioritize any risks should they exist.

#3. Have you considered hiring a third-party outside security consultant to help with assessing your internal and external systems for their penetrability? Have you asked a trusted security expert to attempt to penetrate your network and systems to ensure you are defended properly?

I know several broadcast-related companies that send phishing emails with fake viruses and ransomware to employees to test their cyber training; see 1(c) above. If the employee clicks on the suspicious attachment, they are provided further training on how to spot these things. The email gateway still ranks as one of the top arrival vectors for attack, so it is critical that everyone have some training on how to spot that one email which can cause you untold hardships.

#4. Is your network segregated to minimize the damage if something should get through? I often find that networks within the station are combined, on purpose or by mistake. I've been in several facilities where they claim their networks are segregated, yet we find that's not the case.

For example, a PC with a double-NIC (two network cards for separate networks) can be compromised and certain viruses can jump from one network to the other. So the machine that handles traffic but must connect to the automation system — and it is using two network cards — might not be as safe as you thought. Or that one PC that has Remote Desktop on it so someone can get into the network but only though that one "external" machine … well, it may not be the "firewall" you think it is.

There are ways to handle remote access properly and securely. Your trained IT staff or outside security contractor can help you with this.

During the COVID-19 crisis many stations have found themselves needing remote access to their automation playout systems. Normally, as a cyber best practice, these machines are locked down and disconnected from the public internet. If remote capability existed, it was usually through very secure login and VPN methods. I've seen many stations in the past month or so that did not have remote access set up allowing their client and server playout machines to be connected to the outside internet. This was done in a hurry and under emergency conditions; some buildings were cleared out almost overnight. If you are one of these facilities, follow #2 above. Make sure management is aware of these temporary weaknesses and address a plan to close the gaps looking forward. You may need this capability in the future, but now you'll have time to prepare better with more secure access procedures.

#5. Backup, backup, backup. I mentioned this, but it is so important to preventing disaster that it deserves its own reference. It is imperative that you regularly backup all critical files, and do so to locations that cannot be reached by the virus. There are several cases where ransomware found its way to a network backup and encrypted the very files that were supposed to protect the operation!

Do you backup every 24 hours? Do you maintain backups offsite? (That's not only a good idea for protection against the virus but also for events such as fire, hurricanes, other things that could keep you from accessing the studio or transmitter location). With backups you can reinstall critical software and data and potentially alleviate the need to pay a ransom. Or it may simply be less costly in time and resources to restore a machine using a recent backup then using a decryption tool. Therefore, very regular backups are crucial.

If for example, you need to restore your music and spot commercial database and audio files quickly, you'll want that backup to be very recent. Otherwise, you may lose the past several days or weeks of new material — and this could cost the station financially.

I often come across TOCs that supposedly are making backups but are not. The backup tape machine hasn't worked in who knows how long, the NAS drive is full, the software that runs the backups hasn't been running for weeks or months, or perhaps the directories selected for backup are not correct.

The takeaway here is that you should ask yourself or your IT administrator for proof that backups are being run, and run often, on a regular recurring basis.

During the COVID-19 crisis I've seen many stations that did not have remote access already in place allowing client and server playout machines to be connected to the outside internet. This was done in a hurry and under emergency conditions.

#6. If you are attacked, do you have the tools in place to quickly detect and determine its origination point within your facility? Do you have the tools (and instructions to staff) in place to isolate the virus or ransomware quickly? Do you use a security event manager? What is your "first 15 minutes" plan?

As mentioned, network segregation is critical in situations where you become infected. If the business network is infected, for example, do you have a way to prevent this attack from spreading to other business networks in your building or within the company (for larger networks or group operators)? Do you have different offices tied together using a WAN/MPLS or other means that might allow the virus to hop over and then start spreading again in an entirely different location?

If you believe a virus is crawling through your network, do you have a plan in place to stop it immediately from moving further along to the next server or PC? Do you know how to kill your network shares immediately? Do you have a plan to yank users and machines from the network in seconds?

What if an attack happens at 3 a.m. on Sunday morning? Do you have the technology or people in place to alert the proper team leaders? And do you have a response go-team on call including holidays?

This is not make-believe or a far-out fantasy. These attacks are happening regularly to small and large operators, and of course, in all industries.

#7. If your data becomes encrypted, do you have a plan of action filed away so you know what to do? Have you thought about whether you would pay a ransom if presented with such a demand?

There are different schools of thought on whether to pay. Many have paid, and many have not. It is reported by Symantec that only 47% of those who pay the ransom to the bad guys get their data back. It is also claimed by several reputable security firms that if you do pay this time there is a chance you will be hit again because the data kidnappers know you will give in. (Of course, we all know you will be fully protected after the first successful ransom, right?).

Let's say you don't pay; better have your recent backups ready to go. Do you have a backup system that provides for restoral easily and quickly? Do you have a go-team put together who will be ready to restore systems and a chain of command to direct team members on what to do and when? (See #6).

If you decide to pay, most ransoms are paid with bitcoin; do you know how to purchase bitcoin? Do you know from where? It can take a few days to obtain bitcoin, depending on how you buy it. Major cities have bitcoin-capable ATMs that can speed this up. The average ransom ranges from a few thousand to much higher. Do you have a source for that kind of money in a hurry should you need it?

Now is the time to think about these things and have a plan written down. If you don't, you may be scrambling at the last minute while your critical systems are down. That kind of delay can cost you money because your operations are down. If you work with an outside security expert or have such staff internally, and you are not sure what your plans are should you get attacked, ask for one. Do not be unprepared.

On a positive note: Did you know that some ransomware attacks use a software variant that has a free cure? There are free decryption tools out there that might work in your case. Something to check first.

#8. Some ransomware attacks are widespread. We've all heard about them. You'll see them on TV and on most credible news and IT websites quickly. In some cases, these large-scale attacks are shut down and decrypted within 24 to 48 hours by law enforce-

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World Radio History

Hodges' Famous Call Is Part of Registry

Library of Congress adds the latest 25 great or important recordings to its tally

BY SUSAN ASHWORTH

The National Audio-Visual Conservation Center is at the Packard Center of the Library of Congress in Culpeper, Va.

For the millions who are stuck at home, the National Recording Registry has a few new suggestions on how to inspire nostalgia or arouse baseball fervor — and much of it came to you through your radio.

The U.S. Library of Congress recently named 25 more recordings as aural treasures worthy of preservation because of their cultural, historical and aesthetic importance to the nation's recorded sound heritage.

What makes that list? Radio fans well know the thrilling play-by-play of the 1951 National League tiebreaker between the New York Giants and the Brooklyn Dodgers. But there's also the opening melody from "Mister Rogers' Neighborhood," and even the Village People's international dance anthem "Y.M.C.A." They are among the recordings newly inducted.

"The National Recording Registry is the evolving playlist of the American soundscape. It reflects moments in history captured through the voices and sounds of the time," said Librarian of Congress Carla Hayden in the announcement. The library received more than 800 nominations this year.

Under the terms of the National Recording Preservation Act of 2000, the librarian, with advice from the Library's National Recording Preservation Board, is tasked with selecting 25 titles that are for culturally, historically or aesthetically significant and are at least 10 years old. The new recordings bring the number of titles on the registry to 550, still a small part of the Library's vast recorded-sound collection of nearly 3 million items.

Of the different genres and formats, listeners can find old radio sportscasts, classical recordings, jazz music and songs so knowable that it only takes a few notes to decipher its origin, as in "Y.M.C.A."

The new group of recordings also includes the vibrant 2008 "Percussion Concerto" album and Dr. Dre's debut studio album "The Chronic" (1992). Other selections include the 1920 jazz swing "Whispering" by Paul Whiteman and his Orchestra; Puccini's "Tosca," performed by Maria Callas; and the first commercial digital recording of symphonic music in the United States by the Cleveland Symphonic Winds. Several recordings on the list were made by some of America's female changemakers, including Memphis Minnie, one of the most popular female country blues singers of all time and her single "Me and My Chauffeur Blues," which was recorded in 1941.

Also on the list are comedy radio classics. Allan Sherman's comedy classic from 1963, "Hello Muddah, Hello Fadduh" made the registry this year, a fact that would have astonished its author, said Sherman's son, Robert Sherman. "It's still something that people care, sing about. It would have amazed my father, 50-plus years since he wrote it." Other 60s classics include the original version of "Wichita Lineman," written by Jimmy Webb and recorded by country music singer Glen Campbell in 1968.

Recordings of radio broadcasts include an episode of "Arch Oboler's Plays," one of the earliest American old-time horror radio program, and the announcement of the assassination of President John F. Kennedy made by the Boston Symphony Orchestra conductor during the recording of a live performance on Nov. 22, 1963.

And lest we forget the appeal of our nation's pastime, the Library of Congress selected Russ Hodges' call of the 1951 National League tiebreaker between the New York Giants and Brooklyn Dodgers.

In that game, the Giants were down two runs in the bottom of the ninth inning of the final game of the three-game playoff. Ralph Branca was pitching for the Dodgers, Bobby Thomson came to bat, and Willie Mays was on deck.

"Ralph was a good, good pitcher. Didn't have a real good curve but a good fastball," the legendary Mays said to the Library of Congress. "And he placed it a lot, so I thought they would do the same thing with Bobby. Walk him and pitch to me because they knew that was my first year."

They didn't. Instead, Thomson hit a walk-off home run — the "Shot Heard 'Round the World" — and gave the Giants one of the most dramatic victories in baseball history.

Registry titles are preserved at the Library of Congress Packard Campus for Audio Visual Conservation, a facility with 7 million collection items where the library acquires, preserves and provides access to the world's largest collection of films, television programs, radio broadcasts and sound recordings.

The complete National Recording Registry list can be found at https://tinyurl.com/rw-registry. *You can srt recordings by title, artist, year of release, year inducted into the Registry, and genre; and the list can be downloaded in PDF form alphabetically, by genre or by induction year.*

CYBER

(continued from page 16)

ment or white hat hackers. If you are affected by one of these large-scale attacks, check with your security provider, consultant, vendor or IT staff to see if there is a fix before paying any ransom.

#9. If you are in the United States, contact the nearest field office of the FBI or Secret Service and report your ransomware event and request assistance. They may be able to help you. If you are in Europe, go to the Europol website and it will direct you to the local agency in your country. If in Australia, report your event to the Australian Cyber Security Centre. Most countries have a governmental agency that wants to hear from you.

#10. Ask for help. I say this often. Do not be afraid to ask for help. Whether you are a managing director or engineer and IT director, it is OK to ask for resources to assist you with cyber-security. You have friends who know things. You have vendors who know things and who have internal resources to assist you with this. There are local IT firms with experts. Consultants. Lots of free advice on the internet. The United States and many other governments provide free information on ransomware, viruses and other forms of malware.

Now, more than ever, we are all coming together to help one another. I've seen hundreds of posts online (on the various broadcast-related social platforms) from broadcast engineers, offering advice and asking questions on every imaginable topic related to COVID-19. If you need help with setting up a SIP connection to a mobile phone, there are plenty of people who will help you. Do you need help with remote access to a specific playout system? Just reach out to your vendor or another engineer. Some vendors are offering free versions/use of their remote packages. Every manufacturer and engineer are working together to help one another. I've said this before: This is what we do every day; we help stations stay on the air. Even from home!

I walk into too many facilities that are not prepared defensively and that starts at the top. Go back to #1 above. Make sure you have a security-aware culture. Many stations have had to make tough decisions recently on what rules to relax and where the cost/benefit/risk balance lies. This is a decision that is unique to every facility. We are all having to do things differently now than before. Make sure you've kept track of what you've done so you can go back and close the loopholes. Prepare a list of necessary hardware/software that you can present for approval for things you may need to do this again but with additional security (if needed).

Gary Kline is a broadcast consultant who has held technical positions with several major broadcast organizations, most notably as senior VP of engineering at Cumulus Media. He has provided engineering support and consulting in the United States, Canada, China and several South American countries. He is a past recipient of the Radio World Excellence in Engineering Award.

World Radio History

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World Radio History

A Quality Audio Crisis in the Music Industry

Decapitating your audio can't be good for an industry highly dependent on sound quality

AUDIO FOR RADIO

BY DAN SLENTZ

You may have noticed that a lot of new audio coming from record companies and music services sounds heavily compressed, distorted or clipped. When you look at these audio files as a waveform, you can see the clipping, especially when comparing it to music from just 10 years ago, whether from the record company or a service like TM Century.

This article is about the quality of audio radio stations are receiving from music providers today.

To put this together, I spoke with numerous people in our industry, including three experts at well-known audio processing companies mentioned below, to get their take on what's happening and how we can provide great audio to listeners.

What I found is that there is no single answer. But these experts agreed that it's a problem and that quality is an issue.

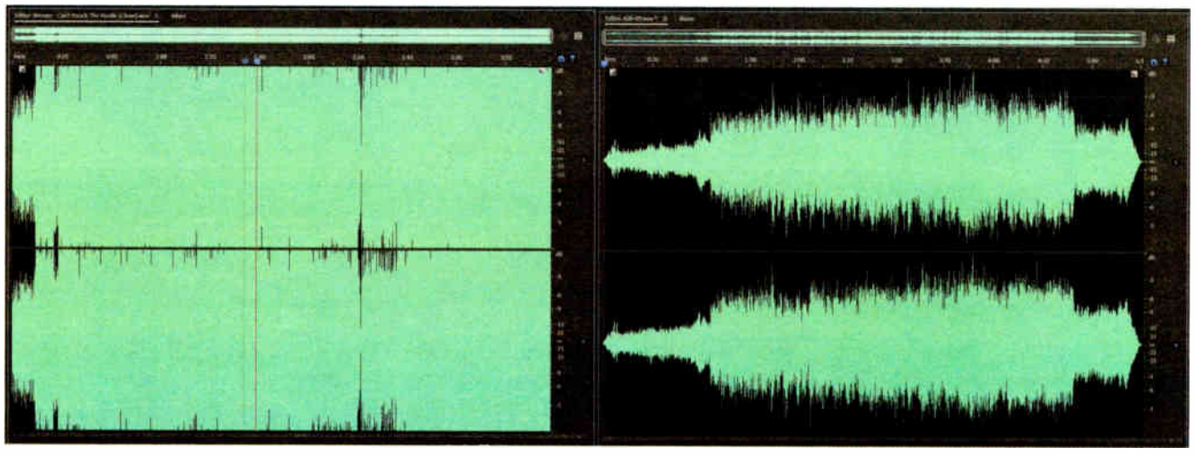

Fig. 1: Weezer "Can't Stop the Hussle" vs. U2 "Where the Streets Have No Name"

Highly processed audio files seem to be the norm. This forces us to ask fresh questions about all of our content.

Everyone has their own take on how to process audio that is (to put it plainly) either recorded too hot and clipped or processed out the wazoo to begin with.

Part of the problem with dealing with audio is not simply the fact that it's frequently hot and clipped, but we are intermixing great audio with full dynamics (from older content) to our own studio material along with newer, highly processed content.

Where do you start and how do you set your processing when your source material is so inconsistent? If you process for new content, your old stuff could sound lifeless. If you process for old content, your new material may have no dynamic range (or feel processed out that wazoo).

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CHALLENGES

If we start at the beginning, we know that getting music for radio stations can be a challenge, unless you're a major-market station with record companies still interested in getting that airplay.

Smaller stations may have to be creative in finding music including subscription services. This isn't to say that music isn't available all over the web, and there are some "non-paying" ways to acquire music (*not* recommended) from posted videos and download sites.

These are not necessarily legal ways to find music; they also may be compressed or have had multiple types of compression reducing the quality to that of a "personal MP3 player" … or even worse.

In the past, there were some great music providers that are no longer in the game (like the old TM Century), and record companies provided music with great dynamics and counted on the radio station to really do their processing on the playback end. Today, there are DJ music service and paid content download sites, but I believe most of us find these files highly processed or even clipped (see examples).

As a bit of an audiophile, I pay attention to quality. I truly want to see dynamic range and peaks that more resemble analog audio than a file with a minimal amount of dynamics and an apparent "flat lining" or clipping of the peaks.

For one thing, I always recommend staying true to "CD quality" with WAV-only files that come from CDs or uncompressed as original WAVs and never converting an MP3 to a WAV. As in life, you will not get something for nothing by turning an MP3 into a WAV. It's still MP3-quality with just a different suffix to it.

In radio, we process (some more than others) for a multitude of reasons. First, since radio is often listened to while driving we want to overcome the background sounds or "road noise" by bringing up quiet passages without completely destroying the song's dynamics. We also want our music to have "more punch" than other stations or other sources available to the listener.

Basically, many of us want bigger, brighter, louder and more punch. Considering FM's own high-frequency limitation of 15 kHz, we have a slight disadvantage to the quality of a stream, but the advantage of something a little more "pure" or "real" in the fact that it's not being "squashed" for streaming (plus the lesser chance of any "digital weirdness").

We really could go back and forth on advantages (radio goes anywhere) and disadvantages (e.g., multipath) of radio, but paying attention to the quality of our files is a great starting point. It's simply because we can never get any better than the quality of the original file.

COMPARISONS

Recently I've begun comparing audio files from TM Century's old Gold Disc files versus a current music service. I'm shocked at what I found.

Let's compare a few WAVs to show what I'm talking about. To do this, I've used Adobe's Audition to open both files. No changes were made to any setting, and the screenshot is taken from unaltered editing images. All of these files are native WAV files, no conversion, no normalizing, nothing changed for what you'll see.

First, a new song by Weezer called "Can't Knock the Hustle," followed by U2 and "Where the Streets Have No Name." See Fig. 1.

You can see the difference, but what are we seeing? There appears to be so much processing on Weezer that there is very little left of the dynamics of the music. In other words, everything is loud! And what happens when we process it? The smallest amount of dynamics that were left are completely eliminated.

What does this translate to? Most program directors and consultants would likely say it will be loud on the radio but it will possibly be distorted or clipped, and that feeding this to a listener will likely result in "listener fatigue." Simply put, our ears need those dynamics because they aid in providing an ear break.

(continued on page 22)

World Radio History

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World Radio History

AUDIO

(continued from page 20)

MORE SONGS

This is Panic at the Disco and Def Leppard (a generally "loud" group). Again, a very noticeable difference in processing and dynamics. See Fig. 2.

Switching gears, another newer song (from 2016) was DNCE's "Cake By the Ocean" and The Romantics' "Talking in Your Sleep." Again, heavily processed but with a little more dynamics versus what appears to me a more heavily processed older song. See Fig. 3.

What is our takeaway from all this? Though this is just three examples, I'm finding new music generally follows these two examples. What I'm seeing is very little in terms of dynamics, some aggressive processing (which includes clipping) and a much different sound.

I spoke with a producer at the company that distributed the first two newer examples and specifically asked if they are doing processing; his response was that they are doing nothing to the audio files and these are coming from the music companies this way.

This leaves us in a bit of a quandary. For a new music-based station (playing lots of current pieces but with older material as well), we might find that to "keep the playing field level," we may need to preprocess the old song files prior to air (something I generally never do other than trim the front and back when needed), increase our mic processing and reduce our own overall main processing.

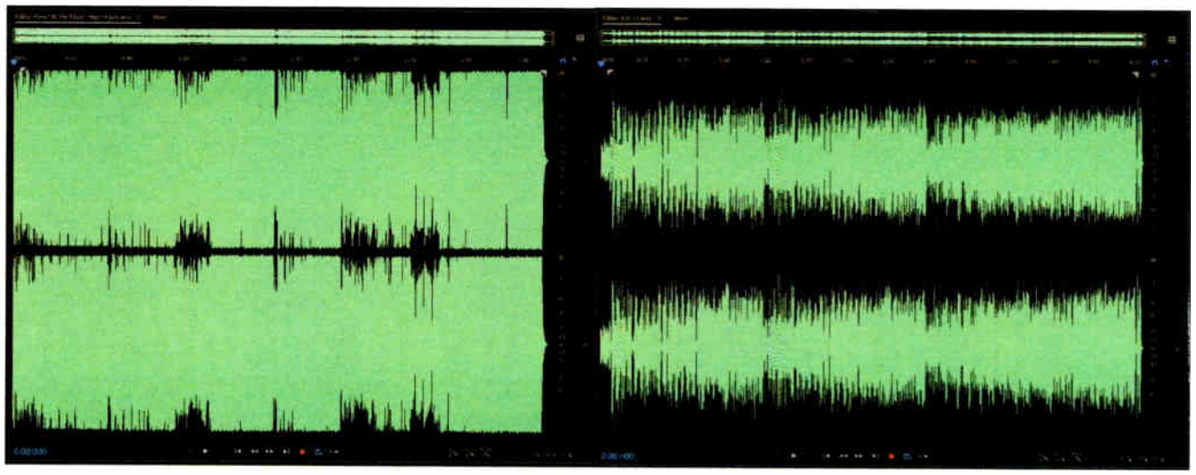

Fig. 2: Panic at the Disco "High Hopes" vs. Def Leppard "Pour Some Sugar On Me"

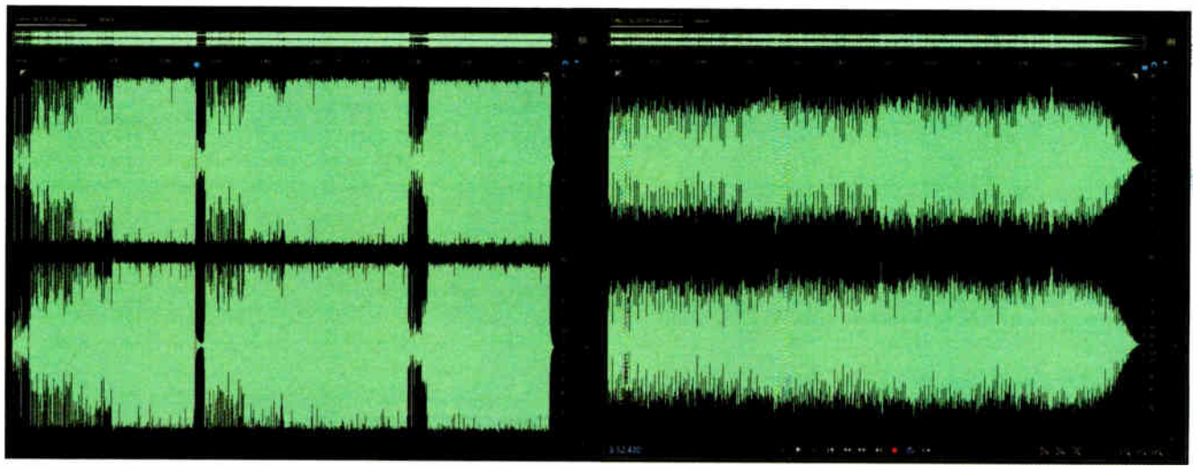

Fig. 3: DNCE "Cake By the Ocean" vs. The Romantics "Talking in Your Sleep"

This also should make us aware of the potential impact on our listeners and their own "ear fatigue" with the content we air. If we are seeing shorter listening time and playing newer music, we might ask if the younger audience has a shorter attention span, or if we're simply killing their ears with overprocessed material.

I spoke with three well-known radio audio processing gurus — Bob Orban of Orban Audio, Frank Foti of Omnia/Telos and Jeff Keith at Wheatstone. I heard a consistent theme: Audio is coming in much louder than it ever did. Ironically, this negatively affects the louder portions of the audio. The dynamic range is eliminated.

An additional lesson is that it's a good idea to bring the overall audio levels of the new content down (the amount varies according to who you ask).

That is something we all know they would do, and that we can appreciate. I'd certainly like to tell you which one is right and which solution is best, but that would be like me telling you which color is best. A lot of this is subjective, and much of it can also be proven by test gear. But the results of the test gear also can be open to interpretation. So when it comes to the available products by our audio processing companies (any of them), a lot will be left up to the individual and also how that processor sounds in their own air chain.

EXPLORING

Consider exploring your audio files and weighing your processing vs. the content and the variation between the audio files. Be sure that all audio files you air are consistent in level. This, at least, is an excellent starting point. Depending on whom you ask, –2 dB down or even more may be the point where you want all your audio files to reside. Ultimately, the determination of whether you preprocess audio files prior to your on-air (or streaming) audio processor is a call you will need to make.

By using audio editing software, it's possible to dig into the waves to really see what's happening. Using Adobe Audition, I first look at the properties of the file and scan it under "Diagnostics." There are presets under "DeClipper," but I found one that allows for some peak restoration. I start with reducing the file by –2 dB prior to running the Diagnostic DeClipper. After it indi-

(continued on page 24)

MARKETPLACE

Mini Mic: Røde's NT-USB Mini is a compact USB microphone for recording to a computer or tablet; the new offering is intended for podcasters, musicians, streamers, gamers and others.

Built around a condenser capsule with RF shielding, the NT-USB Mini — which is 89 mm wide and 141 mm high — sports a directional cardioid pickup pattern to reduce room sound and other extraneous noise.

A built-in pop filter aids reducing plosives and the mic also comes with a magnetic desk stand that attaches to an integrated 360-degree swing mount within the mic.

Besides the NT-USB Mini's USB output, it also has an internal headphone amplifier with precision level control and switchable zero-latency monitoring via a 3.5 mm-1/8-inch headphone output, all encased in steel and reinforced nylon resin construction, finished in matte black.

It ships with a USB cable.

Info: www.rode.com

World Radio History

Congratulations, Jeff!

Radio World and our partners salute Jeff Welton, the recipient of the 2020 NAB Radio Engineering Achievement Award.

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Congratulations on your fantastic achievement and this fitting honor. Your friends at Dielectric.

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Congratulations, Jeff, for your many years of service to the broadcast industry. Great job and well deserved!

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Congratulations to Jeff Welton and thank you for the tireless dedication from your friends at RF Specialties.

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RADIO WORLD

World Radio History

AUDIO

(continued from page 22)

cates errors (newer audio files can have hundreds, while material like that from the old TMC Gold Discs usually have none), I run Repair. At that point, I go with a percentage and "normalize" the audio to –1 dB down. This reduces everything equally so only the peaks hit –1 dB. By doing this, I know my processor (both on-air and streaming) will be seeing consistent levels. See Fig. 4.

A file may start out looking like this example. The following is a song "as delivered" by the music provider. You can see how extreme the level is. The song is "Blinding Lights" by The Weeknd. See Fig. 5.

The same song reduced by –2 dB (Fig. 6).

Then the song is analyzed to find what Audition recognizes as clipped areas. Audition noted 333 errors (Fig. 7).

And finally, a –1 dB reduction overall and "the fix" is applied. This is how the resulting file looks (Fig. 8).

It's better than what it was, and audibly has a cleaner, "less crunched" feel to it.

Unfortunately, these highly processed audio files (intended for broadcast) seem to be the norm. This forces us to really consider all of our audio content and how to process it. It also requires us to think about our own recordings including commercial and PSA production audio files.

How does recently produced material stack up compared to old music audio files? What about in comparison to currently produced music? How we preprocess the audio we pass off to our audio processors needs to have consistency.

The manufacturers of our processing gear recognize what we are dealing with and they're using their own magic to help us maintain great audio for our listeners as well. Just keep in mind that they all have slightly to greatly different ways of doing this, so your ears (and those of possibly the music director, program director, operations manager, general manager, et al) may want to weigh in on this.

And don't forget that webstream audio will very likely differ from the air audio, so be aware that all your audio should be considered when it comes to processing and preprocessing.

Dan Slentz has been chief engineer at radio stations from Athens to Zanesville (Ohio), and Dallas to Denver. He is also an Air Force vet who worked with Armed Forces Radio & TV from 1986–90 in Spain.

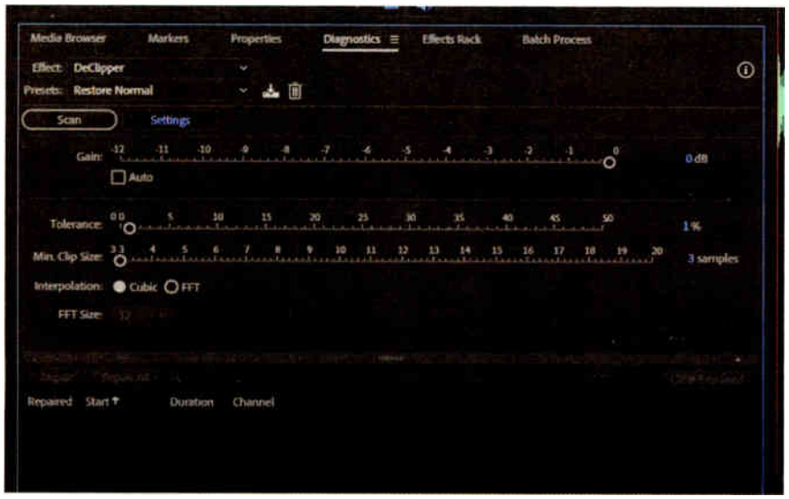


Fig. 4: The DeClipper control panel shows 1% tolerance.

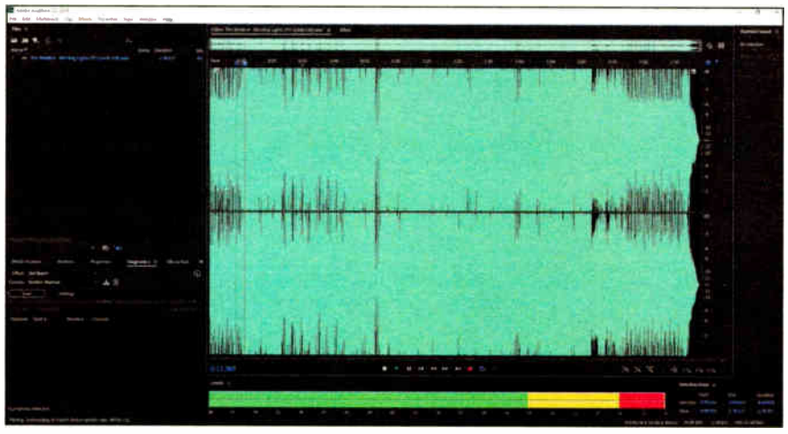


Fig. 5: The Weeknd's "Blinding Lights" as originally delivered, note lack of peaks leading to poor dynamic range.

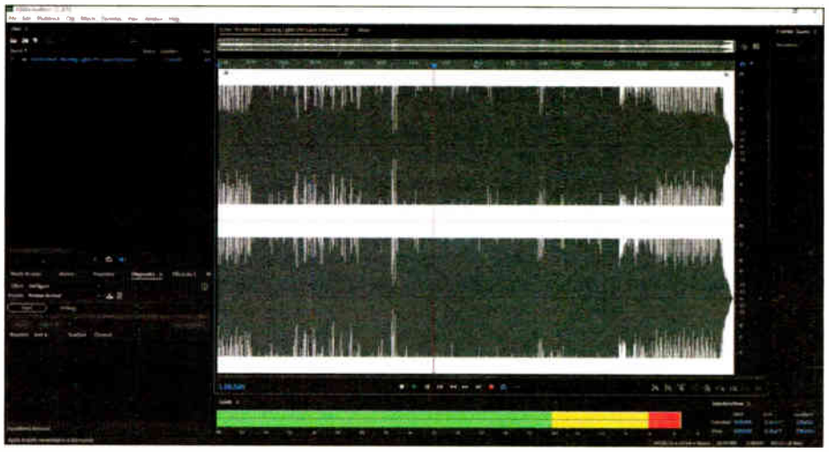


Fig. 6: The Weeknd's "Blinding Lights" reduced by –2 dB, note open headroom and available bottom.

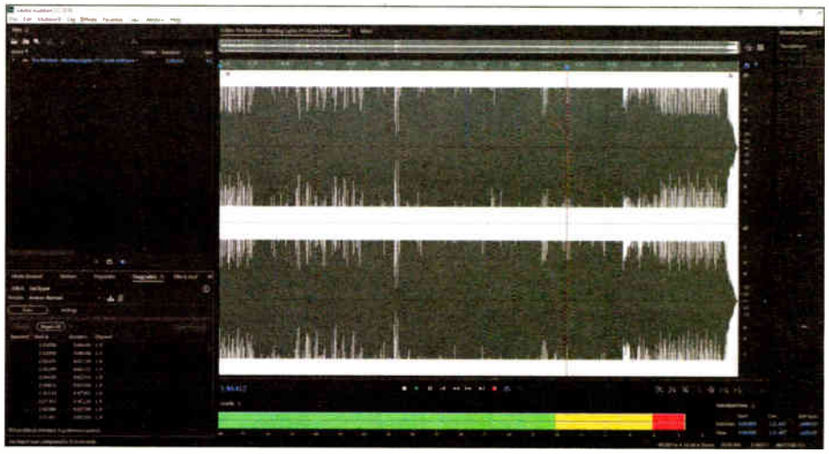


Fig. 7: Lower left pane shows errors detected in The Weeknd's "Blinding Lights."

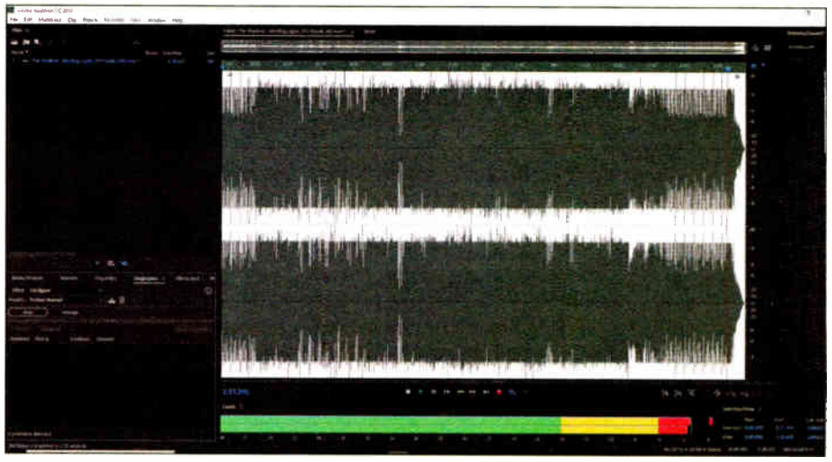


Fig. 8: The DeClipper add adds back in some of clipped peaks.

Write to RW

Email **radioworld@futurenet.com** with "Letter to the Editor" in the subject field. Please include issue date and story headline.

World Radio History

MARKETPLACE

Open Face: Steinberg has introduced its new UR24C, the latest model in its line of UR-C USB 3.0 interfaces.

The interface itself sports two balanced Neutrik combo inputs, D-PRE microphone preamps, two TRS main outputs, four RCA line outputs, MIDI in and out, and USB Type-C (USB 3.1 Gen 1 SuperSpeed) connectivity, making it compatible with PCs, Macs and iOS devices. It features 32-bit/192 kHz audio resolution, MIDI and numerous DSP effects that can reportedly be used when monitoring audio without latency.

Onboard DSP effects, e.g. REV-X reverb, Channel Strip and Guitar Amp Classics, are accessed by the unit's dspMixFx mixer. Those looking for more effects can pore through the software bundle that comes with the UR24C; the bundle includes Cubase AI music production software; Basic FX Suite, consisting of effects and sound processing tools; native versions of the DSP effects (both VST 3 and AU compatible); and the Cubasis LE music production app for the iPad.

Info: www.steinberg.net

Server Sees: With a mission to make codec herding easier, Tieline has released the TieLink Traversal Server. According to Tieline, it is "designed to facilitate simple codec discovery, NAT traversal, and connections throughout an entire codec network."

A recent firmware upgrade for ViA, Genie and Merlin codecs provides their compatibility to the server.

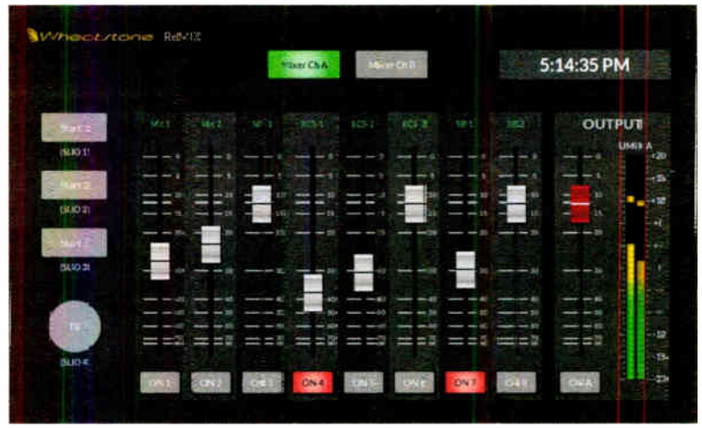
Tieline VP Sales APAC/EMEA Charlie Gawley explained, "TieLink is particularly useful to networks with many IP codecs, because the 'address book' approach to grouping codecs greatly simplifies dialing for non-technical users."

According to Tieline, the TieLink Traversal Server is a secure, independently hosted global server network, with multiple global backups. It centralizes the Tieline codec contact list management and provides self-discovery of codecs within customized call-groups.

It adds that users can view the online or offline status of all codecs in a group and whether it is connected or disconnected."

TieLink Traversal Server is compatible with Tieline's Cloud Codec Controller software.

Info: https://tieline.com



Remote Mixer: Working remotely has inspired Wheatstone to release ReMix, a remote mixing application.

ReMix is a Windows PC or tablet app that can access a WheatNet-IP audio network from afar.

According to Wheatstone, ReMix provides an affordable, quick alternative to a physical home studio for remote broadcasting and voicetracking by remotely accessing existing equipment at the station, such as codecs, hybrids, and playout systems.

Wheatstone Director of Sales Jay Tyler said, "ReMix is proving to be a great little application for all our broadcasters who need to get talent up and operating from home quickly and securely."

The application can be installed on a Windows desktop, laptop or tablet in a home or remote studio or on a station PC that can be accessed by talent remotely through a secure VPN.

ReMix provides a direct user interface to the utility mixers found in the I/O blades that make up the WheatNet-IP audio network. Each I/O blade includes two built-in 8 x 2 stereo mixers, the inputs and output busses of which are available as resources on the network. The WheatNet-IP utility mixers are accessible anywhere in the audio network for simple functions such as summing, splitting, and level adjustment, performing crossfades and segues between sources, as well as creating custom mixes or intercom systems.

Info: www.wheatstone.com

PRODUCTS & SERVICES SHOWCASE

World Radio History

KCVM Is Part of Life in Cedar Valley

Coloff Media station is chosen for the NAB Crystal Heritage Award for service

PUBLIC SERVICE

BY KEN DEUTSCH

A station can only be honored with the NAB Crystal Heritage Award after receiving five Crystal Radio Awards for outstanding community service. KCVM(FM) in small-market Cedar Falls, Iowa, is the latest station so honored.

How small is Cedar Falls? If one combines it with the population of the larger nearby city of Waterloo it is still only Nielsen Audio market 237. Yet, Jim Coloff, owner and general manager of KCVM, is able to run that station and three others in his cluster, make a profit and still devote hundreds of hours each year to public service for his communities.

"Yeah, I love small markets," he said. "I wouldn't say it's more difficult than operating in a large market, but we all do have to wear more hats.

"We have smaller staffs, we don't have big budgets, but we sure have a diverse workday because we all do a little of everything. I will say we have fewer employee-type headaches so in that sense it may be easier! But if we're doing the right job, we might be the only game in town, the only local media voice and the only local access these communities have."

MAGICAL MIX KIDS

Coloff came by radio and public service naturally; his parents Tony and Sue Coloff started a station in 1978 in Forest City, Iowa. Jim joined the company in 1991 and partnered with his parents until purchasing the Coloff Media Group in 2017.

"My parents, mostly retired at this point, used to work as volunteers for various causes when I was growing up. I was raised with the belief that you support the community that supports your business. So I immediately got involved and now I require the same of my staffs, here in Cedar Falls and in the other markets where we own stations."

Coloff Media owns stations in other Iowa mini-markets including Britt, Charles City, Forest City, Manchester, Mason City and New Hampton. The group now includes 12 stations, all of which follow the "give back" directive from the Coloffs.

KCVM took its desire to help the community a step further 20 years ago when it began its own charity, Magical Mix Kids, a 501(c)(3) organization.

"Magical Mix Kids, named after the station's designation as '93.5 the Mix,' is similar to the national Make-A-Wish, but the difference is that our kids are not necessarily terminally ill," said Coloff.

"Most of our kids are suffering from chronic and life-shortening conditions as well as terminal conditions. We feel the psychological and financial stress that is put on these families makes them deserving of a respite from their troubles. What better place to send them than Walt Disney World?

"This is the biggest activity we're involved in, and every year we send these kids and their families, about 80 or 90 people in all, on that trip. It takes the entire year to raise the nearly $100,000 it takes to accomplish that."

Jim Coloff, right, accepts a donation from Diya Pradeep of Cedar Falls, who for her 10th birthday asked friends to donate to the charity instead of giving her a gift. She raised $1,000.

Fun at a Magical Mix Kids event.

SMART HIRING

Getting good personnel is a challenge in any market, and in a small town there's always the danger that the best people will want to go elsewhere to make more money. Add to that Coloff Media's special criteria for all employees.

"We've had some people who moved on to larger markets, but we scout like everyone else at the college level and we go to the recruitment fairs," said Coloff.

"We check out the workforce development sites and work fairs, but I tell you, it's not so much where we look but the kind of people we're looking for that matters. We want people who need to make a difference in their community," he continued.

"Of course they have to have talent, but we would take someone with less training and experience but who is willing to learn. And most of all they have to have already been involved their

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community. Some of our people have been with us 15, 20, 25 years, and it's because they are talented enough but they decided that this community is where they want to raise their families."

Kim Manning is manager of the Cedar Falls Tourism and Visitors Bureau and a frequent collaborator on promotions with KCVM.

"All we have to do is pick up the phone and call the station, and anyone there will be willing to help us, not just Jim," she said.

"He has instilled this attitude across his entire staff; and if an event will benefit the community, they are always on board. For example, we all worked together on Pedal Fest, which is a cycling event we started five years ago. It's free and this year it'll be every weekend in September. Jim Coloff attends just about every auction in town, and he's active in Rotary Club and other service organizations. He's always there for anyone who needs him."

The KCVM calendar can be found on the station's site *www.935themix.com*, and in normal non-pandemic times is full of events like blood drives, Kiwanis meetings, fundraisers and pancake breakfasts.

Bob Westerman conducts interviews during a broadcast from the site of a flag mural on a local Amvets post in Cedar Falls.

School fundraiser organizers are interviewed on 93.5 The Mix.

Radio stations must still pay the bills and meet payroll. Here is what Coloff says about radio's viability and how it is tied to his goals for the community.

"I can't speak for every market in the country or every radio station, but I think if radio is done right, and if the stations are involved in their communities, and make that goal part of the culture of the radio station, radio can be a huge part of its listeners' lives.

"Our stations provide a locally connected community delivered via live and local audio, available on every distribution channel including terrestrial radio, mobile/PC stream, enabled devices and even video. I think a radio station can be a driving force in a community's success in a lot of ways, but you have to be committed to spending time and resources on becoming involved and doing hyper-local programming."

Ken Deutsch is a former disc jockey and former TV director who also ran a jingle studio for 24 years. In fact, he says he's now a former almost everything.

Volunteering at a food event to help the needy are station staff, from left, Janelle Rench, Mark Simpson, Lori Payne.

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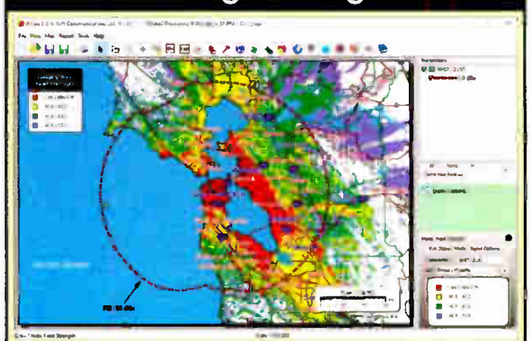

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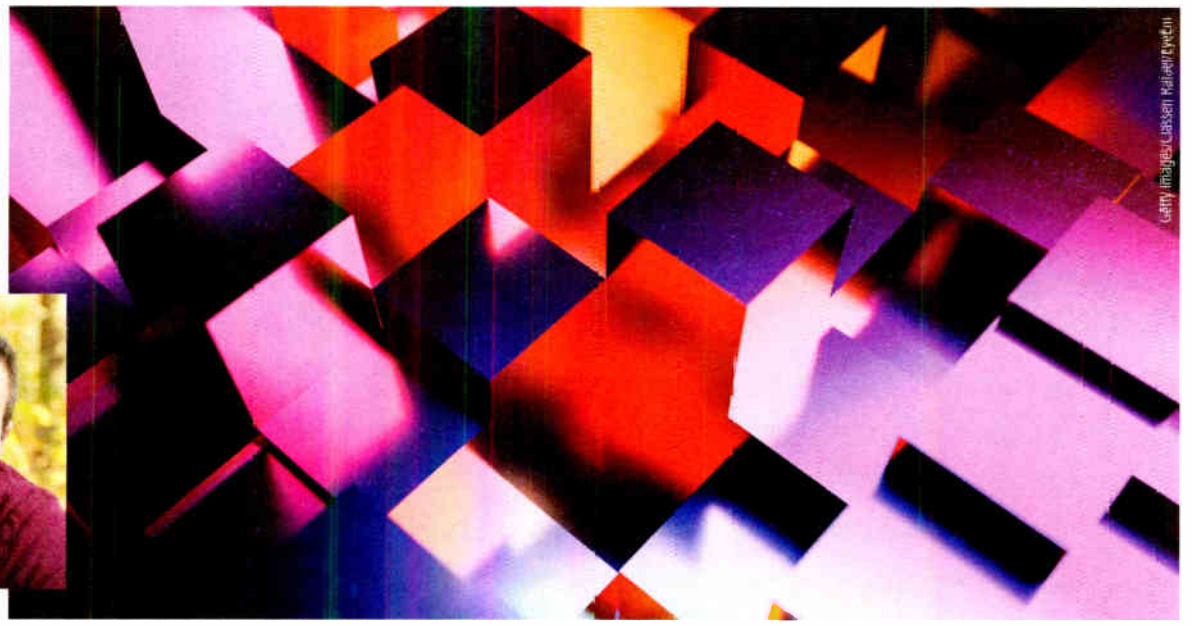
Containerization as an Alternative to Virtualization

Having several containers running separate services can help with security protection and flexibility

RADIO IN THE CLOUD

BY SCOTT GERENSER



The author is a senior software engineer at Wheatstone Corp.

Scott Gerenser

One term popping up more and more in the cloud space is "containerization." If you're paying attention to the trends in cloud computing, you've probably heard about it, or at least about the most popular container platform, Docker.

Containerization is becoming a popular alternative to virtualization for running many different applications on a single machine or cloud instance. It has many of the benefits of virtualization but without some of the downsides, which makes it useful for transitioning from a fixed-location studio to a virtual operation.

Whereas virtualization involves emulating an entire machine, including the hardware and operating system, containerization involves encapsulating one or more applications and supporting files (so called "userspace" in Linux lingo) into containers that can then run on top of a single common operating system (usually Linux).

BENEFITS

For example, in a virtualization scenario, you might have a server running VMWare ESXi hypervisor software, upon which are four Ubuntu Linux virtual machines for Service X, two Red Hat Linux VMs for Service Y, and a couple of Windows 10 Server VMs to handle any Windows applications you have.

Using virtualization this way still provides big benefits over maintaining multiple physical machines. Administration is easier. Spinning up a new server or changing configurations of the individual VMs is much easier than tinkering with hardware. Communication between the VMs is very fast and efficient.

The downside, as compared to containerization, is the relatively large overhead associated with virtualization. This is because each VM is running a complete OS kernel, each with their own dedicated memory and each using up a percentage of your CPU to mostly do a lot of the same things.

Containerization, by comparison, also allows the running of a number of different isolated services on one machine, but within containers rather than full virtual machines.

Conceptually, a container can be thought of as a very lightweight, resource efficient VM. One container could host WheatNet-IP audio drivers and audio playback software, while another could host the station automation system, each totally isolated yet run off the same OS kernel.

Because each container operates independently of the others, you can avoid unintended interactions between software components and eliminate a single point of failure. Each application or container communicates with the others only through their defined APIs.

The container virtualization layer is extremely flexible and can scale up to meet rising demand for any of the services. Once you define what services are running in one or more containers, it's possible to move those containerized services between on-premise machines and the public cloud. This allows you to more easily scale services locally at your regional studio or in a cloud provider such as AWS or Azure.

And unlike with virtualization, there is no extra supervisory overhead to contend for resources, and containerization platforms are even able to run on top of virtualization platforms.

This last point is critical for long-term planning, since Amazon, Microsoft and other public cloud providers are already running hypervisor software on their cloud instances. Attempting to add your own VM hypervisor on top of a cloud provider's machine instance may work poorly, or not at all. Containers, by contrast, work well on just about all the cloud providers and instance types. Most providers even offer tools to make it easy to manage and coordinate your containers running in their cloud.

Fundamentally, containerization and virtualization are two different ways of doing the same thing. Having several containers running separate services pushed up to a cloud won't solve issues such as communication latency over the internet, but it will offer some added security protection and flexibility, and let you allocate resources more efficiently, which is the point of the cloud, after all.

READER'S FORUM

ROCKET IN YOUR POCKET

I liked the "radio listening" article about Bob Crane's radios in the Dec. 18 issue.

I still do play-by-play for a local collegiate summer baseball team here in Terre Haute. The home stadium is close to downtown, and is situated 1.2 miles from a 50 kW station on 99.9, 1.6 miles from another 50 kW on 100.7, and 1.7 miles from a 3 kW on 105.5.

My problem was I was broadcasting on yet another FM station on 104.9 that was only 1 kW and it was 18 miles away. Believe it or not, some of us still listen *off the air* to our audio at our venues because we're *not* using any kind of latency-inducing device to send our audio to the station. We still use a good old Marti, which works fabulously.

However, every radio I bought locally, while big on "bling," had what most would call "barn door" selectivity. That, coupled with rather poor sensitivity, made hearing our 104.9 signal at the stadium impossible.

I contacted Bob Crane explaining my issue, and he said he had two radios that he would guarantee would work in my situation. So, I bought the now-famous CCrane Pocket radio. And Bob was correct. I could get crystal-clear reception of the 104.9 signal with no interference or blanking from the other *three* FM signals.

I would highly recommend that radio to any broadcaster who had a similar problem. While my application was FM, I was pleasantly surprised how well it does perform on AM. Then add the fact it also has NOAA receive, and it's quite a little package.

Jerry Arnold
Terre Haute, Ind.

World Radio History

READER'S FORUM

88 CHANNELS WITH NOTHING ON

Pete Simon

Hi Paul, thanks for Dick Taylor's commentary "Invest in People and Programming, Not More Signals" (March 18 issue). If I may use an analogy:

Ocean City, America is expanding its boardwalk to accommodate more commercial space for eateries. Sounds great, right? There is the promise of more variety of food offerings for increasingly diverse populations, young and old. We'll finally have room for more Asian, Latin, Caribbean and Middle Eastern fare that a number of people have been requesting, for decades.

Here's the problem. The new spaces are being taken by chain restaurants, with no room for "mom and pop" independent vendors. The "new spaces" will only be an extension of what is already available, up and down the boardwalk: everyone's favorite Italian and Mexican chain restaurants and another "Big Marty's" burgers, greasy fries and funnel cake, all because "it sells."

Sound familiar? That's exactly how commercial radio has operated since 1996. As with retail in Ocean City, it has nothing to do with adding more variety to the radio dial and everything to do with who controls the radio real estate under current rules and regulations.

We can thank the National Association of Broadcasters for the rider it succeeded in tacking on to the 1996 Telecommunications Act, signed by President Clinton, which increased the number of radio stations that one entity can own in any given radio market in the country (eight stations per major market, and now they want even more stations per market).

What this did in effect was reduce programming choices across the radio dial, slash payrolls, and with it send more and more talented people out on the street. When I hear someone say they think expanding the number of radio stations we have will improve anything, I laugh, given the current ownership rules. The "big boys" like iHeart own all the "blowtorch" signals everywhere and they homogenize everything they get their hands on.

Under the current "playing field," expanding the number of radio stations we'd have would only expand the mundane. Instead of "57 channels with nothing on," we'd have "88 channels with nothing on." No imagination, no freedom for innovative people, just the same tainted focus group-driven pap.

For just once, I wish "gurus" like iHeart's Bob Pittman would take a peek back to a time before FM radio became king in the radio marketing world in the 1960s, when circular polarization had just been perfected, but before that ground-breaking technical breakthrough pushed FM radio into the limelight. It was a time when the "inmates ran the asylum" with "underground FM" radio, before the top-40 radio doctors arrived around 1973. It was the most spontaneous, creative and fun time in the history of commercial radio.

That is the kind of investment in people and programming that I think Dick Taylor is hinting at in his article; not to dredge up those old album rock tracks, but to bring back that wide-open spirit that has sorely been missing since that contrived "super stars" format arrived to mimic "hip FM" radio in 1973. People see through that kind of plasticity. The numbers show it.

If you want a clue, find a 1972 aircheck from KDKB(FM), Phoenix to hear unbridled imagination and fun taking place, which included not only cutting-edge music of the day, but well-produced (in-house) fake commercials and spoof commentary. It was a golden age of radio for boomers.

Pete Simon
Arvada, Colo.

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BUILDING NEWS/TALK

Ken Deutsch was certainly right that his GM "failed to predict the cost of the upgrade" from rock music to news/talk ("Adventures in 1970s AM: Helloooo, Punkie!" on *radioworld.com*, keyword Punkie). It was and is a very expensive format to create, day in and day out, week after week.

While at KPRC/Houston in the early 1970s I was news and program director, and found myself one day in the president/GM's office having a conversation similar to the one Ken mentioned.

KPRC was an MOR station in those days, not rock — still essentially a strong music image with good news presentations. The bottom line was, in fact, the bottom line, and the audience transfer for music from AM to FM was well underway.

I was tasked with putting together a format for AM that would build an adult audience without costing an arm and a leg to create. Something other than a strong music image for the Houston market.

I told my boss I'd need to do a bit of traveling to hear what was happening in a few respected major markets but that I'd have a solution within two weeks. I flew to Los Angeles and camped out with my trusty radio/recorder, legal pads, stopwatch and plenty of coffee, and began monitoring. Within a couple of days I knew what was working and what was not, so I hopped a plane up to San Francisco and did the same thing there, followed by Chicago, Detroit and then back to Houston.

Luckily KPRC could absorb the significant costs that come with a news and programming staff of about 60 or 65 people. We were a radio/TV combo; and then there was the newspaper that was still publishing. The company was OK ... but no one likes to see red ink, and we'd been tasked with finding a workable solution to the dwindling audience numbers on our 5 kW AM.

What we developed was our very successful version of News/Talk (which I had the pleasure of hosting mornings); and we gradually worked the format into place over a period of about 5 or 6 months. It turned out to be a hit; and to say the sales department was pleased would be an understatement.

We learned a few things about the format along the way, and word spread around the world about our successes. This meant we wound up in a few far-flung places including Paris, Moscow and Prague, plus a few cities in Asia and Africa, consulting with some terrific broadcasters.

News/Talk today is simply a well-established staple for thousands of U.S. broadcasters, and we were simply lucky enough early on to have been asked to create a format for a great station in a great market for a great broadcaster at the right time.

Don Watson
Pensacola, Fla.

World Radio History

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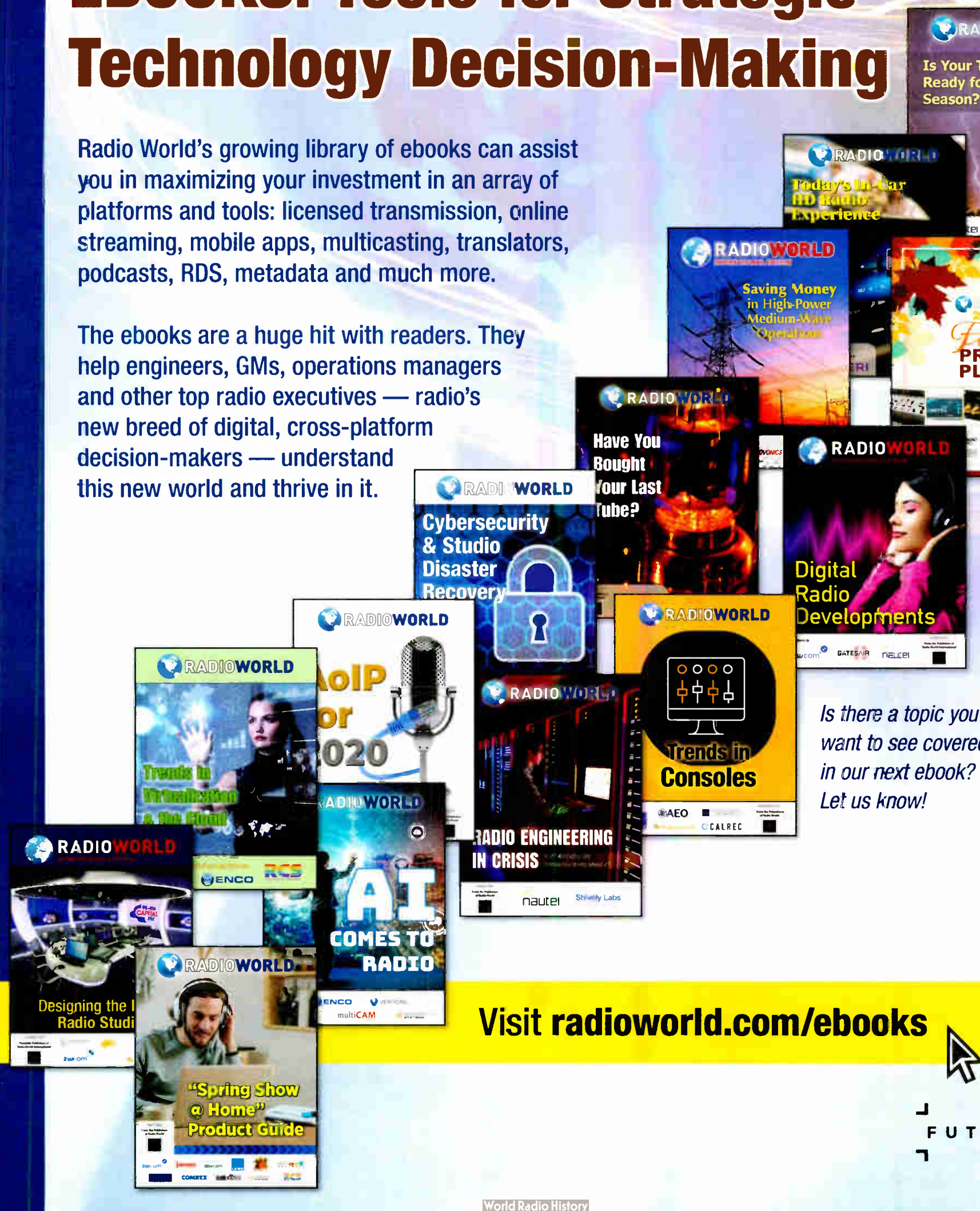

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