

THE SPECTRUM MONITOR®

Amateur, Shortwave, AM/FM/TV, WiFi, Scanning, Satellites, Vintage Radio and More

Volume 4

Number 1

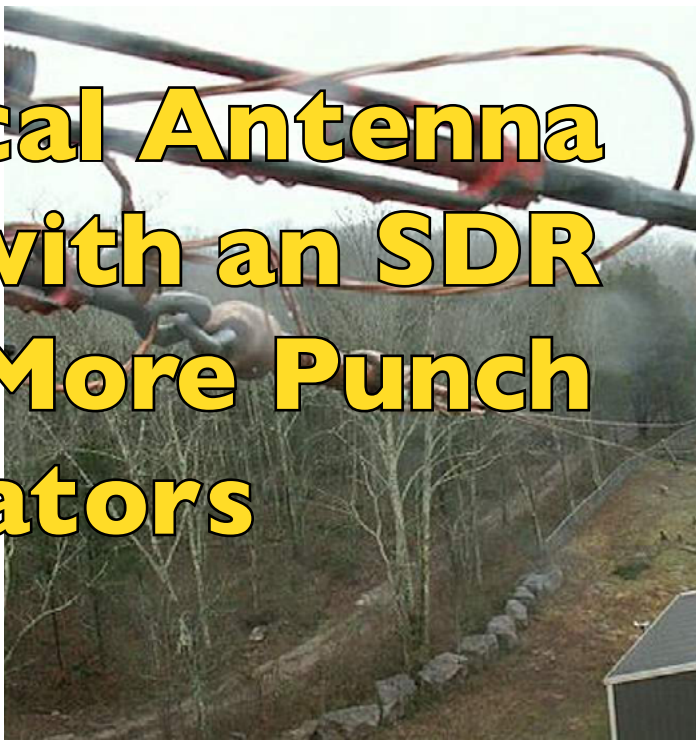
January 2017



Living the Shortwave Dream at WTWW

Plus:

**SteppIR Vertical Antenna
Going Mobile with an SDR
SSB Gives CB More Punch
Big-Dish Actuators**



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Dear TSM:

Send your comments to editor@thespectrummonitor.com
The Spectrum Monitor reserves the right to edit comments
from readers for clarity and space availability.
Anonymous comments will not be published.

Comments, Advice, Kudos and Questions from Readers



W6JRY and KA6IRL Recreation of the Eddystone All World Two Regen, Circa World War II (Courtesy: <http://theqrper.blogspot.com>)

Regenerative Receiver Parts

“This new Eddystone recreation [‘A Salute to the Esteemed Regenerative Receiver’ by Richard Fisher KI6SN, December 2017 *TSM*] got me thinking. Right before it was the listing of antique radio resources. Couldn’t one put the two together and publish a bill of materials to get the parts needed? Or maybe you’re going to sell kits. A terrific project either way, I think, but having to order the parts separately seems like a good way to get folks involved a little more deeply. Keep up the good work!” – Ron Chester

Richard Fisher Replies:

“What a great idea, Ron. Thanks for suggesting adding a parts list and component sources to upcoming DIY projects. Making things as efficient as possible for the potential builder is key to getting people ‘involved a little more deeply.’ Home brewing can be really gratifying. This will make it all the more so! Much appreciated.” – KI6SN

Hollywood Vintage Radio Mystery

“Attached is a frame grab from the 1940 Republic Pictures movie serial, ‘King of the Royal Mounted,’ showing a vintage piece of radio equipment. In the serial, this radio is used by actor Robert Strange, portraying the head of a spy



Eric Beheim’s Radio Puzzler. (Courtesy: Eric Beheim via “King of the Royal Mounted”)

ring, to communicate with his minions in the field. This set, which also appears as a prop in several other Republic serials, appears to be an actual piece of gear rather than a studio mock-up. Can anyone identify the radio and when it dates from?” – Eric Beheim

Eric Beheim is a regular contributor to TSM on vintage radio subjects. Thanks for this interesting question, Eric! How about it, vintage radio sleuths, any suggestions? – Editor

Easy Amateur Satellite Antenna?

“It occurred to me yesterday, as I looked at an antenna on my shelf, that it could be used for amateur radio satellite comms with some modification. Would not the 2-meter/440 ladder-line J-pole antenna, wrapped around a form, say a 3 or 4-inch drainage pipe, work as a RHCP antenna? The right spacing and the right width and some duct tape and you’re on the air in RHCP [right-hand circular polarity] for next to nothing.” – Todd Dokey

I was intrigued by the idea and asked VHF antenna expert, Kent Britain WA5VJB, his take on the suggestion. He wrote, “No, your J-Pole is way too small to make a circularly polarized antenna out of it. The J-Pole would need to be several wavelengths long and wrapped on 3-foot sewer

pipe.”

Kent is a longtime contributing editor on the subject of VHF antennas and has written for *CQ magazine*, *Popular Communications*, *Monitoring Times* and many more. You can check out some of Kent's antenna products at <http://www.wa5vjb.com> – Editor

Editor's Message: A New Year with TSM

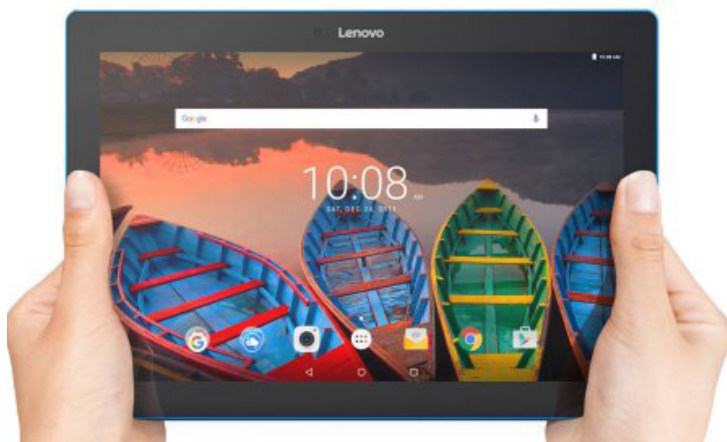
I'd like to welcome all readers to a new year of *The Spectrum Monitor*. Thanks to all who renewed their subscriptions, especially those who have been charter subscribers from the very first issue (January 2014). And, here's a shout-out to the many new subscribers, especially those who were former *Monitoring Times* and *Popular Communications* readers just now finding out about *TSM*. Welcome all to our fourth year of publication!

Here are a couple of quick housekeeping notes: Links to each new issue are usually sent to subscribers on the last day of the month prior to the publication date. So, a link to the February 2017 issue will likely be released Tuesday, January 31. If you have not received your email with the February link by the first or second day of February, just send an email to me, editor@thespectrummonitor.com, and I'll re-send the link.

It's a good idea to save the links to a Word document so that, throughout the year, you'll have access to any issues if you accidentally delete an issue or acquire a new device on which you would like to read your issues. If you are missing any issues that you had earlier paid for, just let me know and I'll send links to those missing issues. If you have accidentally deleted an issue, and haven't been saving the links, just let me know and I'll resend the link to the issue you need.

If you don't want to read *TSM* on your desktop or laptop computer, consider getting an e-tablet. As a PDF file, this magazine, when read on a tablet, gives you a better experience than reading on a desktop, laptop or even a "real" printed magazine. You can store many years worth of issues on most tablets, they're portable (take them anywhere you would a paper magazine) and the magazine's page size conforms well to most 10-inch tablets. You also have the advantage of expanding photos and charts, and following embedded links with the touch of a finger. Plus, tablets are much less expensive than when *TSM* first began. I read the magazine on a 7-inch tablet I bought at Walmart for \$70, they're now down to \$35. An Android device, it not only holds the magazines but also decodes SSTV and WXFAX images directly from shortwave frequencies using free software. Just after Christmas last month I found a 10-inch Android at Walmart for \$100.

If you're new to *TSM*, and are looking for additional reading material in between issues this year, you can buy any of the previously published issues singly (\$3 each) or buy the whole year (\$24 for each set of 12 issues, a \$12 savings over single issue purchases). You can look at an index of all feature articles and column topics for each year by clicking the



Lenovo Tab 10 16 GB tablet \$100 at Walmart (Courtesy: Walmart)

“more info” button under each year's purchase option on the left side of the homepage. To see the contents of any single issue published, just click the “more info” button under the cover of each monthly issue.

Some *TSM* columns (Maritime Monitoring, Amateur Radio Satellites and Amateur Radio Astronomy) appear once every three months. Some topics, such as pirate shortwave radio, appear every four months in the World of Shortwave Listening column.

We are always looking for interesting topics for feature articles, so if you have such an idea, pass it along and we'll see what we can do with it.

If you have an interest in writing a feature article or product review, just let me know and I'll pass along our “Writer's Guidelines.”

We have readers all over the world and at subscription renewal time many take the opportunity to say how much they enjoy the magazines. Here are just a few comments:

“Thanks for all the effort that you put into *The Spectrum Monitor*. Every issue has been pure enjoyment.” – Dave

“*TSM* is perfect reading with a lot of interesting tips and tricks.” – Ladislav

“Thank you for the excellence of the magazine. I've enjoyed the last two years immensely. It adds to the enjoyment of my amateur radio/SWL hobby a great deal.” – Guy

“Great magazine. Have enjoyed it for two yrs and hope it continues.” – Steve

“Great magazine! *Ham Radio*, *Popular Communications*, 73, *Monitoring Times*, etc., all gone now. Keep up the great mag.” – James

“I read the magazine cover-to-cover and find things I've never known before.” – Richard

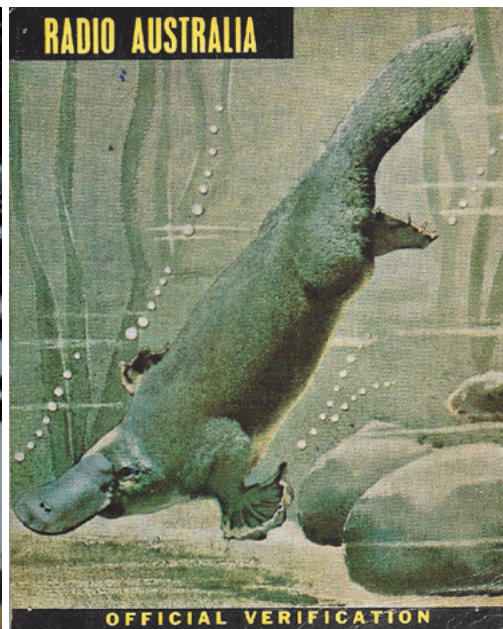
On behalf of the entire staff of writers at *TSM*, thanks to all for subscribing! And, when you're getting ready to make a radio purchase, check with *TSM* advertisers first, they help support this magazine too. -- Ken Reitz KS4ZR, Publisher/Managing Editor

TSM

RF CURRENT

News from the World of Communications

RF Current is compiled and edited by Ken Reitz KS4ZR from various news sources and links supplied by TSM readers. If you find an interesting story pertaining to amateur, shortwave, scanning, broadcasting or satellites, send a link to editor@thespectrummonitor.com



Left: Radio Australia's shortwave transmission site at Shepparton (Credit: ABC) Right: Radio Australia QSL card from 1965. (KS4ZR collection)

Radio Australia Leaves Shortwave

Widely reported in radio-related media was news December 5 about the Australian Broadcasting Corporation (ABC) ending its longtime broadcasts on the shortwave bands as of January 30, 2017. Here is the text of the ABC statement:

"The ABC will end its shortwave transmission service in the Northern Territory and to international audiences from 31 January 2017.

"The move is in line with the national broadcaster's commitment to dispense with outdated technology and to expand its digital content offerings including DAB+ digital radio, online and mobile services, together with FM services for international audiences.

"The majority of ABC audiences in the Northern Territory currently access ABC services via AM and FM and all ABC radio and digital radio services are available on the VAST satellite service.

"ABC International's shortwave services currently broadcast to PNG and the Pacific. Savings realized through decommissioning this service will be reinvested in a more robust FM transmitter network and an expanded content offering for the region that will include English and in-language audio content.

"Michael Mason, ABC's Director of Radio said, "While

shortwave technology has served audiences well for many decades, it is now nearly a century old and serves a very limited audience. The ABC is seeking efficiencies and will instead service this audience through modern technology."

"The ABC, working alongside SBS, is planning to extend its digital radio services in Darwin and Hobart, and to make permanent its current digital radio trial in Canberra. Extending DAB+ into the nation's eight capital cities will ensure ABC digital radio services can reach an additional 700,000 people, increasing the overall reach of ABC digital radio to 60% of the Australian population.

"ABC Radio is also investigating transmission improvements to address reception gaps in the existing five DAB+ markets. It aims to ensure a resilient DAB+ service in every capital city, with enhanced bitrates and infill where necessary.

"Extending our DAB+ offer will allow audiences in every capital city in Australia equal access to our digital radio offering, as well as representing an ongoing broadcast cost saving owing to lower transmission costs," added Michael Mason.

"ABC International's Chief Executive Officer Lynley Marshall said the reinvestment from closing international shortwave services would maximize the ABC's broadcast



An aircraft from the Netherlands Aerospace Centre carried a prototype Iris terminal connected to Inmarsat's next-generation SwiftBroadband-Safety satellite service. During four flights to different destinations in Europe, the connection between the aircraft and ground networks was tested extensively and air traffic control messages were exchanged. The trials were part of the public-private partnership between ESA and UK satellite operator Inmarsat to deliver high-capacity secure digital data links via satellite for air-ground communications for cockpit crews over European airspace under ESA's Iris Precursor programme. (Text and image courtesy of Inmarsat)

capabilities in the region.

"In considering how best to serve our Pacific regional audiences into the future we will move away from the legacy of shortwave radio distribution," Ms. Marshall said. "An ever-growing number of people in the region now have access to mobile phones with FM receivers and the ABC will redirect funds towards an extended content offering and a robust FM distribution network to better serve audiences into the future."

I asked *TSM* contributing shortwave editor, Rob Wagner VK3BVW, about the move. He wrote:

"This has been very much on the cards for some time. However, in the various SWL Facebook forums there has been some dismay expressed over the decision. Alas, too late to bleat about it now! The move will save the organization around A\$2 million. Successive governments have slashed the ABC budget over many years. Bits of Radio Australia's (RA) service have fallen off during that time. Now there's no more to cut.

"It will be interesting to see what will happen to the RA transmitters at Shepparton, Victoria. These are not owned by the ABC but by a broadcasting organization called Broadcast



Uniden BCD996P2 TrunkTracker V scanner. (Courtesy: Universal Radio)

Australia. The ABC was leasing these from BA. The NBC in Papua New Guinea leased time at Shepparton and Brandon, Queensland to broadcast their Pacific Games last year. Perhaps other organizations might look at doing business with BA now that the transmitters will be freed up, but too early to say right now."

EU Steps Toward Satellite-based Air Traffic Control

An article in Phys.org, December 20, reported that the European Space Agency (ESA) has completed test trials using satellites in the modernization of the European Air Traffic Control system. According to the article, "The trials are part of the public-private partnership between ESA and UK satellite operator Inmarsat to deliver high-capacity secure digital data links via satellite for air-ground communications for cockpit crews over European airspace under ESA's Iris Precursor program." The EU plans call for a second round of test by the end of 2017.

Uniden Announces DMR and ProVoice Add to BCD996P2 and BCD32592 Scanners

Uniden announced December 20, "the addition of support for Digital Mobile Radio (DMR) and EDACS ProVoice decoding for two additional models, further cementing Uniden's position as the leading scanner manufacturer worldwide. Digital Mobile Radio is used on thousands of systems worldwide. This \$60 paid upgrade allows existing and future owners of the BCD996P2 and BCD325P2 scanners to easily add support for monitoring DMR, MotoTRBO Connect Plus, MotoTRBO Capacity Plus, and DMR Tier 3 systems. ProVoice systems are used by several major agencies in the United States. This \$50 paid upgrade allows people who live in one of these areas to easily add support for monitoring all unencrypted comms on these systems."

The announcement included information on how consumers can get the upgrade. You can read about it here: <http://info.uniden.com/twiki/bin/view/UnidenMan4/DigitalMobileRadioUpgradeforBCDxxxP2>

FCC Releases 6th "Measuring Broadband America" Report

On December 1, the FCC released the results of its

ongoing study of fixed broadband Internet access service nationwide. Here are the highlights:

Compared to four and one-half years ago, the median download speed, averaged across all participating Internet Service Providers (ISPs) has “almost quadrupled, from approximately 10 Mbps in March 2011 to approximately 39 Mbps in September 2015.”

The FCC report found that actual speeds experienced by most consumers meets or exceeds advertised speeds. As might be expected, “fixed cable or fiber broadband customers experienced speeds that were 100 percent or better than advertised. But, the actual speeds experienced by subscribers of some ISPs satellite technologies were lower on average than the advertised “up-to” speeds for their respective providers.”

FCC Repacking Update

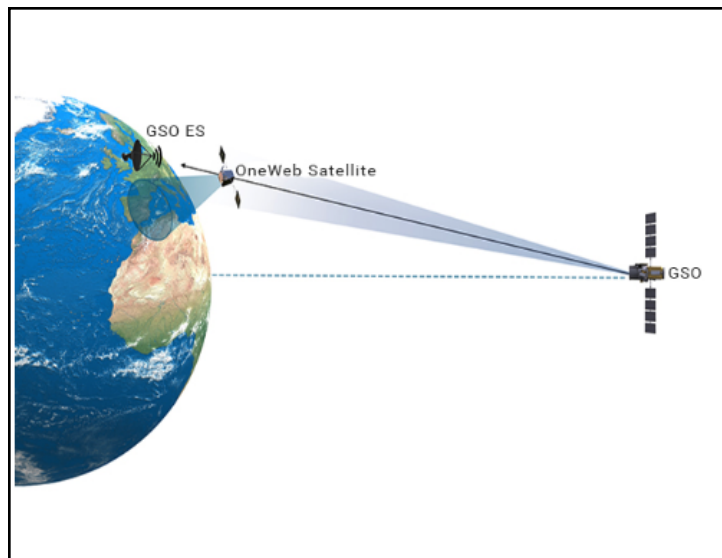
A story we’ve been following all of 2016 is the long running saga of repacking America’s TV bands, which continues at the FCC. With a target of 84 MHz of TV band spectrum, bidding in the “clock phase” of stage 4 of the reverse auction is in progress as this is written during the last week of December. The bidding process began August 15, 2016 and will likely continue through this month and into February or until the spectrum has been successfully auctioned off. It’s hard to get information about the auction because the FCC prohibits participants from communications in connection with the auction process until the auction is over. At the conclusion of the auction we will provide full analysis of what it will mean to US TV viewers.

FCC Fines California FM Pirate \$25,000

A ministry operating out of Panorama City, California, discovered that there was no hiding place from a fine leveled by the FCC against its operation of an unlicensed FM radio station. The case goes back to January 8, 2015 when FCC field agents, working out of the FCC’s Los Angeles field office, received a complaint about an unlicensed FM station operating on 95.1 MHz. Agents found an FM antenna fixed to a guyed tower on church property and issued a Notice of Unlicensed Operation (NOUO). No response was received.

On May 28, 2015 agents returned to the site to find the transmissions continuing and issued another NOUO. The agents returned once more on June 12, 2015 and recorded that the station continued in operation on 91.5 MHz. This time the owner called the field agents back and admitted that he was the operator but that the transmissions had quit. But on July 22, the field agents once again returned to the site and observed the station continuing in operation.

On January 8, 2016, one year after the initial investigation, the station was still operating on 91.5 MHz. Visits on June 17 and July 8 found the station still there. Agents warned the operator of significant monetary penalties. On August 29 the site was in operation but with an unmodulat-



From OneWeb website: “Our vision is shared and supported by the United Nations International Telecommunications Union (ITU). In 1997, the ITU recognized the potential disparity in connectivity access and prioritized specific global spectrum to connect the world. This is the only spectrum of its kind and OneWeb’s license to utilize this capacity is a globally unique position. The priority spectrum allocated by the ITU came with a significant constraint: Our use of the spectrum must not cause interference with the GEO satellites. To accomplish this, we developed a key enabling technology we call “Progressive Pitch™”. This patent pending technology allows us to unlock the spectrum in the most efficient way by gradually and slightly tilting our satellites as they approach the equator to make sure we never cause, or receive, interference.” (Text and graphic courtesy: OneWeb)

ed carrier, as it was on October 4 and October 17. Finally, on December 8, 2016 the FCC issued a Notice of Apparent Liability for Forfeiture (NAL) in the amount of \$25,000.

Japan Corp to invest \$1 billion in OneWeb Project

The startup known as OneWeb Ltd., has gained a \$1 billion investment from Japan’s SoftBank Group Corporation. The project aims to employ a constellation of some 640 satellites to deliver two-way Internet access to developing countries. OneWeb is the brainchild of Greg Wyler who is the executive chairman and chief architect of the project, which counts British billionaire and *bon vivant*, Sir Richard Branson, among its other investors.

The company has had more than monetary hurdles to climb, not the least was the issue of interference, which has bedeviled several other would-be satellite service providers. To get around the problem, OneWeb plans to operate their Low Earth Orbit satellites in such a fashion as not to cause interference to geosynchronous satellites operating in the same frequency band (see illustration above).

Still, OneWeb has competition from other billionaires, including Elon Musk who, never to be outdone by any other billionaire, previously announced that he would launch a similar service that would feature not a paltry 640 satellites, but 4,000 satellites. So there!

TSM



Left: WTW's 100 kilowatt Continental transmitter number 2. Each row of buttons on the front panel controls one "channel" which corresponds to an output frequency of the transmitter. (Courtesy: WTW) Center: A close-up view of the turnbuckles and feed system for one of WTW's massive rhombic arrays. (Courtesy: John Hettish – Middle Tennessee Two-Way, Inc.) Right: Ted did a lot of the design work for WTW's antenna system. This photo shows the massive twin lead feed line on the ground before being installed on one of the station's huge rhombic antennas. (Courtesy: John Hettish – Middle Tennessee Two-Way, Inc.)

Living the Shortwave Broadcasting Dream at WTW

By Keith Baker KB1SF/VA3KSF

As a young boy growing up in rural New Hampshire, I recall listening to an old, tube-filled Philco console radio in my bedroom closet. I'd sit for hours in front of that old radio with a pair of my grandfather's decrepit (not to mention tinny-sounding) headphones clamped on my head listening to shortwave broadcasts arriving on my long-wire antenna from both near and far.

About that same time, I remember thinking, "Gee, wouldn't it be neat to be on the transmitting end of those broadcasts...to own and operate a radio station that could send signals (and the music of my young era) over the air to be heard on the other side of the planet?" At the time, that was a huge dream of mine.

But, as dreams often do, the reality of high school studies, marching band, then university studies quickly overran my immediate thoughts. But I still managed to keep my dream alive by working first as a DJ at our university's 10-watt student FM radio station (WUNH in Durham, New Hampshire) and then later pulling weekend "gigs" at a number of local AM and FM broadcast radio stations in New Hampshire, Massachusetts and (during the summer months) in Florida.

Eventually, one of my colleagues at my workplace at

Wright-Patterson Air Force Base in Dayton, Ohio, introduced me to amateur radio, and I was hooked. Now, with my freshly minted amateur radio license in hand, I too could send my own signals to the other side of the world...on the ham bands.

That interest in ham radio eventually led me to my work with the Radio Amateur Satellite Corporation (AMSAT) and to a fellow...in fact, to his entire family...who has since been living the dream that I once had all those many years ago.

His name is Ted Randall, his amateur radio call sign is WB8PUM, and his shortwave radio station is WTW located just outside of Nashville, Tennessee.

Well, it's not really "his" station. But it might just as well be....

WTW's Heritage

Officially, WTW is an international shortwave radio station licensed in Lebanon, Tennessee. According to their website (www.wtww.us) their call sign stands for "We Transmit World Wide."

A quick check of the US Federal Communications



Ted Randall's QSO Radio show currently airs on WTTW on Tuesday at 8:00 PM (Central) on 5.085 MHz and again on Saturdays at 1:30 PM (Central) on 9.330 MHz (Courtesy: WTTW)

Commission (FCC) International Broadcast Service database shows that WTTW was originally licensed under a construction permit as WBWW on June 30, 2009. On-air testing began in January 2010 and ended in mid-February 2010. The testing frequencies used at that time were 5.755 MHz and 9.48 MHz, and several listeners later uploaded the test audio to YouTube.

Both of the frequencies used for testing (5.755 MHz and 9.48 MHz) along with their transmitters were previously used by Christian shortwave outlet KAIJ in Dallas, Texas. WTTW officially signed on at 1500 UTC on Friday, February 19, 2010 using the 9.48 MHz frequency at a low over-the-air power using primarily streamed programming from the Scriptures for America broadcast network.

Currently, WTTW is licensed to operate with full power at either 50 or 100 kilowatts (with antenna azimuths of 40°, 45°, 50° and 180°) every day on 9.475 and 5.830 MHz with programming primarily from the Scriptures For America broadcast network. As of early 2013, WTTW can also be heard broadcasting in the evenings throughout Eastern North America, Canada as well as into Europe, Africa and the Middle East on 5.085 MHz.

Enter Ted Randall

During the on-air test, shortwave listeners had a chance to catch the first broadcast of the new shortwave transmitter installed at WTTW in Tennessee. At the time, Ted Randall WB8PUM hosted a show called "This is Only A Test." That program has since evolved into a regular weekly feature on the station that he calls his "QSO Radio Show," along with other, amateur radio-related and music programming.



For the last few years, Ted Randall WB8PUM has broadcast his QSO Radio Show live on WTTW from the Dayton Hamvention. Here he is shown at the 2016 event with his wife Holly KG4WXV (left) and son David KG4WXW (right) at their indoor broadcast booth. (Courtesy: Author)

In answer to the obvious question as to why he is doing this on shortwave, Ted notes that, "The shortwave listening audience is huge. As a result, the typical shortwave radio listener is also a great potential candidate for amateur radio. That's primarily because, there are now more than 1.5 billion shortwave receivers in use worldwide. In fact, the BBC estimates that at any given moment, over 200 million shortwave radio sets are tuned in to shortwave broadcasts."

Ted says the overall objective of his show is to, "Demonstrate HF communications and to put radio amateurs on the air to a worldwide audience to tell their story." For example, each year, during the ARRL's "Field Day," he regularly interviews North American hams who call in to his live program from their Field Day sites. A YouTube video of one such interview with Bob Heil K9EID (the owner of Heil Sound) while Bob was enroute from one Field Day site to another is at: https://www.youtube.com/watch?v=KrCRfmnd_kg

But, what's even more amazing in all this is that, according to Ted, "This is not a commercial venture in any way."

Not a commercial venture? How can that be in an age where advertising time using any broadcast medium (including even the Internet) has become increasingly commercialized...and on a high-powered radio station with a worldwide audience to boot?

Sweat Equity

The answer lies in a very generous station owner who routinely offers use of multiple, high power shortwave transmitters and the "sweat equity" of not only Ted, but also that of his entire family.

Indeed, as the station owners do not live in the local Lebanon, Tennessee, area (and Ted is a paid broadcast engi-



A lot of famous hams like to stop by Ted's booth and chat with him over the air on WTWW. In this photo, he shares the microphone with Martin F. Jue K5FLU (the name behind MFJ Enterprises) (Right) and another guest, at the Dayton Hamvention. (Courtesy: WTWW)

neer for a group of radio stations in and around Nashville, Tennessee) he's worked out an arrangement with the station owners where he (and his family) help to keep the station on the air in exchange for a significantly reduced cost (to Ted) for air-time on the station.

Says Ted, "We don't own WTWW. Rather, we are the caretakers. We're the ones that keep it running and make things happen over the air. And we really enjoy taking care of the thing!"

And "taking care of the thing" also includes producing his QSO Radio Show, a feature of the station that has been airing now for years. As Ted says, "The whole point of the (QSO) program is to promote the radio hobby. It serves absolutely no other purpose."

The Shortwave Audience

Ted notes that, while some governments have stopped broadcasting on shortwave, he thinks "that's cool" because it sends more people to WTWW and to his program. He goes on to note that, shortwave over the years has been growing "like a stealth type thing."

For example, when he recently talked to the folks at the Tecsun Company in China, he was astounded when he asked them how many shortwave radios they are producing in China. Their answer was several thousand... a day.

Ted notes that his audience is tremendous. "You can get an email or the phone will ring and it's some guy in South Africa or somebody in Germany or Chicago, Illinois. It's hard to even imagine where people are listening to you."

Says Ted: "I can be having a depressing day, but when I sit down to do my two hour program and I start getting emails and phone calls from all over the world from people who are so excited to be hearing good programming on a



The Dayton Hamvention is not Ted's only source of guests for his QSO Radio Show. Here he interviews two guests at the Huntsville, Alabama hamfest. (Courtesy: Ted Randall)

shortwave station, it all makes me smile."

Back to the Basics

Ted notes they are "trying to do the basics". The station's Bible programming runs seven languages on one transmitter. But he says that there are all kinds of programs running on the other transmitters as well.

Says Ted, "Our number two transmitter is currently our 'wild card.' We are trying our best to make it a fun thing to listen to. We air oldies and country music on it during the weekends. During the week, we used to have Art Bell coming on at 11 o'clock at night. And, of course we also air the QSO program." What's more, Ted recently added Bob Heil's Internet-based "Ham Nation" offering to the program mix with a simulcast on 5.085 MHz every Wednesday evening US Central Time.

Ted noted that, "We're trying to make shortwave radio into something that people will say they are glad they got one of these radios rather than not being able to find anything to listen to. So, again, that's our goal...to make shortwave listening fun. And right now, we have two more transmitters sitting waiting to be put on the air for even more fun."

The Transmitters

Indeed, any way you cut it, those transmitters are huge! WTWW currently uses three transmitters...two are Continental Electronics Model 481Es rated for 100 kilowatts and another is a Harris Model MW-50 rated at 50 kilowatts. Both Continental transmitters use Continental's patented solid-state modulator circuit that is housed in a separate "cage" behind each transmitter. (<http://www.contelec.com/swmodulatorfeatures.htm>)

Their "antenna farm" consists of Penn-Tech rhombic antennas with rated gains on the order of 12 dB. Ted also

did a lot of the antenna design work and installation. In fact, in typical amateur radio fashion, he also helped build the station from the ground up to get it on the air. When the output power of the transmitters is combined with the gain in their antennas, the effective radiated power of just one of WTTW's three transmitter and antenna combinations is on the order of 1.6 Megawatts!

Ted's son Matt KG4WXX recently used a camera-equipped drone to produce a YouTube video of WTTW's rhombic "antenna farm" from the sky. (https://www.youtube.com/watch?v=yckBR9i6V_w)

War Stories

Like most broadcast engineers, Ted has his share of "you won't believe this" stories from being around such high power broadcast transmitters. Says Ted, "You get to experience some really weird stuff when you get to the 100 kilowatt power level. And when you are working on transmitters over that power level...to 250 kilowatts or even 500 kilowatts...the anomalies get even worse. Things like people hearing the transmitter audio out of a fence a mile away."

One particular story Ted likes to share is about hearing voices in his vehicle with all the radios shut off. Says Ted: "I was coming up the driveway of the WTTW transmitter site one day underneath one of those rhombic antennas, and I heard voices. All the radios inside the vehicle were off. We got closer to the transmitter building, and still, we were hearing this voice. Finally, we discovered it was coming from a paper cup in a cup holder up on the dashboard of our vehicle. Apparently someone had put a cup filled with a cola drink up on the dash, the liquid had dried up, and the empty cup was now rectifying the RF and forming a receiver circuit!

Another time his son, Matt, was driving his pickup truck up the station driveway underneath one of the rhombic antennas while it was energized and the RF absolutely "fried" his truck's electrical system. "It burned the wiring black," said Ted.

In fact, just to give you an idea of how much gain is in their antenna system, Ted noted that one time, a snake cut across the station's AC power pole and shorted out one of the input power transformers. So, while they were waiting for the power company to come out and fix the power pole, they used a small antenna tuner (and about 50 watts) to feed one of their huge rhombic antennas so as to keep the station's program at that time up and on the air. Even with this "peanut power" they were still putting a strong AM signal into Europe that night!

It's A Family Affair

Ted will be the first one to tell you that he is not the only one keeping the station on the air. His charming wife, Holly KG4WXXV, and sons, David KG4WXXW and Matt KG4WXX, along with other local families in the area also help to keep things going at WTTW. Says Ted of the



Sometimes, Ted, himself, becomes the "interviewee." Here he answers questions about WTTW and his QSO Radio Show on Bob Heil's "Ham Nation" Internet broadcast #212 (called "Shortwave 101") on September 3, 2015. In the background, Ted's son David KG4WXXW pulls up photos of the WTTW transmitters and antennas to share with Bob's Internet-connected audience. (Courtesy: Bob Heil's "Ham Nation" program)

transmitters, "These things are big and at times, they can be disagreeable. At other times, they purr like kittens." In many ways, the transmitters are more mechanical than they are electrical, using various gears and motors for tuning the transmitters to their assigned frequencies.

To make tuning a bit easier, there is an automatic setting on these transmitters where it will "look" for the appropriate setting for each function. For instance, during the day, in order to transmit on 9.930 MHz, either Ted (or one of his family members) will push the automatic button for 9930, and the transmitter switches to the 9930 channel, and then the transmitter "looks" for the internal motor settings of plate loading, plate tuning, etc. It will then stop tuning when each of those parameters are met. At that point, the transmitter is tuned and "on the air."

"But", says Ted, "It's not a perfect system. And one of us still has to be out there several times a week to fine-tune the settings because the settings tend to drift." He goes on to note that, "The difference between Continental and Harris transmitters is that the Harris transmitter just doesn't go down. Maybe that's because we run the Bible transmissions on it!"

And he also says that, "The other transmitters will sometimes drive you crazy. For example, transmitter number 1 is continually 'out of tune.' Sometimes, you go out and tune it up and those settings will only last for two or three days, and then BANG...it's out of tune again. At other times, it will go a month before it detunes."

The other issue is that the Harris transmitters are no longer being manufactured. So, as Ted says, "If you purchase one, you had better also get some spare parts to go along with it. Maybe even buy two or three more transmitters that you can later use for spare parts."



A telephoto view of how the twin lead feed line connects to the feed point of one of WTWW's huge rhombic antennas. (Courtesy: John Hettish – Middle Tennessee Two-Way, Inc.)

Shortwave Transmitting is Expensive!

And speaking of parts for transmitters, we hams tend to be cheap, and think nothing of scrounging spare parts (or used final amplifier tubes) from a junk box at a local ham-fest to keep our ham stations up and on the air. But keeping high-power shortwave transmitters on the air is a whole other ballgame.

For example, Ted notes that the final transmitting tubes for just one of their transmitters at WTWW runs about (US) \$20,000 new. A rebuilt one goes for about half of that amount. What's more, Ted notes that, when all their transmitters are running "full bore" for extended periods, the electric bill for the station can run as much as (US) \$70,000 per month. Clearly, high-power, commercial shortwave broadcasting is absolutely not for the faint of heart...nor can it be successfully done "on the cheap."

A Labor Of Love

All in all, what Ted, Holly, David and Matt are now doing at WTWW is nothing short of a labor of love. With the approval of a very generous station owner, they routinely offer their "sweat equity" in exchange for helping to keep a high-powered, Christian-based, shortwave radio station up and on the air. In return, and as an added bonus, their donated work also allows them a unique opportunity to provide interesting ham and shortwave radio-related programming to a worldwide audience on the shortwave bands.

Says Ted: "This all has been quite a learning experience for me and my family. Specifically, my two sons are now as current as anyone I know on the technology behind high power, shortwave broadcasting, particularly when one of the transmitters goes down and its time to troubleshoot what's wrong."

And to emphasize that point, Ted says, "I'm just glad I no longer have to do all of that by myself!"



A close-up view of the turnbuckles and support system for one of WTWW's massive rhombic arrays. (Courtesy: John Hettish – Middle Tennessee Two-Way, Inc.)

Selected References and other Online Videos

<http://www.wtww.us> (WTWW Main Web Site)

<http://qsoradioshow.com> (Ted Randall's QSO Radio Show Web Site)

<https://www.youtube.com/watch?v=8bv-KuoMPE2M#t=38.220729> (A WTWW transmitter on the air broadcasting the old rock and roll classic "The Bird Is The Word")

<https://www.youtube.com/watch?v=yeGeRroy5gI> ("Short-wave 101" Bob Heil's "Ham Nation" program Number 212 from September 3, 2015. An interview with Ted Randall starts at approximately 28 minutes into the piece.)



Left: Shrink tube installed at antenna joints. Center: Assembled fiberglass mast and element housing unit (EHU). Right: Installed antenna with 80 meter coil option.

Tuning the antenna can be performed initially by using the up/down band selector. Fine and coarse tuning on each band is accomplished by stepping through the band in 10 or 100 kHz increments using up/down switches. Another way is to use the optional transceiver interface. Data from the radio is sent to the SDA-100, which tracks the transmitter frequency and makes the necessary adjustments to the antenna. Most popular radio brands are supported, including Icom, Kenwood, Elecraft, Flex, Yaesu and others.

You should not need to use an ATU with this antenna. Since the antenna can be adjusted for every frequency, you should always have a near-perfect match. If required, it is very easy to make small adjustments to element lengths and get a low standing wave, using an SWR indicator to check the resonance.

The 3/4-wavelength mode allows you to switch your vertical antenna from the standard 1/4 wavelength to a 3/4 wavelength vertical. A 3/4 wave vertical antenna has a 4 dB advantage over a 1/4 wave vertical, and some higher angle energy. SteppIR provides this option to give you the flexibility of trying both ways, however, this feature only works from 21 MHz through 54 MHz.

Coil Kit

To get 80 and 60-meter coverage, SteppIR sells an optional 80-meter loading coil kit. Essentially it's a high-Q loading coil that accomplishes the base loading needed for the extended coverage. The SteppIR coil has four taps on the 80-meter band and one tap on the 60-meter band—plus one position that switches the coil out of the circuit for operation on 40 meters and above. An internal stepper motor and rotary switch does switching. The SDA-100 controller automatically selects the proper tap and antenna length for the selected frequency.

SteppIR decided to use external brass screws as terminal points for the control cable—it requires a second control

cable independent of the one used for the EHU (element housing unit). The exposed terminals provide convenient access, but a water-resistant connector like the one used on the EHU or a closed compartment would be an improvement. In northeast Ohio, it's likely ice or snow build-up during winter weather conditions could cause trouble for the 80-meter box and the operation of the coil.

Rather than using the recommended RTV silicone to protect the terminals (which could get messy), I used a modified version of AEIS's electrical box solution (http://webpages.charter.net/kotarak/bigir/80m_coil.htm) utilizing a 1-gang shallow Zip Box purchased from Home Depot. I trimmed off the side tabs, applied clear silicone to the box edges, and covered both the ground and control connections with the box.

Assembly

Construction begins with the fiberglass element extensions. An outer sleeve gives the vertical element some rigidity while two sections of 3/4 inch PVC positioned inside guide the copper-beryllium tape up to the top extension tubes. Weather protection is provided at the joints/couplers in the form of large Polyolefin heat shrink tubing filled with a heat-activated adhesive. You need a real heat gun—hair dryers aren't up to the task. Rubber boots with screw clamps are used to connect the two fiberglass pieces and the EHU to the mounting base.

A wind reinforcing kit composed of a metal plate and clamping hardware is included with the kit. It helps stabilize the vertical element, especially if the antenna is not guyed. Though it's not in the manual, SteppIR recommends that if you are planning to use high power in combination with the 80-meter coil option, skip the reinforcing plate installation and use the recommended guying procedure instead because some users have reported arcing problems. In my case, I occasionally use high power. I made a copy of the plate from



Modification of existing mounting base—originally a DXE tilt base.

1/4-inch polymer to add some minimal reinforcement and it doubles as a mounting for a choke balun.

The last portion of this installation is the addition of the 80-meter coil, which covers 60 meters as well. It dwarfs the EHU, but is very lightweight. Mounting requires four screws with spacers, attaching on the back of the EHU. Screw orientation is reversed compared to the others, so be careful here.

Mounting is done using a two-foot long 1.5-inch OD aluminum pipe. It can be secured in the ground with concrete or driven directly into the ground when used in combination with a guy system—one guy mounting is provided. Be sure to take their mounting suggestions seriously. The EHU should be no more than 8-10 inches above the ground/radial plate. Failure to do so will likely cause higher SWR readings and require more adjustment of the antenna controller to compensate.

In my situation, there was already a 1.75-inch OD piece of steel water pipe heavily anchored in concrete surrounded by an existing radial system. This installation required trimming the steel pipe and using a DX Engineering Genius Clamp to place the trimmed mounting post parallel to the existing pipe. Everything fit, and the EHU was 10 inches above the radial plate when installed.

Currently, there are 33 radials in place, each extending as far as they can to the house/property boundaries. Don't cut corners when installing the radials. With ground-mounted antennas and buried radials, more radials and longer radials are better. A choke balun was also installed in the feedline as recommended in the manual. All coaxial connections were sealed for weather resistance using 3M Temflex covered with vinyl electrical tape.

Manuals

After working through the assembly process, I felt the only weak link was the various manuals. A revision/reorganization/update would be helpful. I also noticed that the manual that came with my antenna ordered in September



Internal detail of EHU—note tape and sprocket drive.

2016 was dated as an August 2013 revision.

Though the basic construction of the extension and telescoping poles are clear and well documented, other assembly instructions can be somewhat vague and hard to follow at times. One example was the 80-meter coil manual. It started with mods that needed to be made to earlier versions of the Big IR—somewhat irrelevant and confusing to someone like me who ordered a new BigIR antenna. It might have been better organized, or better yet, separated into a manual for new installations and another for retrofits on older BigIR antennas.

The SDA-100 controller is used for all the SteppIR antennas, but the functions of each antenna differ somewhat. For example, the create/modify instructions were generic and attempted to cover all the various flavors of SteppIR antennas. Those that apply to the vertical antennas should be listed separately from the Yagis for clarity and better comprehension in the controller manual.

Fortunately, solid tech support is available by phone or email to make up for these shortcomings. If help isn't immediately available, I've found that they generally return calls and emails the same day during normal business hours. Upon initial installation, my SDA-100 locked up and would not operate. Rich at tech support walked me through a solution that included some reprogramming and replacing a L6219 stepper motor control chip.

Operation

Before getting on the air, I took some time to check out SWR readings with a Rig Expert AA-54 analyzer. Plots were done for each band, and I adjusted the antenna length band by band using the create/modify menu in the SDA-100 controller—3/4 wave settings were also done separately for everything above 21 MHz. The general pattern that emerged from my installation was that the antenna needed to be shorter on each band. After the process, the SWR was 1.53:1 or less on all bands. Given these figures, it was unlikely I'll



SteppIR BigIR controller.

ever need to use a tuner for this antenna.

You can control the SDA-100 tuning by way of an optional transceiver interface that utilizes Icom's CI-V or similar interfaces on other brands of transceivers. However, band-switching during these operation tests was done manually. I have a couple of HF rigs capable of doing this, but have yet to choose among them and obtain the appropriate cable.

I made several QSOs on 20 and 40 meters, including Illinois, Curacao, and South Africa yielding good-to-excellent signal reports—even during some mediocre band conditions. Receive performance was as good, if not better, than verticals that I've used in the past. It works as advertised and doesn't disappoint.

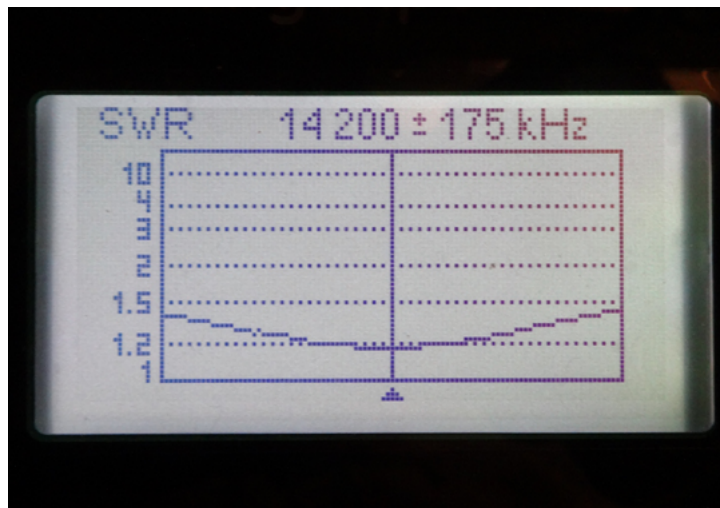
Impressions

I have some very understanding neighbors who put up with my antenna farm. Though the BigIR is actually 8 feet taller than the antenna it replaced, they don't seem to mind since the color of the vertical element seems to blend in better. Some amateurs may find that their HOAs may have fewer objections as it can be less visible than other antennas, and the base can be easily hidden in shrubbery.

Once the installation is complete and the controller properly set up, operation is essentially intuitive and straightforward. If you buy this antenna, be sure to sign up for the Yahoo SteppIR group. I've found some of the tips from members informative, if not downright invaluable.

One great feature is that during strong winds or lightning storm, the antenna element can be retracted in the EHU. In the case the wind damage, repairs would then be less expensive should any of the fiberglass tubes break. This feature also could potentially save the equipment from a potential lightning hit once the antenna is retracted, as there is no conductor in the tube. You may also want to consider retracting the element when not in use for an extended period of time.

Buy the DB25 field splice. It's used to connect the control cable to the SDA-100 controller. The field splice uses



SWR plot taken on 20 meters.

terminal headers with screws—so much easier than soldering a standard DB25—and allows you to easily remove the connector if you need to reroute wires.

One thing I'd like to see is a simple, inexpensive method to help protect the driver chips. Should an accidental short or surge occur in the control line, it will wipe out the chips. Sure, there's a ALP module or the Array Solutions voltage suppressor available, but there should be a less expensive alternative. Perhaps some sort of buffer made of a cheap, expendable and easily replaced component, like transistors, or some MOVs would be a suitable first line of defense and could be included as part of the controller.

To Sum it Up:

Pros:

- Continuous coverage 80-6 meters—great for WARC and MARS frequencies
- Lightweight, installation can be done by one person
- Weather-resistant fiberglass
- Neutral colors blend in
- Easy access with ground mounting

Cons:

- Pricey compared to other verticals
- Requires a number of radials—as do all verticals
- Requires control cables that need to be buried for most installations
- Add-ons required to protect controller

Contact Information:

SteppIR 2112 – 116th Ave NE, Suite 1-5 Bellevue, WA 98004 Telephone: 425-453-1910, <http://www.steppir.com/vertical-antennas>

Price:

BigIR: \$1149, 80-meter coil option: \$405

TSM



Left: Beyond the capabilities of the USB Dongle, the RTL-SDR has two antenna connectors so there is no need to swap out antennas when switching between VHF and HF. (Courtesy: Radioddity.com) Anker Astro E3 ultra-compact portable charger. (Amazon.com)

Going Mobile with Software Defined Radio

By Robert Gulley AK3Q

There are a number of reasons to go mobile with an SDR, not the least of which is the adventure factor! Every new place offers new listening opportunities; it is a bit like fingerprints in that no two locations are exactly the same. Every location offers something different, and with the wide-ranging capabilities of the SDR there are always new things to hear.

Another reason for going mobile is to get away from local noise, whether inside one's house, or from local neighborhood interference. Of course, a trip does not have to be elaborate. Just getting away for an hour at lunch can be a great listening opportunity, and I have several friends who do just that regularly.

For me, one of the best reasons to go mobile is to find great reception spots that present variety from my main operating location at home. Mind you I like my "shack" and have serious radio capabilities there, but sometimes a change in scenery not only brings interesting reception possibilities, but it can also provide inspiration. Sometimes part of the fun is solving a challenge "out in the field" so to speak, and this adds greatly to the pleasure of mobile operation.

Mobile operation can be as simple as taking a basic setup to a local park, or just operating in the car up on a high point right in town. Operating away from home can also be a real adventure such as taking a hike, going camping, or taking a mini-vacation somewhere where reception is sure to be good. I will leave that side of things for discussion on another day. Here I will just cover some of the basics of what one might use on a typical mobile/portable outing.

Power

One of the great things about SDR operation is very minimal power is required to operate, and another is the

power can come from a multitude of sources. For example, if traveling by car there is the option of plugging into the cigarette lighter outlet (or power outlet as they are sometimes called) to power a tablet or phone. Using an OTG (On The Go) adapter for the tablet or phone (if accepted by the device) allows the tablet or phone to be powered while also allowing access to a (typically) standard USB port.

If using a laptop in the car a power inverter is a solid option, but watch out for poorly made inverters, which have noise and/or ripple in the power line. The best kinds to get are those producing a pure or "true" sine wave on the AC side, which, although rarely perfect, reduce power fluctuations to the computer. Computers can be very sensitive to varying power. Of course, we also must make sure the power output of the inverter is sufficient for the laptop, so make sure you understand the power output needs. This information should be printed clearly on the laptop's AC power supply.

For lunchtime breaks or short outings, a fully charged device will likely be enough to enjoy portable operation. A fully charged laptop may last 4-6 hours or more, especially if dimming the laptop screen and or turning off Wi-Fi conserve power. Tablets often have a brightness display that can also be turned down to conserve power.

There are all kinds of options for portable power, from the previously mentioned inverters to home-built power packs designed for one's specific needs. There are some especially useful portable power packs designed for recharging devices away from a wall socket, and these can be useful for powering tablets and phones for use with SDRs as well. Two such power packs are shown here, both of which can fully recharge a tablet or phone several times, or be used to charge the device while operating it. They are small (about the size of a typical phone) and can easily fit into a shirt pocket or



Left: Using an OTG (On The Go) adapter for the tablet or phone (if accepted by the device) allows the tablet or phone to be powered while also allowing access to a (typically) standard USB port. (Courtesy: Dell)

small case with the SDR.

There are larger options for extended use, as well as solar options for USB charging and DIY charger kits available, so in many respects, the sky's the limit. Just make sure you are aware of the power requirements and charging requirements of the devices in use.

Computers

SDRs for the most part require computers (a notable exception is the CommRadio mentioned below), and the most natural choice is a laptop. There are many choices, sizes, and price-ranges, so I will not take up space here for those other than to say that, while small laptops typically use less power, their smaller screens may make working with waterfall displays or spectrum displays more difficult. I prefer a larger screen with the brightness turned down to conserve power over a small screen, but these are personal preferences.

In addition to the tablets mentioned above for portable operation, there have been a number of smaller computers to come on the market in recent years which, when paired with a display adapter, can significantly limit the travel size of equipment.

An interesting computer options include the dual OS boxes by several different manufacturers, which use both Windows 8.1 and Android 4.4. The boxes run anywhere from \$85-\$175 depending on features, and they offer substantial power and versatility. Sometimes marketed as TV boxes, they do have the ability to run serious software, and should be able to handle most SDR and digital mode software applications.

One unit I saw even has a 7-inch screen built in, so it has the portable advantages of a tablet as well as the dual OS capability. While I do not have one of these I would assume there is also the ability to load a Linux distribution in place

of the Windows, unless the partitioning hardware does not allow for this.

Even smaller are several "stick" computers using either Intel Atom or ARM processors, selling for \$100 to \$250 which are Bluetooth, HDMI, wireless networking and USB 2.0 capable. These units tend to be a little light on storage space, but then again, they are not seeking to replace full-blown computers. These are niche products in my opinion, allowing us to have inexpensive computer power to offload work from our main computers.

The best part of all of this is that there are many options available, with more coming every day. Processing power is no longer an issue, nor are storage requirements, as even micro-SD cards are coming in 32, 64, and 128 gigabyte sizes now. For the price of one desktop computer from just a few years ago, a person can now have 4 or 5 computer systems if desired.

If someone would have told me 30-40 years ago I could have a whole computer on a stick I would have said they were nuts. I guess that's what the original room-sized computer operators would have said about the future desktop PCs back in the 1950s!

SDRs

For \$25 or less and a decent VHF/UHF antenna, the SDR dongles are an incredible steal in terms of capabilities and free software options. For another \$20-30 more you can add HF capability and have a full-blown all-mode radio receiver, which is completely portable and controllable through software on a laptop or tablet.

Beyond the capabilities of the USB Dongle, this unit and ones like it have two antenna connectors so there is no need to swap out antennas when switching between VHF and HF. The unit is also enclosed in a metal box providing more



Soft66RTL3 RTL-SDR plus upconverter, plus RF amp combination circuit. (Courtesy: RTL-SDR.com)

shielding to the electrical components inside, which in turn provides cleaner signals and stronger reception. I noticed a significant increase in the number of airplanes I have been able to monitor in ADS-B just by having this unit over the dongle stick.

My very first experience with this unit pointed in this direction, and subsequent use has confirmed it. When I initially hooked up the unit I merely swapped out the dongle for this unit and immediately I had an additional 7 or 8 airplanes show up in my RTL-1080 Mode-S software. Oh, and did I mention this was coming from the included mini-mag mount antenna as compared to an outdoor antenna which had been connected to the dongle?!

Since my initial experience I have seen consistently more planes in the list compared to the dongles I had used previously. I regularly see 13-15 planes at a time, whereas I used to see only 7-8 even with the outdoor antenna.

With a size about equivalent to a small deck of cards the unit is highly portable and lightweight, which means it is great for travel. Most of us travel with some means of computing, such as a laptop or a tablet, and this will work fine on any operating system, which will accept a dongle.

Will this receiver or similarly priced SDRs rival a good shortwave or amateur radio? Not by a long shot. But they do have some advantages over a traditional radio for those times when capability and/or convenience are more important than signal quality. First there is the coverage which goes somewhere around 100 kHz through 1.7 GHz, yes, Gigahertz!

That's a whole lot of radio in one package. With software packages freely available on the Web, there is the capability to use it for shortwave, amateur, broadcast, utility, aeronautic, military, public service, maritime and AM monitoring just to name a few.

Additionally, signals can be seen over a waterfall or as with a spectrum analyzer, and audio may be easily captured for later analysis. Tuning is as simple as clicking a mouse or tapping on the desired signal displayed in the waterfall. Some more expensive units even allow for multiple receivers to be operated at the same time from the same SDR!



RSP-1 from SDRPlay (Courtesy: SDRPlay)

Soft66RTL3

A new entry into the RTL-SDR field but which looks very promising is the Soft66RTL3 which runs around \$40.

This unit features VHF/UHF coverage up to 1.7 GHz, while also having a 50 MHz up-converter for HF (meaning 50 MHz is added to whatever HF frequency is desired: 57.250 MHz setting in the software would translate (or up-convert) to 7.250 MHz actual listening frequency through the software offset. The Soft66RTL3 offers an input gain pot adjustment or trimmer for the HF side to improve HF reception. It also has heat sinks to keep the unit cooler and thus more stable.

SDRPlay

Stepping up about \$80 there is another SDR unit which has recently come on the market and which is a giant leap forward in terms of quality, the SDRPlay RSP. It retails for \$129, has much broader bandwidth coverage at a single time, and of course has better filters and ADC (analog-to-digital conversion) capability.

What is perhaps most significant is that this unit does not rely on OEM software; rather it can run on any software platform that supports the EXTIO library. This means the radio can run under Windows and Linux, and even run on a Raspberry Pi 2/3. The lack of specific OEM software could make troubleshooting a little more difficult, but the wide range of free software more than makes up for this limitation. No worries about software becoming obsolete if the manufacturer should abandon future development.

The wider bandwidth coverage means you can record whole swaths of a band and then later analyze each signal one by one. On a similar radio I once recorded about two hours' worth of the entire AM radio band, and can play each station to listen for IDs and programming. I did this on a particularly quiet night atmospherically, because it is rare at my location.

The same capability could allow one to record whole sections of the HF band to study propagation conditions on



AirSpy R2 (left) and SpyVerter (right) The basic unit covers 24 MHz to 1.8 GHz, while the add-on SpyVerter takes coverage down to DC range. It has a 10 MHz view capability, which means one can see a lot of spectrum in one swipe. (Courtesy: AirSpy)

a given day, catch short burst transmissions such as used in military and civilian aeronautical communications, or record an evening's worth of police and fire calls as just a few examples. Try this with a traditional radio - you simply cannot do it!

AirSpy

For another \$100 or less the AirSpy has been getting excellent reviews (including one by Bob Grove in *TSM* November 2015). The basic unit covers 24 MHz to 1.8 GHz, while the add-on SpyVerter takes coverage down to DC range. It has a 10 MHz view capability, which means one can see a lot of spectrum in one swipe. While I have not used one personally, I have seen them in use and several friends I know who have them are very pleased.

Additionally Spectrum Analyzer software has just been released for the AirSpy, called Spectrum Spy which combines with SDR# software. According to the author: "A new utility app is available for download with the standard SDR# package. It allows the visualization of larger frequency spans by exploiting Airspy's fast frequency tuning capability. The scanning speed is comparable to real spectrum analyzers (maybe faster even!) The project is still in a PoC state, but the basic functionality provided is fully operational."

Elad FDM-S2

One last unit I will mention along these lines is the Elad FDM-S2, which covers 9 kHz-52 MHz, the broadcast FM band, and 135-160 MHz. The SDR retails for around \$520. The maximum bandwidth is 6 MHz, and the recording capability is excellent. Additionally, one can have four virtual receivers freely tunable within DDC window using Elad's included software, with each virtual receiver holding settings for mode, bandwidth, volume, squelch and audio output

routing. This means you can pipe each virtual machine out different audio ports (using virtual audio ports or multiple sound-cards), as well as record four different virtual receivers.

While I had played around with RTL dongles for a time as an introduction to SDR, it was the purchase of the Elad that really brought home the power of SDR for me, and it is still small enough to take on the road along with my laptop. (As an aside, I was able to use the Elad comfortably on a WinXP laptop with its own excellent software, so computing power is not a big issue for any of the SDRs I have mentioned. More power does mean better functionality in terms of recording and opening up virtual receivers, but even the old dual-core machines from years ago can work fine.)

CommRadio CR1A

In something of a category by itself is the CommRadio CR1a which is an SDR radio but which does not need a computer to work. It is a self-contained, battery operated unit which functions basically like a standard SW radio, but which has the capability to be connected to a computer and operated like a traditional SDR. For an excellent review of this radio you can read Thomas Witherspoon's comments [here](#).

(Just announced and tentatively available in early 2017 is the CommRadio CTX-10 QRP transceiver with adjustable power output up to 10 watts. More information may be found [here](#).)

All of these SDRs can travel easily, operate with minimal power requirements, and accept a multitude of antennas for their operating ranges. There are other SDR models as well, and more coming on the market almost every day. There are software packages for Windows, Mac, Linux, Raspberry Pi and other operating systems for SDR/radio combinations. A great starting point to learn about SDR soft-



Left: Elad FDM-S2, which covers 9 kHz-52 MHz, the broadcast FM band, and 135-160 MHz. The SDR retails for around \$520. (Courtesy: Elad) Right: self-contained, battery operated unit which functions basically like a standard SW radio, but which has the capability to be connected to a computer and operated like a traditional SDR. (Courtesy: CommRadio)



ware is **RTL-SDR.COM**.

Here is an interesting point not to overlook: since most SDRs use USB ports on a computer, we do not have to be limited to only one radio! We can go mobile with several SDRs plugged into the laptop. The real limitation is how many antennas do we want to take! I have found most modern laptops have more than sufficient processing power to handle at least two SDR/software combinations. I would suggest experimenting with this at home before going mobile, but with a judicious use of resources there is no reason laptop users cannot have at least two units going if desired.

Tablets are another matter in that they usually do not have more than one USB port available, and their onboard memory might not fit two SDR programs comfortably. Again, experiment before going mobile to see how the system reacts.

Concerning antenna capability, I would highly recommend if you are going to get a unit that covers both HF and VHF+ spectrum, get one which accepts separate antenna connectors for these two spectrum ranges. One antenna simply cannot properly cover this wide of a frequency span without some severe compromise in quality. In fact, this is a good time to look at some antenna options.

Antennas

Choosing the right antenna depends on the RF spectrum to be covered by the SDR. The simplest connection is the antenna that came with the SDR dongle or SDR-Cube. These provide some basic coverage, and depending on one's mobile location, can do quite well. However, like any radio, the better the antenna the more likely one is to receive better signals, at least within limits. Most portable radios are subject to front-end overload, and SDRs are no different.

The SDR dongles can be overloaded with strong signals, although some of this can be mitigated by the software controls such as attenuation and sharp digital filtering. For portable VHF-and-above use there are a number of antennas that can work well for SDR reception, just as with any typi-

cal portable radio setup. Mag-mount antennas for the car can do quite nicely, and if used away from the car a simple metal baking sheet or pizza pan can work as a usable metal base.

Roll-up J-pole antennas are a good option if operating from a fixed location. A bit of twine or string-trimmer line can be used to elevate the antenna using a convenient support such as a tree limb or the like. Similarly, a basic ground plane antenna will work just fine for general reception.

Depending on what you want to monitor, specialized antennas can also be used which, in the upper frequency ranges, do not take up much space. For example, if using the SDR for ADS-B aircraft reception, one could easily design a small antenna built for that frequency. Such an antenna could also work well for the 900 MHz ham band or the 1.2 GHz ham band. Another antenna could be used for the 800 MHz public service band, or a small discone antenna can be used to cover almost all the frequency range of the typical SDR dongle.

Portable Antennas for HF Coverage

When using SDRs for HF coverage or lower, portable antenna choices become more about space, time, and convenience. There are vertical options as well as typical dipole options, and so more than anything else antenna choice will depend on one's needs and their logistics.

For casual operation where one only has a limited amount of time, a key to portable operation will be the time it takes to set up the antenna. There are numerous designs for compact antennas on the Internet, and these can be a source of inspiration for designing an antenna for your own personal needs.

I will mention a few simple ideas here, but do not be afraid to experiment with numerous homebrew designs, as what we build for ourselves will usually meet our needs far better than a general-purpose commercial option.

An antenna which is in almost everyone's arsenal is the wind-up reel antenna included with many portable shortwave radios. Stretched out in the open in a relatively noise-free



TSM regular contributor made this portable BuddiPole antenna system using their Versa-Tee coupler device that allows the user to erect the system in either a dipole or ground plane configuration. (Courtesy: Keith Baker KB1SF/VA3KSF)

environment, these antennas will do surprisingly well. Of course, a random wire antenna can do the same thing, but if you have a reel antenna already they are compact and very convenient.

So-called Hamstick antennas can be useful as either an omnidirectional vertical antenna, or as a convenient dipole when combined with an identical second Hamstick. While these are commonly mounted on vehicles, they can certainly be used in other configurations.

Some supplies, which are nice to have on hand, include telescoping poles such as fishing poles, paint-roller poles, or similar items. Mounted to the ground either with a tripod base or attached to a rod driven into the ground, these collapsible poles can allow the use of a simple dipole antenna. If driving to a location, having a couple of sandbags available to drape over the legs of a tripod can add some stability to the mount.

I will assume for the sake of discussion any needed connectors/adapters are available to connect coax, ladder-line, or random wire antennas to the SDR as needed. I have built up a fairly extensive collection of adapters, barrel connectors, pigtails, and connection options for use depending on my immediate need and antenna options.

Another basic portable dipole option is to use speaker



The BuddiPole Triple Ratio Switched Balun accessory provides an effective match from transmitter to antenna for almost any transmitter/antenna/coax combination. (Courtesy: Keith Baker KB1SF/VA3KSF)

wire wound around spools for each arm of the dipole, with the feedline mounting hardware connecting them. When stored the wire stays untangled, and when deployed, can be easily mounted to a convenient mast and unwound from the spools and tied off to the ground or to local supports.

I also like having a spool of wire for a basic counterpoise for vertical antennas, as this can reduce some of the noise inherent to vertical antennas. These may be clipped on or attached permanently.

Keep in mind since we are just receiving and not transmitting, we do not really have to worry about SWR or matching antenna lengths for resonance. I still like to have an antenna long enough to be useful for the bands I want to receive, so if I want to work in the low bands, for example, I will want an antenna that can receive those long wavelengths decently. In other words, I will use as long of a random wire as I reasonably can, or make my vertical as tall as possible while still being easily portable. Antennas are a highly subjective choice for folks, and you will find what works for your needs with some experimentation.

Wrap-up

Going mobile with an SDR can be a great experience, both in terms of new signals received and for getting away from local noise and interference. The power requirements are low, and computer options today are better than ever in terms of variety, portability and convenience. Take your SDR on the road and have fun—the possibilities are almost limitless!

TSM



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There are a few SSB CB rigs on the market, but a favorite of mine is the Bearcat 980SSB. It earns good “style points” and is a solid performer. It also has NOAA WeatherRadio capabilities, which come in handy more than you might think. (Courtesy: Universal Radio)

The Extra Punch of SSB on CB

By Cory GB Sickles WA3UVV

In recent months, we have spent a good deal of time on the VHF and UHF aspects of CB, but CB is thought of more for what goes on at 27 MHz. To be sure, the core HF allocation is where the majority of CB users start and where they stay. As a simple option to enter the two-way radio hobby, it's hard to beat. But that doesn't mean the world of CB has to be limited to 4 watts of amplitude modulation.

After World War II ended and the Cold War warmed up, SAC (Strategic Air Command) was formed to provide the United States with air superiority and a failsafe means to deliver nuclear bombs throughout the world. While SAC could deliver a “first strike” offense, it was described as a strong deterrent in a world that was becoming increasingly nervous.

When you sent out squadrons of bombers carrying the most horrific weapons known to man, you wanted to be able to keep in contact with them, in case specific in-flight missions needed to be redirected or recalled. That last part is particularly important, as no one wanted to start wholesale death and destruction by mistake.

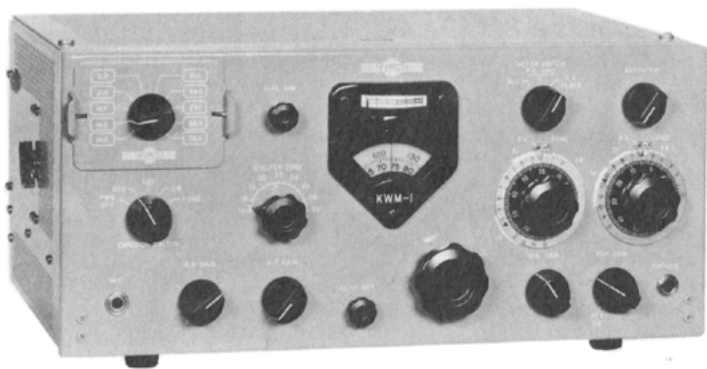
General Curtis LeMay (newly appointed head of SAC) wanted a way to be able to communicate with all aircraft under his command across the entire planet. AM—the preeminent voice transmission technology of the day—was simply not up to the task. (Neither was FM, in case you were curious.) Not to be deterred, LeMay pursued the idea and eventually the Collins Radio Company came up with a proposed solution, Suppressed Carrier Single Sideband, or SSB. While a form of AM, it offered a lot more efficiency and “punch” in delivering a reliable signal.

With the introduction and successive demonstrations of the KWM-1 “transceiver” (another technological breakthrough) SSB became the cutting edge technology that SAC was looking for. The KWM-1 covered 14 to 30 MHz. Advertising and industry write ups also caught the eyes of many hams, who thought about how nice this technology would be for working DX on the 20 (14 MHz) 15 (21 MHz) and 10 (28 MHz) meter bands.

While Collins gear was priced above the budget of the average ham, DX enthusiasts and contesters seem to find the money for such things. Early reaction by traditional AM operators to the “Donald Duck” sounds of SSB were not exactly positive (as is the reaction by many to new technologies) but reports and articles covering the increased performance of SSB could not be long ignored.

As FM on 2 meters eventually overtook AM, and now DV (digital voice) will overtake FM. AM is now a novelty mode (though prized by those who enjoy the wider bandwidth fidelity), which is surpassed by SSB. Because of the different ways each modulation scheme is used (and the increased equipment cost) AM mode on CB continues to prevail on most channels and for most conversations, but SSB has its place as a better communications tool – for those who are more “serious” about their interests.

SSB also offers increased output power, with 12 watts PEP (Peak Envelope Power) being the legal limit. That alone would offer a 3-dB increase in your transmitted signal's footprint. However, as SSB is more efficient, it is effectively far more than that.



The transceiver that started it all. Although limited to the upper HF bands, hams were inspired by it and it helped introduce SSB and serious experimentation. For Collins collectors, it remains a prized possession today. (Courtesy: Universal Radio)

AM produces a constant RF carrier, whether or not there is any sort of “intelligence” (voice, music, hum, etc.) modulating the carrier. The stronger the audio, the higher the PEP, at that given moment. With SSB, the carrier is suppressed and appears only as the audio modulation does. This happens in a very linear and quickly fluctuating fashion, which also makes amplification of a lower-gain per stage, lower-distortion throughout, sort of design. Remember this if you are ever tempted to buy an (illegal) amplifier, but I hope you never are.

Simply suppressing the carrier actually created a DSB (Double Sideband) signal. This is more efficient, but still as wide as conventional AM. By eliminating an unwanted sideband, you create a more spectrum efficient signal; making it (at least theoretically) possible for two signals to coexist in the same space as a single DSB or AM transmission. A USB (Upper Sideband) signal extends up from the carrier frequency – perhaps 27.385 MHz – up to about 27.388 MHz. An LSB (Lower Sideband) signal extends down from 27.385 to 27.382 MHz. Thus, if very precise oscillators were used, it is possible for both to be used without interference. In practice, designs dictated predominantly by price do not allow for such precision, although the typical “bleed-over” is normally not all that noticeable.

Marketing folks like to promote SSB CB rigs as having “120 channels.” They think of it as 40 for AM, 40 for USB and another 40 for LSB. Again, with very precise gear, you could get away with specifying 80, but 120 is a real stretch of the imagination.

As an AM signal of sufficient strength can cause issues with SSB, certain channels have been set aside on an “understanding” basis—more than a gentlemen’s agreement—so that more can enjoy this mode. Channels 35-40 are where you’ll find most activity, with Channel 38 (LSB) seemingly the most popular. In heavily populated areas, this is something of a “call channel” where operators establish contact and then move to another channel to continue.

Bearcat 40 Channel Base CB Radio WASHINGTON



Though long discontinued, the Washington 40 channel CB radio by Bearcat is often found on vintage radio sites selling for \$50-200. (Courtesy: Universal Radio)

Since there are more than a few 23-channel models manufactured long ago that are still on the air, you will also find activity on Channel 16, the original SSB “watering hole.” Give a call here on both USB and LSB, as I’m not sure there’s really a set standard here.

Of note, SSB requires more precise tuning than AM. While it is not legal to move the transmitted signal around, there are fine tuning controls for the receiver. Known more commonly as a BFO (Beat Frequency Oscillator) or RIT (Receiver Incremental Tuning) the more often used labeling on SSB CB rigs is “clarifier.” For most communications, you can leave it in the centered detent position. But when operating under temperature extremes or with older radios, a little adjustment goes a long way toward making the incoming signal sound “normal.”

Notice that I have only lightly covered the technical aspects of SSB, without delving deep into the means by which signals are created and recovered. In this piece, I am more interested in conveying the operation than what is under the (figurative) hood. Much like the complexities of the internal combustion engine, knowing exactly what is going on under the (literal) hood does not necessarily make you a good driver.

With that in mind, operation on SSB is less like what you will hear on AM conversations and more akin to amateur radio. The use of Unit Numbers (a kind of callsign) is encouraged and the use of handles is strongly discouraged. Q-signals are also preferred over 10-signals. Also, before you get on the air, it is a very good idea to adopt another tenant from amateur radio—listen first.

If you invest a little time into monitoring SSB activity in your area, you will sound like less of a “newbie” in your initial conversations and folks will likely warm up to you faster and be that much more helpful.

While SSB is just fine for quieter and more “mature” communications, the increased efficiency and (typically) better receivers increase your range and make for longer



Ameco makes a very nice preamplifier that's good for CB, amateur or SWL use. Designed for transceiver use, it has the necessary switching circuitry built in. (Courtesy: Universal Radio)

distance contacts. While it is important to keep in mind the FCC's 250 km (155.3 mi) distance limitation, SSB does encourage DX (long distance) operation. Another thing that can help with range, as it helps to lower the noise floor, is the use of horizontally polarized antennas. Verticals are normally used and are best for including mobiles into the mix, but going horizontal has its advantages even if the antenna is just a dipole.

Better antennas of some directional design, whether rotatable with three, five or more elements, or a fixed position wire Yagi, will give you gain in a specific direction. The more elements, the narrower the beam width and the better the rejection from the reverse direction the antenna is pointed.

If you have enough property available, a simple diamond shaped rhombic (or set of four, for each compass heading) can be used to provide that gain. As antennas for 27 MHz are relatively small, compared to one at 7 MHz, it doesn't take up all that much space and they don't need to be excessively high above the ground.

For that matter, an "extra long" end-fed wire will reward you with gain. Any of these ideas can produce an ERP (effective Radiated Power) of nearly 50 watts (ignoring possible cable losses) and increase your reception, by a matching factor. Yes, commercial antennas await you, but a little experimenting in this field is inexpensive and gratifying.

Plus, you get to essentially increase your radio's "footprint" without the additional expense of (illegal) amplifiers for your transmitter or (legal) pre-amplifiers for your receiver. If I were to spend additional money on a non-passive device to increase my range, however, it would be the pre-amp. As the old adage goes: "You can't work 'em if you can't hear 'em."

An excellent choice of a "plug 'n' play" preamplifier is the Ameco PT-3. It provides 20- dB of gain, which is quite significant. Designed for use with a transceiver, it can sense

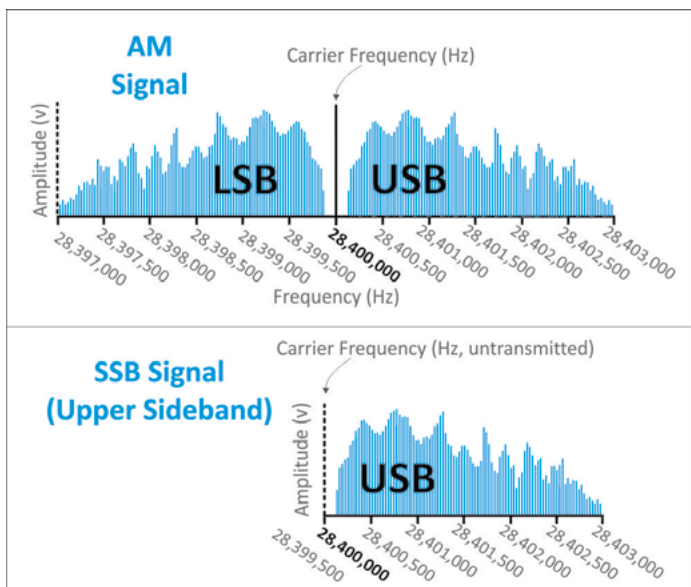
RF and safely handle up to 250 watts, so use with CB power levels is no problem. If you are a ham or enjoy the SWL (shortwave listening) hobby, then this preamp has additional utility, as it covers 1.8-54 MHz.

I mentioned earlier that SSB encourages DX operation. I've never been sure how the 250 km limit was determined to be "the" number. Also, while it is in the rules, I can not think of any times when violating that particular rule was the sole reason for any enforcement actions, at least in the 45 years I've been paying attention. Given the number of stations I can hear each day trying to "work skip" – bouncing signals off the ionosphere or taking advantage of other propagation, it is such a common occurrence that I would think some sort of enforcement action would have been taken, if there was interest.

With that in mind, DX operation is a constant and is welcomed by many CB enthusiasts, especially those that have embraced SSB. As a ham who enjoys QRP (low power – commonly understood as 5 watts or less) operation, I am perfectly fine working DX with legal power limits, a good antenna, solid power supply and preamp. Such a combination makes for a very nice station and is relatively compact.

There are however, those who do not want to communicate within such "limits" and prefer to operate outside the law – and the 40 channels. With a history that goes back decades, they use amateur radio equipment that's been modified or "opened up" to be able to transmit outside of the amateur radio allocations. There are legitimate reasons for being able to do this, but CB is not one of them, and my "wag of the finger" is not going to put an end to it.

There are five channels that are used for Class C devices, such as remote control toys. The "Free Banders" show up in these allocations, from time to time, and take advantage of the quieter spectrum, while staying within the confines of the CB band. If you have a general coverage communications receiver and would like to listen in, here is a list.



AM as used in two-way communications takes up 6 kHz of bandwidth. SSB takes up 3 kHz, or essentially half. With the clipping of sub-audible audio (< 300 Hz) and very stable frequency control, it is possible to have independent LSB and USB conversation going on, using the same bandwidth as one AM signal. (Courtesy: www.hamradioschool.com)

Channel	Frequency
3A	26.995 MHz
7A	27.045 MHz
11A	27.095 MHz
15A	27.145 MHz
19A	27.195 MHz

But the real domain of the Free Bander is below and above the CB band, mostly the latter. A common watering hole is found at 27.555 MHz. There are even social media pages and groups dedicated to this frequency and the activity that surrounds it. This is an international activity and out of the sole control of the FCC. While there is some enforcement, there are simply not anywhere near enough radio police to make a significant difference.

In my book, if you are going to put forth all that effort into just one small part of the HF spectrum, you would be better off to put forth the effort to become a ham. The investment is similar and the rewards are greater. Plus, the nearby 10-meter band (28-29.7 MHz) does not represent the only set of DX opportunities that are available to you. Of some consideration, working DX as a ham, with up to 1500 watts PEP available as a legal power limit, plus all the other fun stuff you can do, and it's absolutely legal. There are no worries every time an unmarked SUV shows up in your neighborhood.

If you are not exactly sure what modern ham radio is and what it has to offer, point your favorite browser over to www.arrl.org for more information. Also, use the "Clubs" link to see what groups are near you. The resources that a good club and its members offer can be simply amazing.

Back to the matter at hand, CB radio offers hobby en-

thusiasts a low-cost entry into the world of two-way communications. The service can be used for business activity, staying in touch with family and friends or making contact with other like-minded operators. MURS and GMRS, covered in previous installments, offer low-cost direct communications or the use of repeaters, respectively. Class D CB gives you an inexpensive taste of local HF communications and the SSB mode offers even more thrills and fun.

Plus, there are plenty of public service opportunities to help out your community during events and in times of need. More important to those activities are organization and training. Groups with a good track record behind them like REACT, SKYWARN and CERT use elements of CB to great advantage.

Unleashed onto the citizenry in 1958 and hitting its peak in the 1970s – CB continues to have relevance and purpose. With the post-explosion activity of decades past, the lower number of users makes for a more civilized experience, in most cases. Like ham radio, it is a microcosm of society, so there are mostly good folks with a few non-good ones in there, too.

I hope you have enjoyed this series and learned something along the way. If you haven't tried any of the aspects of CB for yourself, I hope you do. If it has been many years since you were active on the 40 (or even 23) channels, then maybe this has inspired you to give it a try once more. Should you have any questions that might come up in the coming months, feel free to email me. Who knows, I might just have an answer. If so, I will be happy to share.

Common Q-Signals:

Q-Signals can be posed as a statement or a question. Originally designed for use with Morse code communications to save time. Hams have often used them for voice communications in a "shorthand" form (QRM = interference) and SSB CB users employ them even more so. Here are some that are more commonly used.

- QRM - interference
- QRN – static
- QRT – going off the air
- QRX – stand by
- QSB – fluctuating band conditions
- QSL – an acknowledgment, like "10-4"
- QSO – contact or conversation
- QSY – change frequency/channel i.e. "QSY to 16 low"
- QTH – location
- QTR – the time i.e. "QTR 8:45"

You may hear others in use in a particular area. An Internet search will reward you with a more extensive list.



Left: Thomson Saginaw linear actuator motor for a C-band dish installation. (Courtesy: TVantenna.com) Right: Von Weiss linear actuator motor. (Courtesy of the author)

The Basics of Motorized Satellite Reception: Linear Actuators

By Mike Kohl

This month I'll concentrate on linear actuators, commonly used for motorizing satellite dishes that have a polar mount, not to be confused with the smaller motors used to drive 36-inch Ku-band Free-to-Air satellite dishes.

It is a safe recommendation to the beginner that you should try to acquire the best linear actuator (also referred to as motor drive) that you can afford. Linear actuators come in a variety of sizes and duty ratings, and one should never attempt to use an under-sized device to accomplish the job. Ignoring this advice will inconvenience the user immediately when temperatures get below freezing, with sluggish movement and sometimes even complete failure of a motor after it has struggled with a heavy and/or frozen load. Even in warmer climates, it is still wise to use common sense to avoid operational problems and catastrophic failures.

A few tips to consider: follow general recommendations on which model(s) are appropriate for your particular installation. Test operation and alignment of the system at the dish with a temporary short length of cabling, so that you can observe operation of the system, and identify any abnormalities.

In North America, install the moving end of the arm to the right (west) side of the dish as viewed from the back if you are west of Denver, Colorado (105 west longitude). If you are east of 105 degrees west, install the moving end so

that it attaches to the east side of the dish.

In general, you should install the center clamp as close to the moving end of the actuator's outer tube to take advantage of maximum potential range of travel. Carefully test the sweep of the motor drive's east/west range, avoiding over-extending the arm and/or wrapping the arm around the dish mounting pole by setting a mechanical limit inside of the motor that stops electrical contact past a certain mechanical point.

Two common systems used to do this are: an adjustable rod or "plunger" that is set to trip just past your desired maximum length of travel, or a rotating cam with a pointed edge that hits a mechanical stop as it turns. These mechanical devices form a fail-safe protection that is enhanced by also setting minimum and maximum electrical limits in your antenna controller or satellite receiver.

When installing the motor drive onto the dish, verify that a perfectly horizontal line is formed between the attachment point of the pivot bolt and the moving end of actuator, where it attaches to the dish, both typically using 1/2 inch hardware. Use washers and longer bolts if necessary to keep these two reference points "level" in height above the ground (should cause a carpenter's level to bubble at the center if placed horizontally across the arm of the motor drive). Otherwise you may have loading problems left/right or up/down that could shorten the potential life of your lin-

ear actuator from such added mechanical stresses.

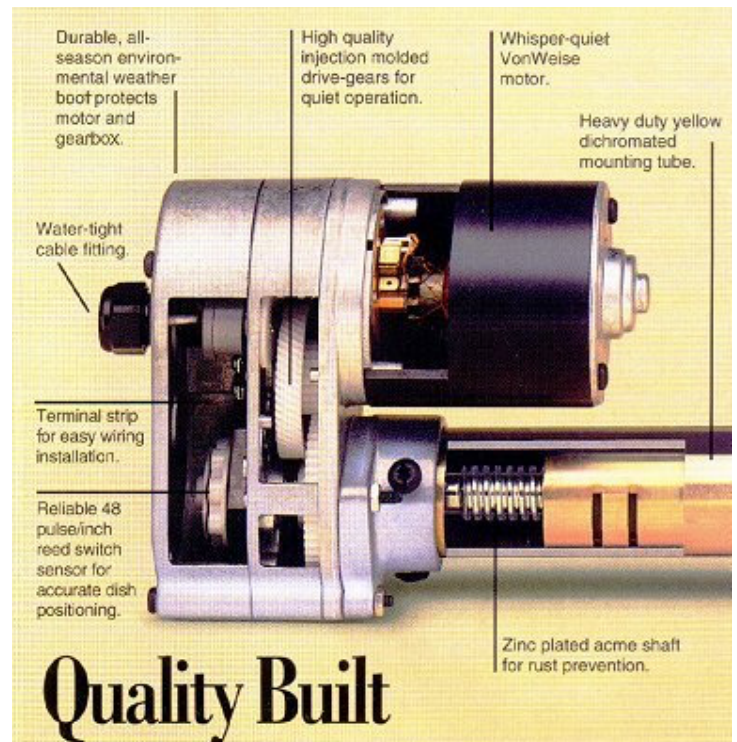
Smaller diameter motor drive tubes (1-1/2 inches O.D. or less) should be avoided unless you are using on a smaller diameter (4 feet or less) satellite dish. Conventional tube diameter on better motor drives is 2-inches O.D. If you are given the choice between an ACME type motor screw and a BALL type screw, choose the BALL type because it is more efficient and longer lasting. An 18-inch length motor drive is sometimes used on budget systems, but those needing to cover the entire geostationary arc are recommended to be use actuators with 24 inches or longer in travel. 36 inches may be needed on a larger, heavier, solid commercial type dish, because attachment points are typically further away from the center pivot point, and require a longer arm length to cover the same distance of travel in the sky. One caveat about what some people assume without first checking mechanical facts: upgrading from a 24 to a 36 inch arm length on most medium duty mesh type antennas does not always give you wider coverage of the sky. Many mesh antennas have motor drive attachment points close enough together that you are not using all of a 24-inch actuator's potential length to cover that sweep of sky. Switching to a 36-inch model simply creates a need to set a mechanical stop at about the same distance, with the excess length at the motor end getting in the way when you are mowing the lawn.

Once you have installed your system and completed alignment, it is a good idea to move the antenna across the sky using the motor system, to determine the lowest height of the motor during its east-west travels. This can collect water inside the bottom of the motor, unless a small drain hole is drilled in the bottom. If in doubt, ask a professional, to avoid drilling in the wrong place.

Still another thing to think about is following manufacturer's instructions about how to twist and later secure a linear actuator in its clamp. The motor should normally be rotated skyward from the tube, and typical plastic wiring plug needs to be secured to prevent water from flowing inward. Still another consideration in properly installed systems is the inclusion of a rubber boot over the moving end of the arm, and a shroud over the motor itself. These may be sold separately by some companies.

Wiring is one consideration that many novices tend to overlook. The old fashioned 4 or 5 multi-ribbon cable for C-band and C/Ku-band installations is becoming very difficult to find nowadays. You may find it cheaper and easier to locate a "Siamese" cable that has one RG-6 type coaxial cable, and one Motor Drive bundle cable, if using a C-band LNBF.

Extra coax for a 2-input LNBF can be run and cable-tied, if necessary. Typical motor drive bundle consists of two 14 or 16 AWG wires for motor connections M1 and M2. Then there are usually three wires typically 22 AWG and colored orange-green-brown, for motor drive sensor connections. Old fashioned four or five wire ribbon cable will normally have three 20 AWG wires in black-red-white, used for servo motor polarizer connections, and one or two



Inside the Von Weiss actuator motor. (Courtesy: Von Weiss)

RG-6 coax cables. These wiring options generally work well in installations less than 125 feet long. If you are requiring a longer cable length, contact a satellite or cabling professional for advice on optional wiring configurations, which may be as simple as doubling up on the motor drive wiring, or using electrical cable such as 12 or 14 AWG Romex for the M1 and M2 motor wires. Excessive lengths of cabling, or undersized wire conductors cause more current to be drawn from your motor drive controller, having adverse effects on performance and life expectancy of such devices.

Three major motor drive/linear actuator manufacturers remain in the North American consumer satellite industry. They are Thomson-Saginaw, Venture, and Von Weise.

There are also some motor drives imported from China, with mixed and often substandard quality. We will first look at Superjack, made by Jaeger, as a typical Chinese brand.

Not all actuators are equal, and stress tests done in cold weather using heavier antennas often find problems. The author experienced this first-hand, using one of the better Superjack actuators, sourced from China, on a medium heavy 10-foot Orbitron mesh antenna. This actuator used a less costly ACME screw (as opposed to the much better BALL type screw), and had a 450-pound capacity. No lubricated parts, no weather boot, no motor cover. At 10 degrees F, it would quit working. That left me two choices other than waiting for the weather to warm up. Carefully heat the tube with a propane torch without actually harming the actuator, or possibly install a heat tape commonly used for keeping water pipes unfrozen. Before I had the ambition to go back out there, I waited until the following day to test it again, thinking maybe it had warmed up sufficiently to move. It had...just enough to allow me to break something inside the



Lowly, but still functional, SuperJack linear C-band dish mover. (KS4ZR photo)

drive arm that had become brittle in the cold. That was the end of that experiment, trying to save a few dollars. You will probably get the same results with many of the smaller 12 and 18-inch mini-actuators when using them on an oversized load. Another frustration with many of the Chinese units is miniature screwdriver connections that do not allow a secure tightening to prevent the wire from falling out of its miniature socket.

My advice is to buy American! Thomson-Saginaw is a very popular name in the commercial and semi-commercial antenna world. While Thomson-Saginaw has an extremely wide line of actuator products, four models are most commonly used in the satellite reception industry. These would be the 24 and 36-inch versions of their Ball Screw Actuator, in either a Potentiometer (3 wire) or a Reed Sensor (2 wire) version. All are rated at being capable of a 1500-pound load. One retail source is Viking Satcom at (517) 629-3000, or on the web at **www.vikingsatcom.com**

Venture Manufacturing also has a variety of actuators in three product lines. First is their Mini T standard duty actuator, using a 1-1/2 inch outside diameter tube. Rated at 500# and intended for smaller antennas, typically six feet and less. Venture also makes an 18 or 24 inch Acme Screw actuator using a 2-inch outside diameter, rated at 1000 pounds of thrust. Those not satisfied with Acme Screw option should consider a heavy duty Ball Screw model, with same length and tube sizes, but capable of 1500 pound capacity.

Contact Volunteer Satellite Distributing at (615) 943-0838 or **www.primefocusantenna.com** is a trusted source for Venture products.

Von Weise was my favorite motor drive manufacturer during the heyday of C-band in the 1990s. One particular model that I sold more than any other was the Von Weise V76-5.

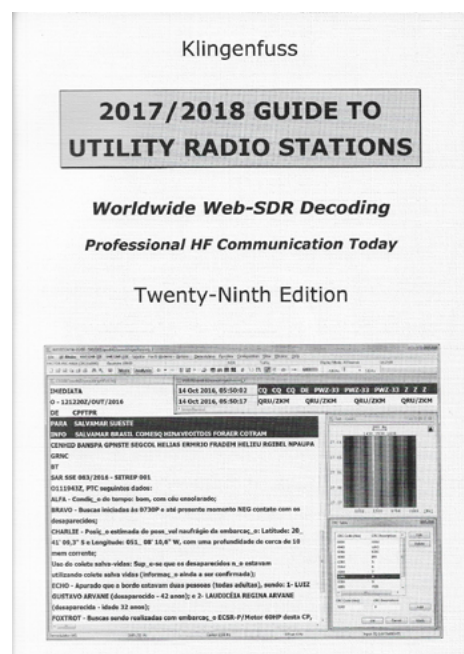
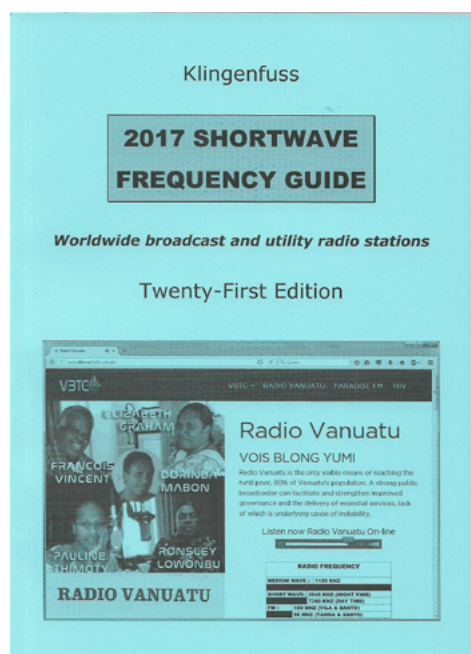
It was fast, quiet, and more than sufficient for any consumer installation that I encountered. The secret was a 19:1 gear reduction that greatly improved efficiency, and this model was the ONLY actuator that did not overheat during



New life for linear actuator manufacturers in the PV solar industry, driving solar panel arrays. (Courtesy: Ali Express.com)

some torture tests that I did with it and competing models while developing a patented compound lever mechanism within a polar mount that allowed a 24-inch actuator to travel a full 180 degrees, as compared to perhaps 90 to 110 degrees with an average normal polar mount. Incredible stresses were delivered to any actuator as we put it through its paces, but this particular unit remained almost cool during the worst of the testing that made other actuators physically hot to the touch. I have re-discovered Von Weise now providing a huge array of actuator products from a Michigan headquarters, continuing in business for over 50 years, with some changes in ownership in between. There are now potentiometer as well as Reed sensor models of the Von Weise V76-5 actuator, rated at 600 pounds of thrust @ 36 VDC yet only drawing 3 amperes of current, and moving an amazing 11 inches per minute. Von Weise products can be found on their website: **www.vonweise.com**

Further information about these and other motor drive products can also be obtained directly from the author, preferably by email at globalcm@mhtc.net



Left: Klingenfuss 2017 Shortwave Frequency Guide (21st Edition) Center: 2017 Super Frequency List CD. Right: Klingenfuss 2017/2018 Guide to Utility Radio Stations. (Courtesy: Klingenfuss Publications)

TSM Reviews:

Klingenfuss 2017 Shortwave Frequency Guides

By Bob Grove W8JHD

For several decades, Joerg Klingenfuss has been the consummate publisher of radio frequency directories on a global basis. His latest offerings include frequency guides, databases and CDs, code books, signal sound CDs, a frequency list for the Perseus SDR, screen shots on a USB stick, and Internet web pages.

We decided to take a look at his offerings for 2017. Three of his publications were chosen: the 2017/2018 Guide to Utility Radio Stations, the 2017 Shortwave Frequency Guide, and the 2017 Super Frequency List on CD. We weren't disappointed.

The 544-page Utility Guide, the 29th edition of this superb reference, should put to rest any suspicion that shortwave utility use is waning. The first 200+ pages are arranged in frequency order from 1.6 – 28 MHz with some services between 20 and 612 kHz. Lists include, where applicable, frequency, call signs, location, mode, and schedules.

Successive lists of call sign identification; meteorological services; Telex and digital data; NAVTEX, and an extensive collection of digital data transmissions and images follow an additional alphabetical arrangement of stations, by location.

The Utility Guide concludes with an extensive list of Q, Z, SINPO, and SINPFEMO codes. A handy list of international emission designators is provided along with station classes and designation of the services. A final list of global band plans for the aeronautical mobile service, maritime mobile service, and a glossary of terms and abbreviations,

leaves little to the listener's imagination. Contents of the guide are continuously updated online on their "hot frequencies" Web page.

The 21st edition of the 352-page Frequency Guide for 2017 separately addresses broadcast and utility stations. For new shortwave listeners, an introductory section outlines various classes of stations that can be monitored on the shortwave spectrum. It is a global overview of modes, countries, and services.

The utility frequency section, covering 20 kHz to 26 MHz, is arranged in ascending frequency order, and includes station name, location, schedule, language, and targeted countries. The international broadcast services are arranged by country of origin, and include clandestine stations. As with the utility guide, a handy list of abbreviations concludes this directory.

Klingenfuss' new 23rd edition of the Super Frequency List on CD is a massive compendium of the print guides' contents (some 37,000 entries!), and includes a separate list of hundreds of discontinued frequencies along with identifiers. The CD has a voluminous collection, nearly 500 examples of digital images actually taken from the shortwave spectrum. Its contents are separated into two volumes: English and German.

Klingenfuss publications are available internationally from his web page: www.klingenfuss.org, or domestically from TSM advertisers Universal Radio: www.universal-radio.com.

TSM

SCANNING AMERICA

By Dan Veeneman

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New Digital Modes for Some Scanners

For many years, the only digital systems consumer scanners were capable of monitoring were APCO Project 25 (P25). Although P25 networks are common and numerous, other types of digital systems, including Digital Mobile Radio, MotoTRBO and NXDN, are also rapidly gaining in popularity.

Digital Mobile Radio

Digital Mobile Radio (DMR) is a set of digital standards defined by the European Telecommunications Standards Institute (ETSI). The standards have three tiers, where Tier I defines low power (less than half a watt of transmit power), low cost consumer operation, Tier II defines higher power licensed conventional professional mobile radio (PMR) operations, and Tier III specifies licensed trunked systems with voice, packet data and short messaging services.

Unlike some other standards, DMR is open and freely available for anyone to read and review. This is intended to encourage competition between equipment providers and prevent customers from being locked in to a single manufacturer.

DMR uses a two-slot time division multiple access (TDMA) scheme that fits two users into a standard 12.5 kHz channel. Each user is assigned to transmit during one of the two timeslots and to receive during the other timeslot. For instance, User A will transmit during timeslot 1 and receive during timeslot 2 while User B will do the opposite, that is, receive during timeslot 1 and transmit during timeslot 2. These timeslots are very short, which means that a radio will rapidly switch back and forth between transmitting and receiving. So rapidly, in fact, that to the user it will seem like the radio is continuously transmitting or continuously receiving.

From a hardware design perspective, using TDMA in this manner actually simplifies the radio hardware. Because the radio does not have to transmit and receive simultaneously, a single frequency synthesizer chain can be used for both transmitting and receiving instead of two. More importantly, because the transmitter portion of the radio is never active at the same time the receiver portion is working, the designer does not have to worry about the locally transmitted signal interfering with reception of the desired external signal.

TDMA also allows additional functionality by enabling



Whistler TRX-2 (base/mobile) scanner now DMR and MotoTRBO capable. (Courtesy: Whistler Group)

the radio to receive commands and instructions while the user is talking. For instance, an emergency signal could interrupt a talkative user or a dispatcher could remotely disable a radio with a stuck 'transmit' button.

Since in normal DMR operation each user is transmitting to and receiving from a repeater site, the repeater will receive User A and User B in turn, alternating between them. The repeater will transmit to User B and User A in turn, also alternating between them. Because two users fit within a 12.5 kHz channel, DMR provides the equivalent of one user per 6.25 kHz of spectrum, which is a Federal Communications Commission (FCC) requirement for system efficiency.

Each DMR timeslot is 30 milliseconds long, with a one-millisecond guard time between each user. This guard time provides a buffer between user transmissions, preventing these two signals from overlapping if a radio has a poor internal clock or is located far from a repeater site. A radio may have an internal clock that varies by as much as a half-millisecond, which means that it won't transmit exactly at its assigned time – it may be just a little bit early or a little bit late. This uncertainty about exactly when the user transmits can be up to half of the guard time. Since two-way communication requires both transmission (uplink) and reception (downlink), in practice there might be only a quarter of a millisecond between transmissions as seen from the repeater site. At the speed of light, a radio signal travels about 45

miles or so in that quarter of a millisecond and is therefore the theoretical maximum range of a DMR repeater site.

The guard time also gives the radio hardware sufficient time power up and power down the transmit amplifier and to retune from the transmit (uplink) frequency to the receive (downlink) frequency and vice versa without delaying the start of transmission or reception.

DMR uses a four-level frequency shift keying (4FSK) modulation method that assigns two information bits to each of the four levels. Each of these levels represents a unique symbol that a receiver can recognize. 4FSK can be implemented in radios relatively easily with inexpensive, power-efficient transmit amplifiers that allow batteries to last longer and do not generate much heat.

DMR transmits these symbols at a rate of 4,800 each second. Because each of these symbols represents two bits of information, the channel data rate is 9,600 bits per second (bps), about the speed of an old dial-up computer modem. After accounting for overhead information and forward error correction, the actual data rate available for a single voice user is 2,450 bits per second. This relatively low rate requires a very efficient voice encoding and decoding scheme, which is provided in DMR by the patented AMBE+2 vocoder from Digital Voice Systems, Inc. (DVS).

In 2005 a number of radio manufacturers agreed to a Memorandum of Understanding (MOU) and established the first set of DMR standards. In 2009, MOU members set up the DMR Association to ensure interoperability between different vendor equipment and promote the use of DMR. Membership in the Association now includes more than 120 manufacturers, application developers, end users and technology partners. The Association also maintains a technical working group as well as a testing and accreditation laboratory. All of the DMR standards can be found on the Association website at www.dmrassociation.org.

MotoTRBO

MotoTRBO is a digital radio system sold by Motorola that is compatible with DMR but with a few additional features. It carries two users in a 12.5 kHz channel using TDMA and has three trunking options: Connect Plus, Capacity Plus, and Capacity Max. Each Motorola product has a set of performance capabilities and limitations on the number of users and simultaneous transmissions but retains basic compatibility with the ETSI DMR standard.

NXDN

Next Generation Digital Narrowband (NXDN) is a digital radio protocol developed by ICOM and JVC Kenwood Corporation. Kenwood markets their equipment as “NEXEDGE” and ICOM uses the “IDAS” (ICOM Digital Advanced System) brand name. NXDN is used in many different markets, including railroads, construction, taxi companies, and hotels, as well as smaller public safety orga-



Whistler TRX-1 hand-held scanner also now DMR and MotoTRBO capable. (Courtesy: Whistler Group)

nizations.

NXDN uses frequency division multiple access (FDMA) to fit a single user in a 6.25 kHz channel, which is conceptually simpler than the TDMA methods used in DMR. NXDN also uses 4FSK modulation, but runs it at half the rate (4,800 bps) in order to fit within the narrow channel. NXDN uses the same AMBE+2 vocoder as DMR but the over-the-air formats of the two technologies are not compatible.

NXDN supports conventional operation as well as two trunking protocols, referred to as Type-C and Type-D. NXDN Type-C trunking uses a dedicated control channel that is constantly transmitting and receiving and centralizes the allocation of traffic channels. Type-D does not use a control channel and distributes the selection of traffic channels in a manner similar to the old Logic Trunked Radio (LTR). Each radio is assigned to a “home repeater” and a low data rate stream on a home voice channel provides control information.

As with other trunked radio technologies, NXDN supports operation over both stand-alone and multiple repeater sites as well as carrying individual and group conversations.

Short data messaging is also available.

The NXDN standards are also open to the public. The NXDN Forum was created in 2008 to promote the development and deployment of NXDN technology and currently has more than 30 member companies. It can be found on the web at www.nxdn-forum.com.

Whistler Update

In the June 2016 column we discussed the announcement from the Whistler Group regarding the introduction of two new scanners capable of monitoring Digital Mobile Radio (DMR) and MotoTRBO transmissions. The new models, the TRX-1 (handheld) and the TRX-2 (base/mobile), are both capable of monitoring Project 25 Phase I, Phase II and the interim X2-TDMA, along with conventional DMR and MotoTRBO trunked systems.

The TRX-1 and TRX-2 scanners began shipping in late June and have street prices of about \$550 and \$630, respectively.

At the time of the announcement in May, Whistler indicated that development of NXDN monitoring was underway and promised to release a no-cost firmware update that would enable the TRX-1 and TRX-2 to monitor NXDN transmissions. In December Whistler made good on their promise.

The updates are available now and can be performed using the Whistler application called EZ Scan, which is included on the scanner's SD memory card but is also available for download from the Whistler website at www.whistlergroup.com. After connecting the scanner to your PC and running EZ Scan, check for updates and let the application download the available firmware updates. Whistler recommends that you perform the updates in the following order:

1. Update the PC Application
2. Update the CPU
3. Update the DSP
4. Update the Library

Whistler also offers free updates for the WS1080 and WS1088 (handhelds) and WS1095 and WS1098 (desktop/mobiles) scanners that provide DMR and MotoTRBO monitoring capability. The updates are also installed using the EZ Scan software.

Uniden Update

Uniden has two updates available for their late model digital scanners that add additional monitoring capabilities. These updates are separate and independent of each other and there is no particular order in which they need to be installed.

The first upgrade enables the BCD436HP, BCD536HP, BCD996P2 and BCD325P2 scanners to monitor DMR, MotoTRBO Connect Plus, MotoTRBO Capacity Plus, and



Uniden BCD536HP scanner now DMR and MotoTRBO capable at a price (Courtesy: Uniden)

DMR Tier III systems. This upgrade is priced at \$60.

The second update, priced at \$50, adds support for monitoring ProVoice systems to BCD436HP, BCD536HP, BCD996P2 and BCD325P2 scanners.

ProVoice is a digital voice format used on many EDACS (Enhanced Digital Access Communications System) networks, including several major public safety radio systems like San Antonio, Texas and Honolulu, Hawaii. It uses an older vocoder called IMBE (Improved Multi-Band Excitation) licensed from DVSI, Inc. Although P25 systems also use IMBE, the two over-the-air formats are not compatible.

These two upgrades are available to registered scanner owners, who can enter their device's electronic serial number (ESN) at the website my.uniden.com. After purchasing the upgrade, Uniden will provide an authorization key that needs to be entered into the scanner.

Uniden explains their decision to charge for updates as a reflection of their "a la carte" business model that does not force all customers to pay for capabilities they do not need. It also allows Uniden to pay license holders only for those scanners that actually use their technology.

All of the scanners listed below are capable of monitoring the following:

- Conventional analog channels
- Conventional P25 digital channels
- Motorola Type I and Type II trunked systems carrying analog and P25 voice traffic
- EDACS analog trunked systems
- Logic Trunked Radio (LTR) analog trunked systems
- P25 Phase I and Phase II digital trunked systems

Updates will enable the following capabilities, as noted:

- DMR Tier II conventional channels
- DMR Tier III trunked systems
- MotoTRBO Capacity Plus trunked systems
- Conventional NXDN (Whistler only)
- EDACS trunked systems carrying ProVoice traffic (Uniden

only)

The following scanners are capable of monitoring the digital systems as listed, after performing any required firmware updates:

Make	Model	Capabilities
AOR	DV-1	DMR, MotoTRBO,
NEXEDGE (no trunking)		
Uniden	BCD436HP	DMR, MotoTRBO, Pro-Voice
Uniden	BCD536HP	DMR, MotoTRBO, Pro-Voice
Uniden	BCD325P2	DMR, MotoTRBO, Pro-Voice
Uniden	BCD996P2	DMR, MotoTRBO, Pro-Voice
Whistler	TRX-1	DMR, MotoTRBO,
NXDN (conventional only)		
Whistler	TRX-2	DMR, MotoTRBO,
NXDN (conventional only)		
Whistler	WS1080	DMR, MotoTRBO
Whistler	WS1088	DMR, MotoTRBO
Whistler	WS1095	DMR, MotoTRBO
Whistler	WS1098	DMR, MotoTRBO

St. Croix County, Wisconsin

In December, the county of St. Croix in western Wisconsin awarded a \$2 million contract to RACOM for upgrades to the public safety radio network, including a distributed simulcast radio system from Harris and nine new dispatch radio consoles.

St. Croix County is home to nearly 85,000 people and is located on the border with Minnesota, about 40 miles east of Minneapolis. It covers an area of just over 700 square miles.

The St Croix County Emergency Center, located in the town of Hudson, is a public safety answering point (PSAP) for 9-1-1 calls and provides dispatch and centralized communication services for more than three dozen local fire, emergency medical service, and public service agencies.

The county sent out a request for proposals (RFP) in August and received responses from four potential vendors. A selection board chose RACOM as the most cost-effective. Contracts for new repeater site facilities and a microwave backhaul upgrade were awarded earlier in 2016, marking the first substantial upgrade to public safety radio systems in the county since the 1970s.

The new system will allow the county to control radio communications from both primary and backup dispatch locations. The new system will operate in the VHF (Very High Frequency) band and have the proper equipment to support analog and P25 radios, allowing local agencies to transition

to digital operation at their own pace. Repeater sites will be configured to transmit the same information at the time using a method called simulcast.

The new system is expected to be deployed and tested during the second quarter of 2017.

The following analog frequencies are in operation in the county:

Frequency	Description
37.1000	Baldwin Department of Public Works
150.9950	County Events
151.1750	Hudson Emergency Medical Services
151.2500	County Emergency Management
151.6250	Cedar Lake Speedway (New Richmond)
154.1000	New Richmond Police
154.1900	Glenwood City Fire
154.3250	County Fire (Dispatch Repeaters)
154.7250	County Sheriff
155.0250	Baldwin Emergency Medical Services
155.0925	Baldwin Department of Public Works
155.1450	North Hudson Police and Dept. Publ Works
155.3400	Emergency Medical Services to Hospital
155.5800	County Sheriff (West Dispatch)
155.7000	County Sheriff (East Dispatch)
155.7450	County Fire and EMS Paging (Dispatch)
155.8350	Somerset Department of Public Works
155.8650	Somerset Police
155.9250	Roberts Department of Public Works
155.9550	Hudson Police (Car-to-Car)
156.2250	County Highways
453.4000	County Emergency Management
453.6125	County Jail
454.0000	Cedar Lake Speedway (New Richmond)
462.4500	Baldwin Area Medical Center
462.7500	St Croix Medical Center (Paging)
463.9750	Allina Hospitals (River Falls)

There are also a number of DMR channels in operation. Several are licensed under FCC call sign WQVL952 in the towns of Hudson, New Richmond, and Hammond:

Frequency	Description
453.1625	County Health Center Maintenance (New Richmond)
453.2375	Unidentified (Hammond)
453.4500	County Health and Human Services (New Richmond)
453.5500	County Government Center (Hudson)

Westfields Hospital in New Richmond is licensed for two base station frequencies, 152.4575 MHz and 160.1100 MHz, which are reported to be operating as DMR channels. In addition, utility provider Midwest Natural Gas is licensed for a DMR channel in St. Croix County on 461.1925 MHz.

TSM

FEDERAL WAVELENGTHS

By Chris Parris

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A New Year In Federal Monitoring

Hello again to all the readers of *The Spectrum Monitor*, and welcome to another year of Federal Wavelengths! 2017 will have a number of large-scale public events that will give listeners a lot of potential for intercepting federal and military radio communications. Events such as the 2017 presidential inauguration in Washington, DC, and Super Bowl 51 in Houston, Texas, will both have large federal agency responses. I will be covering these events from the viewpoint of the related federal and military communications. But there are more items of discussion ahead!

New Digital Modes!

One of the hottest topics in both scanner monitoring and amateur radio these days has to be the new digital modes that are now available for both two-way radio users and monitoring hobbyists. In recent years, more and more business, commercial, amateur radio and some public safety systems have been utilizing various forms of digital communications that could not be monitored by any available scanner models. The modes included DMR (marketed by Motorola as TRBO), NXDN (Developed jointly with Icom and Kenwood, marketed as IDAS or NEXEDGE) and others. As the sales of these different digital radio formats to the small public safety market started to increase, the demand that digital scanners cover more than just one digital mode started to increase as well.

The first introduction of digital audio reception with a scanner was introduced by Uniden in 2003, when they released their BC-250D and BC-785D scanners. Both required an optional digital card that would allow the reception of un-encrypted APCO-25 digital, popular at the time with some police and public safety digital trunking systems. Shortly after, GRE of Japan released the PRO-96 and PRO2096, both sold in the U.S. by Radio Shack. These breakout scanners allowed listener's access to radio communications that had previously been inaccessible. And now another milestone in digital monitoring has been reached.

Over the past several years, many radio and computer hobbyists were utilizing the small USB sticks that contained Software Defined Radio (SDR) receivers, allowing them to build and operate radio receivers with computer software. These receivers, with the appropriate software, could demodulate many different digital voice or data modes. But these required the use of a computer to operate, making portable



Whistler TRX-2 mobile scanner that receives P-25, DMR and NXDN digital transmissions. (Courtesy: Universal Radio)

or mobile operation inconvenient. But in 2016, both major manufacturers of scanning radios sold in the U.S. have begun offering digital reception that had not been available with their radios before.

Uniden first announced a firmware upgrade for their HP-436 and HP-536 scanners that would allow for the reception of ProVoice digital mode. While not widely used, there are still a number of public safety trunked radio systems that utilize the ProVoice digital mode, originally developed by GE/Ericsson. Shortly after the ProVoice upgrade was made available, Uniden announced that they were going to offer another paid upgrade that would make reception of the Digital Mobile Radio (DMR) format on the same scanner models.

Not too long afterwards, the Whistler (formerly GRE) line of scanners offered a free firmware update to allow DMR reception. Whistler also promised another update to the new TRX scanner models that would provide for NXDN digital reception. As of the writing of this column, the NXDN upgrade from Whistler was made available for download in mid-December. Shortly after the Whistler NXDN upgrade was released, Uniden countered with an additional ProVoice and DMR upgrade offer for their 325P2 and 996P2 scanner models. No announcement was made about an NXDN upgrade for any Uniden scanner model.

So how do these new digital modes effect federal monitoring? Initially, it didn't seem like these new digital offerings would be much use to federal agency listeners.

However, as these new digital radios became more and more available in the land mobile radio market, some federal and even military groups and agencies started buying them.

DMR digital transmissions have been heard in use by a number of federal facilities, including:

- U.S. Post Office sorting and bulk mail facilities around the country – Many Postal Service sorting facilities are now using conventional DMR, and larger facilities may be using DMR trunked systems for their operations.
- The Federal Reserve Banks - Some Federal Reserve banks have been heard using DMR digital radios for security and building operations.
- Department of Veterans Affairs Medical Centers – Many VA Medical Centers around the country have adopted DMR radios for building or grounds maintenance. The use of DMR by VA security is still rare, but if you know of any please let me know.
- Reports have been received that the Environmental Protection Agency (EPA) has been heard using DMR radios on their federal VHF frequency assignments at some of their facilities outside of the Washington DC area.
- Smaller federal agencies and offices, many in the Washington DC area, such as museums and non-law enforcement agencies, have been heard utilizing DMR or NXDN radios for their building or security operations.
- A new NXDN digital trunked system, probably managed by the National Telecommunications & Information Administration (NTIA), is on the air in the Washington, DC area. The frequencies used are 406.5875, 407.6750, 408.4500, 409.4250, 409.7500, 409.8500, 409.8875 and 410.9625. Specific users and talk groups are still being discovered.
- There are reports of DMR radios in use at the Dahlgren Navy Support Center in Dahlgren, Virginia on 164.9625 MHz.

While federal law enforcement agencies, such as the Federal Bureau of Investigation (FBI) and the U.S. Secret Service (USSS) were early adopters of the Motorola ASTRO digital radios, now nearly every federal law enforcement agency has adopted APCO P-25 digital radios of some kind. This became the de facto standard in federal digital communications to promote seamless interoperability to various agencies when called upon to work together in an emergency situation. In fact, it has been a federal requirement that even state or local public safety agencies were supposed to adhere to the P-25 digital radios if they were receiving federal funding to buy radio equipment.

But then, why let the Post Office and VA use non-P25 digital radios? Most likely these agencies are exempt from needing to be interoperable with other law enforcement or federal agencies. They are free to purchase whatever radio equipment they need in order to operate their facilities. And, since the radio equipment manufacturers are pushing the new digital lines of hardware, many of these agencies and offices will buy what is offered. Digital radios do offer some advantages to the users agencies over analog, such as GPS locating



*A collection of the various makes of digital portable radios that are being used by government agencies across the country.
(Courtesy of the author)*

and digital messaging.

Keep an eye on what comes over the next several years as the move towards more and more digital radio equipment (and possibly encryption) makes the monitoring hobby much more interesting and challenging!

Presidential Inauguration

Following what could be called a very contentious election season, a new president and vice president will be sworn in to office in 2017. Currently scheduled to occur at noon on January 20, 2017, Donald Trump will be sworn in as the 45th president of the United States, and Michael Pence will be sworn in as vice president of the United States. If the weather permits, the inauguration should take place on the U.S. Capitol's West Front. Information on the presidential inauguration and events surrounding the inauguration can be found at these web sites:

<https://washington.org/DC-guide-to/presidential-inauguration-washington-dc>

<https://www.usa.gov/inauguration-2017#item-213261>

This event will fall under the heading of a National Security Special Event, with the U.S. Secret Service acting as lead agency for event security planning. As with other inaugurations, the federal and military response in the Washington, DC, area will be massive. The security for the inaugural celebrations is a complex matter, involving the not only the Secret Service, but also agencies of the Department of Homeland Security, the Federal Protective Service, all five branches of the Armed Forces, the U.S. Capitol Police, the United States Park Police, and the Metropolitan Police Department of the District of Columbia (MPDC). Federal law enforcement agencies also often request assistance from various other state and local law-enforcement agencies throughout the United States. Nearly every federal agency

and some military units will be actively providing security or support to the actual inauguration and surrounding events. It is expected that the events will draw huge crowds and most likely protesters of many kinds.

It will be a challenge to try and monitor the goings on in the National Capitol Region during all this, as there will likely be many different radio systems and frequencies in use. Unfortunately the primary public safety agencies in Washington, the DC Metropolitan Police and the DC Fire and EMS Department, remain nearly all encrypted on their digital trunked radio system, but there will likely be some clear traffic on some common interoperability.

channels and talk groups. Besides the obvious police, fire and public safety channels, the aircraft bands will be busy coordinating all the federal and military air units, as well as news media. And don't forget about the national and international news crews covering this event, as many will have radios and wireless microphones and IFB earpieces, taking cues from producers. Many businesses will be active with support to events, such as buses, food and beverage delivery and things like portable toilets and water.

For quite a few years the Capitol Hill Monitors group has provided a good overall listing of possible federal and military frequencies that have the potential for use during the run up to the inauguration. Alan Henney has devoted a lot of time and effort pulling these frequencies together in one listing. You should be able to find a copy of this listing at his Capitol Hill Monitors web site, <http://henney.com/chm>.

Super Bowl LI

The fifty-first championship game of the National Football League will be played on February 5, 2017. The game will be played at NRG Stadium in Houston, Texas. This is the second Super Bowl for this stadium and the third for Houston. I will be on site at the stadium doing my primary job as an engineering tech manager for the international clients that will be broadcasting the game to the world. And, hopefully, will have a few scanners along side to monitor what is going on.

As with recent Super Bowl games, this year's big game is also classified as a National Security Special Event, similar to the presidential inauguration. Listeners in the Houston area have already started hearing testing on what might be additional interoperability channels that may be in use for the Super Bowl. Some have heard references to training for the Houston police and fire departments related to the Super Bowl events. There will be some sort of interagency coordination center in operation for the weeks leading up to the big game. It usually carries a name, such as Tactical Operations Center (TOC) or Joint Operations Center (JOC).

Every Super Bowl game brings out multiple federal agencies and personnel from around the country. The Customs and Border Protection (CBP) Air and Marine Operations will provide multiple aircraft, both fixed wing and helicopters, to patrol the airspace over and around the



Even at the “National Tree Lighting Ceremony” in December, Secret Service agents are prepared. They will be all over this month’s inauguration. (Courtesy: US Secret Service)

stadium. The CBP sometimes provides overhead surveillance and live video downlinks during movements of the team busses around the area. During the big game, it is likely there will be a Combat Air Patrol flying fighter jets overhead. And groups such as the Environmental Protection Agency and the Department of Energy will be monitoring the environment for any suspicious changes in background radiation or possible airborne toxins. This testing will begin several weeks prior to game day and will likely occur all over the Houston metropolitan area.

Some frequencies for the National Football League operations in Houston were recently posted on a radio related Yahoo group. You can find these frequencies by searching the FCC Universal Licensing System web site and search for the call sign WQYM440 for the temporary frequencies granted to the NFL.

There were some comments posted that were questioning the need for so many frequencies by the NFL. But what a lot of folks do not realize is how many things are going on during the weeks leading up to the Super Bowl and that are happening all over town, not just at the football stadium. Team hotels, media centers, and the public events, such as the NFL Experience, all have a number of radio channels for the NFL in operation, as well as several city-wide repeaters set up for the events. Starting several years ago, nearly all the NFL radios were DMR, with some encryption.

I will bring you a full “after-action” report on what was heard on the scanners at the Super Bowl and in Houston. I am still trying to identify several VHF and UHF channels that seem to pop up at every big event, but have never been identified as to what agency might be using them. If any readers are out there who might be at the Super Bowl, or the presidential inauguration, please email me and maybe we can coordinate our monitoring efforts and share our findings.

That is all for the first column of 2017, but be sure and check back for the February column, when I report on federal activity at the Rose Parade in Pasadena, California. Until then, keep searching!

TSM

UTILITY PLANET

By Hugh Stegman

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U. of Twente WebSDR Featured in Popular Video

The World Wide Web software-defined radio (SDR) at the University of Twente, Netherlands, is famous. Its big break in showbiz came in early December, when it was featured in a weekly video that has a large following on YouTube. It's called "The Modern Rogue." It describes itself as follows: "Brian Brushwood and Jason Murphy, professional idiots, field test the things that will make you the most interesting person in the room."

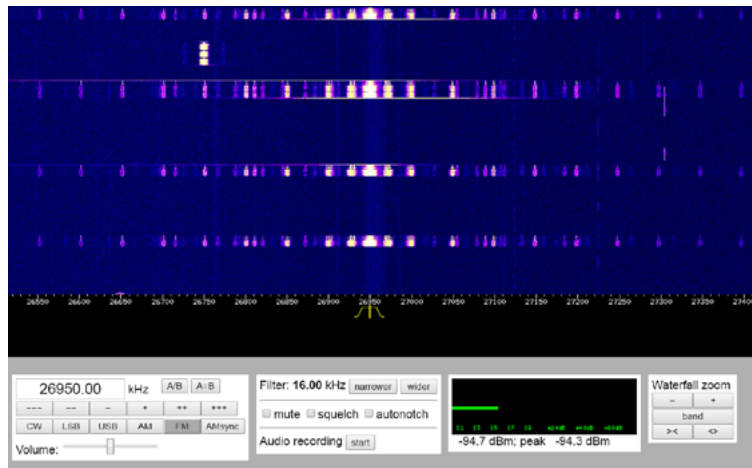
Well, we know utility radio is interesting. In my experience, though, it usually makes me the most unintelligible person in the room. I guess I just have trouble explaining why anyone would want to extract cryptic-looking copy from noises that sound more like a 1950s Si-Fi movie space ray.

The secret here, as always, is "numbers stations." I am perpetually amazed, not to mention delighted, by how much the general public loves these. I get asked to do interviews on the subject about once a year, always on mainstream media aimed at mass audiences. I give my usual speech about how they go back to the early Cold War, or perhaps even farther. I include the good part—evidence for why we think that most of them really are secret coded messages for spies operating in deep cover overseas.

I wouldn't go so far as to call numbers stations Cold War relics, even though many did leave the air afterwards. The remaining ones come mostly from Eastern Europe, Asia, and Cuba. While the system works as well as it ever did, it's not the Internet. People seem amazed to know that anyone would want to communicate any other way. Actually, given all the serious Internet security issues of the past year, I have trouble understanding why they wouldn't.

Be that as it may, the Modern Rogues did a relatively good job describing the whole thing. The two leads are engaging people, coming from out there somewhere. It's kind of like good cocktail party chatter by way of Mythbusters. And this episode was about a search for numbers stations and general strangeness on the WebSDR.

While they did find some, mostly we hear the campus pager on 26950 kHz FM. Users of this SDR will know the sound only too well. Like most paging transmitters, it's running very high power. It blasts the poor little SDR, making spurious reception all over HF. The Rogues were very taken with this pager; though they seemed to think it was slow scan television (SSTV). It isn't. SSTV is indeed heard on



This is only a small portion of the overload that the pager causes on the WebSDR. (Author)

HF, but nearly always from hams on 20 and 40 meters. The problem is that it sounds nothing like the pager. Its analog mode sounds like sped-up radiofax with an additional sync pip, and its digital mode is a narrower ham version of DRM. Both make transmissions several minutes long, as opposed to the pager's short bursts.

Following the posting of the video to YouTube, the number of users on the WebSDR suddenly doubled. Some came looking for SSTV, and had to have it explained to them that they were hearing no such thing. They also came looking for numbers stations, and on my watch we actually found them a couple. I think we also turned on a new bunch of people to priyom.org, a very nice numbers web site.

There's nothing wrong with new people checking out this weird hobby of ours. Most will be utterly mystified, or just bored at the hours of fishing that are often required. A few, however, will stick around. A few of these will end up knowing more than I do, and I'll be asking them questions instead of vice versa. It's all good.

In the interests of accurate communication, though, I must point out a couple of other mistakes in the video. They tune AM signals in USB, but that's picky. Less picky is when they refer to "UTC" as "Universal Time Code." No, far as I can tell, that's a program for converting time formats. UTC is Coordinated Universal Time.

This whole time thing confuses beginners no end. Sometimes we read that UTC isn't "CUT" because it came from French. No, then it would be "TUC." It's really done

to harmonize the name with the other Universal Time scales, which are based on astronomical observation. There's UT0, UT1, UT2, and UTC.

The short explanation is that UTC uses atomic seconds to make it suitable for precise interval timing, but its time of day is kept in relative sync with the astronomical UT1. That's the coordinated part. It's done through an international agreement to insert the dreaded "leap seconds" that news media so love to misunderstand. There's also a long explanation of this whole time thing, but it would fill up the rest of this column.

North Korean Numbers Resume

After a short, five-day pause, the bizarre North Korean numbers broadcast started up again, to maximum hand wringing and doom-saying worldwide. Actually, it's not that bad. Hyped media reports to the contrary, it doesn't mean a nuclear attack is imminent. If it did, I wouldn't be sitting here writing this. It's been on, sporadically, since last June 24. Before that, it was on for years, drawing the ENIGMA designator of V15, before it stopped abruptly during a unification conference in 2000.

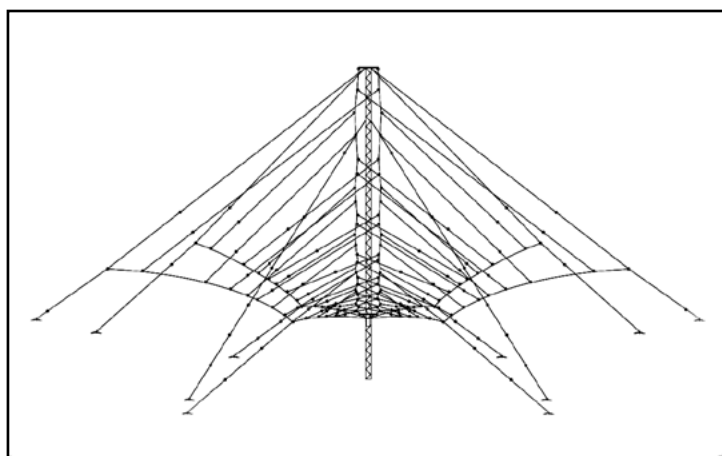
According to the South Korean news agency Yonhap, there have been 13 different broadcast versions as of early December. The V15 designator still applies. They're never completely purged from the list, for exactly this reason. They are merely classified as "inactive." In this weird business, one never knows what's ahead.

While V15 really and truly is a real numbers broadcast for real spies, there are some differences. It's essentially a radio program. Just as in old times, it goes out on the powerful AM broadcast transmitters of the Voice of Korea, formerly Radio Pyongyang. These put out real nice signals, heard daily in Europe and the western U.S.. The whole station is like a Cold War museum, with its stirring martial music and old-school announcers.

V15 has elements of steganography. This term's Greek roots mean "covered writing," or the concealing of secret messages in completely non-secret communication. It's probably nearly as old as human speech itself.

And so we do not hear the usual creepy machine voices intoning groups of numbers. We hear plain speech, from live announcers, sounding like anything else on this rather bizarre station. These announcers are supposedly giving the latest lesson assignments to a group of "expedition agents" who are supposedly studying engineering abroad. The "lessons" start on specific page numbers of specific chapters. It's widely believed that what we're hearing is a variation of the old "book cipher."

North Korea used this one before, during the Cold War. The numbers passed on the air guide the target listeners to specific locations in specific books that were agreed on earlier. The message is then extracted in a variety of ways. Common reference books such as dictionaries are good,



TCI 530 antenna (Courtesy SPX Corp.)

since possessing them doesn't attract the wrong kind of attention. As long as the exact book being used remains secret, the system is quite secure.

Some people are still having trouble getting their heads around the idea that anyone would use such an ancient method in this Internet-routed, satellite-linked era. Some think it's all a diversion, or a psychological tactic to cause unease in South Korea. This could be. Or maybe it's just so old that it's new again, and counter-intelligence wasn't expecting it. As always, the people who know aren't telling.

More on USCG DRM

This comes from Brendan Wahl on the UDXF list. He's a former radioman with the U.S. Coast Guard, from back when such a job title existed. What he came up with further explains the sudden appearance of Digital Radio Mondiale (DRM) with "USCG Journaline" appearing in decodes. Perhaps surprisingly, the Guard was quite forthcoming with details. What we're hearing is an experimental research project. It is testing the best ways to implement something called the Next Generation Arctic Navigational Safety Information System, or ANSIS for short. As we know, the Arctic is becoming a serious shipping and oil exploration area, especially in summer. This creates problems because traditional means of communication don't always work as well as they do at lower latitudes.

For whatever reason, the best system appears to be Digital Radio Mondiale (DRM) on the lower end of HF. It has a relatively high data rate; so detailed charts and information can be disseminated. Note that this use of DRM has no audio. It has clear and encrypted data channels only. The Journaline, as described last month, is a data system using a proprietary version of eXtensible Markup Language (XML). It does not hide its existence. The encrypted? Don't even ask.

As of this column's writing, the frequencies are 2450, 5200, 6850, 8000, 9000, and 11200 kHz. The DRM waveform is hard to miss, being a very purposeful looking and sounding bundle of OFDM carriers. A screen shot by Larry Van Horn on his Milcom blog shows a width of 10 kHz,

same as that used by other stations for audio broadcasting.

The transmitter is at NOJ, the Coast Guard comm station at Kodiak, Alaska. As we noted last month, the antenna is a TCI 530. It's yet another of those awesome wire antennas made by the TCI division of the SPX Corporation. Basically, it's a wire log periodic. It's impressive to look at, being a large, conical affair erected around a tower. Its radiation modes are omnidirectional and NVIS, or Near Vertical Incidence Skywave. NVIS propagation achieves good, even coverage of a limited area, which is often perfect for military use. By definition, it's attained through use of a very high angle of radiation. Since radio has no free lunches, this reduces what's available for us to hear at long distances. So it goes.

Right now, the signals are on the air 24 hours a day, seven days a week. The transmitters are not designed for DRM's high average power, and they're probably being run at reduced output. This, too, is a good thing for them, but not the best for us in this period of solar minimum.

The Coast Guard is interested in detailed reception reports from anybody. Those hearing this extremely interesting broadcast can e-mail these to drminfo@uscg.mil. This address goes right to the Coast Guard research center in New London, Connecticut.

New Indonesian ALE Net

It's always nice to get information from the Pacific region. We don't have many sources out there, and a lot of what we do hear is unidentified USB chatter in various languages. Therefore, everyone's excited to have someone reporting from Jakarta, Indonesia. Already, he has discovered a previously unknown net using second generation Automatic Link Establishment (ALE). It seems to be called the Gunun net. This is Indonesian for "mountain." Indeed, all of the ALE identifiers heard here are the names of volcanoes, though some differ from the common English spellings.

Volcanoes are extremely important in Indonesia. The country is over one of the world's most active tectonic plate boundaries. A string of approximately 130 active volcanoes leads down from the Celebes Sea, and then becomes almost continuous across the southern arc of islands. Seventy-nine of these volcanoes are known to have erupted since the 1600s, killing many tens of thousands of people. One of the bigger catastrophes was the Krakatau (Krakatoa) blowout of 1883, in which two thirds of an island suddenly ceased to exist. The huge tsunamis and other effects killed at least 36,000. Pressure waves circled the planet for days.

In order to protect lives and property, instruments and personnel continuously monitor Indonesian active volcanoes. A Web site has a reference to a "Single Side Band (SSB) net" sending "radio" data to a central location. Presumably this is what's being heard on HF.

The stations exchange link checks and sometimes other data. The addresses (identifiers) that have been reported at press time are: BROMO, CEREMAI, GEDERUA, GUNTUR, LAWU, MELABAR, MERAPI, MERBABU,



*Flight crew boards Coast Guard 1709, a C-130H at Kodiak.
(Courtesy: USCG)*

PANDAN, PATUHA, RAUNG, SALAK, SEMERUA, SINDORO, TAMPOMAS, UNGARAN, and WILLIS. Some of these might be decode errors or transliteration from Indonesian. "Official" volcano lists show MELABAR as Malabar. CEREMAI shows up as Cereme and Ciremai. SEMERUA is also Semeru, and SINDORO can show up as Sundoro. Finally, WILLIS is actually Mt. Wilis in Java.

So far, the frequencies that have been discovered are 11250, 14352, and 18442 kHz, all USB ALE. There are likely others. At least in Jakarta, 14352 is by far the most active. We hope to get more information on this interesting operation. See you next month!

Resources:

Modern Rogue video on "secret numbers stations:"

<https://www.youtube.com/watch?v=RIXF9L6HRLA&list=PLMviV1kG2V2gSs1vOh3UkBK9USraghjj7>

Priyom.org numbers site:

<http://priyom.org>

Ary Boender's Numbers and Oddities:

<http://www.numbersoddities.nl>

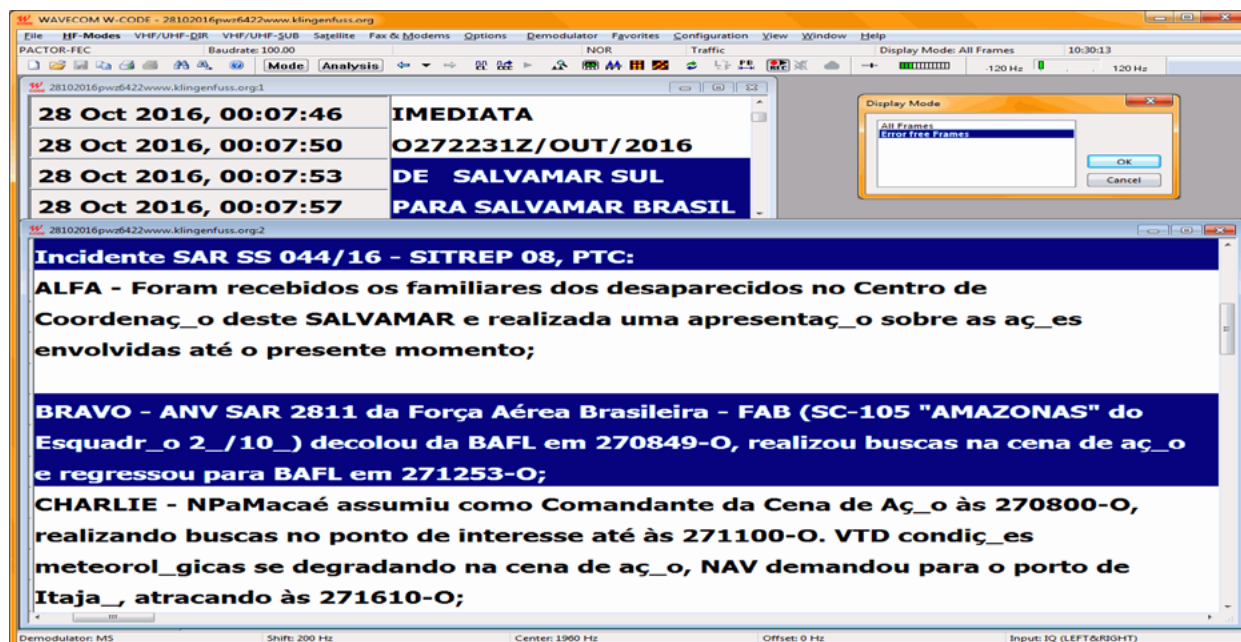
Wiki's map of Indonesian volcanoes:

https://en.wikipedia.org/wiki/Volcanology_of_Indonesia

TSM

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SHORTWAVE UTILITY LOGS

Recent Shortwave Utility Logs Compiled by Mike Chace-Ortiz

Frequenc	Callsign	Time	User, Location	System Details
4005.00	NAU	0230	US Navy, Isabela PR	50bd/850 STANAG4481 FSK, sync, cont, ACF=0
4045.00	???	2344	Russian MIL, ???	AT3004D 12 tone HF modem, tfc (on USB)
4055.20	DHM85	2312	Germany Navy, Marlow	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
4068.00	???	0114	NATO MIL, ???	Link-11 SLEW, tfc (on USB)
4134.00	???	2350	NATO MIL, ???	STANAG4197 HF modem, ANDVT tfc (on USB)
4209.50	TAH	0200	Istanbul Radio, Turkey	100bd/170/I SITOR-B, msgs in TT in SBRS mode
4222.00	???	0200	Russian MIL, ???	AT3004D 12 tone HF modem, tfc (on USB)
4975.00	???	0230	US Navy, ???	Link-11 SLEW, 2 channels tfc (on ISB)
5107.00	???	0027	Russian MIL, ???	75bd/250 FSK UNID System, sync, cont, ACF=0
5160.20	PBC	0020	Dutch Navy, Goeree Island	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
5246.20	SXA	0030	Greek Navy, Athens	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
5258.00	???	0011	Russian MIL, ???	75bd/250 FSK UNID system, sync, cont, ACF=0
5268.00	RDL	0310	Russian Navy, Moscow	50bd/200 BEE, tfc on sync=[0x1414bebe952]
5632.00	???	2350	???, ???	MIL-188-110A/B HF modem, CITADEL digital voice tfc (on USB)
5652.00	???	0300	ARINC, Riverhead NY	HF DataLink, uplinks to aircraft (GND ID=004) (on USB)
5736.00	???	0010	Russian MIL, ???	AT3004D 12 tone HF modem, tfc (on USB)
6258.70	???	0036	???, ???	300bd/300 FSK Packet Radio-like System, tfc
6500.00	2212***	0400	Moroccan MOI, ???	125bd/1750 MIL-188-141A, ALE sounding (on USB)
6501.00	NMO	1204	US Coast Guard, Honolulu HI	USB, OM/EE synthesized reads weather conditions
8098.20	???	2200	UK MIL DHFCS, Falkland Islands	2400bd STANAG4285 HF modem, crypto tfc (on USB)
8113.70	???	2311	???, ???	300bd/300 FSK UNID Burst System, ACF=0 tfc, ACF=16 close-down
8503.90	NMG	0144	US Coast Guard, New Orleans	120lpm/576/800 Fax, WX pix
8603.00	ZSJ	2338	South African Navy, Silvermine	Saab MHF50 33 tone MFSK modem, tfc (on USB)
9122.50	WUE6	2345	US Army Corps of Engineers, Nashville TN	125bd/1750 MIL-188-141A, ALE sounding (on USB)
11459.00	???	2000	Algerian MIL, Algeria	125bd/1750 Thales Systeme 3000 8FSK HF modem, ALE tfc OM/AA coord. (on U
12358.60	UNAL23***	1805	US MIL, ???	125bd/1750 MIL-188-141A, ALE LQA with "RUAL3" (on USB)
12358.60	UNAL23***	1805	US MIL, ???	MIL-188-110A/B HF modem, CITADEL crypto tfc (on USB)
12359.00	2203***	1940	???, ???	125bd/1750 MIL-188-141A, ALE sounding (on USB)
12370.00	COE***	1700	Brazilian Navy, ???	125bd/1750 MIL-188-141A, ALE calling "MR9" (on USB)
12370.00	P01***	1700	Brazilian Navy, ???	125bd/1750 MIL-188-141A, ALE calling "MR9" (on USB)
12396.20	???	2212	UK MIL DHFCS, Akrotiri	1200bps/L STANAG4285 HF modem, tfc (on USB)
12396.50	???	1837	???, ???	MIL-188-141C 3G HF modem, tfc (on USB)
12464.00	RCV	1440	Russian Navy, Sevastopol	CW, 40wpm tfc to ships
12568.20	PBC	1210	Dutch Navy, Goeree Island	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
12661.20	DHJ59	2355	German Navy, Neuhaarlingerseil	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
12666.55	FUG12	2330	French Navy, La Regine	600bps/L STANAG4285 HF modem, "voyez le brick" marker in ITA2 (on ISB)
12704.50	CTA	1228	Portuguese Navy, Lisbon	600bps/L STANAG4285 HF modem, crypto tfc USB, CARB "2314z//cta02i/cta04i
12730.00	FUB	1233	French Navy, Paris	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
12786.00	NMG	2352	US Coast Guard, New Orleans	120lpm/576/800 Fax, surface analysis
12808.50	KPH	2038	Global HF Net, Bolinas CA	CW, "VVV VVV VVV CQ DE KPH KPH KPH QX5 500 4/6/8/1UA/16/22 OBS? <AR>"
12840.50	PBB	2350	Dutch Navy, Den Helder	75bd/850 Baudot, CARB "02a 04b 06a 08a 12b 16x 22c pbb"
12857.00	6WW	2355	French Navy, Dakar	600bps/L STANAG4285 HF modem, "faaa de 6ww6ww6ww" ITA2 tfc (on USB)
12873.60	FUG	2140	French Navy, La Regine (Saissac)	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
12883.60	FUB	2135	French Navy, Paris	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
12892.20	???	2231	NATO MIL, ???	300bps/L STANAG4285 HF modem, crypto tfc (on USB)
12930.70	EBA	2200	Spanish Navy, Madrid	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
14388.20	CTP	1745	Portuguese Navy, Lisbon	600bd/L STANAG4285 HF modem, 2 channels tfc crypto on LSB & CARB on USB
14411.00	RDL	1232	Russian Navy, Moscow	50bd/250 BEE, short messages (//11468kHz) with sync=[0x1eb41eb2952]
14738.50	VIZJOC***	1810	US Army National Guard, US Virgin Islands	125bd/1750 MIL-188-141A, ALE LQA with "AK10JOC", "DE3JOC" (on USB)
16008.00	???	1800	North Korean Embassy, Conakry	600bd/600 FSK UNID ARQ System, burst tfc (+1500Hz on LSB)
16106.20	???	1229	UK MIL DHFCS, Akrotiri	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
16250.00	???	1445	North Korean Embassy, West Africa/Europ	600bd/600 FSK UNID ARQ System, tfc QX5 16008LSB (on LSB)
17060.60	FUX	1630	French Navy, Le Port	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
17106.60	FUF	2130	French Navy, Fort de France	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
17457.50	444***	1730	???, ???	125bd/1750 MIL-188-141A, ALE sounding (on USB)
17457.50	406***	1730	???, ???	125bd/1750 MIL-188-141A, ALE calling "601" (on USB)
17492.60	5150***	1324	US Department Veteran's Affairs, ???	125bd/1750 MIL-188-141A, ALE sounding (on USB)
18308.00	116***	1758	"xx536 Network", ???	125bd/1750 MIL-188-141A, ALE sounding (on USB)
18493.50	FUV	1315	French Forces, Djibouti	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
18534.20	MKD	1137	UK MIL DHFCS, Akrotiri	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
18632.00	???	1950	UK MIL, Ascension Island	2400bd UNID 24QAM HF modem, idle (on USB)

SHORTWAVE UTILITY LOGS

Recent Shortwave Utility Logs Compiled by Hugh Stegman

Frequency	Callsign	User, Location	Time	System Details
280.00	RCL	Rio Claro Airport, Brazil	2225	AM non-directional beacon, repeating Morse ID
302.00	262	DGPS, Pt Loma, CA	2224	MSK (100 baud), GPS corrections using transmitter 881
406.50	BOT	Bottrop, Germany	0056	AM non-directional beacon, repeating Morse ID
490.00	"P"	SVK, Kerkyra, Greece	2235	Sitor-B Navtex bulletin PA72 in Greek
490.00	"X"	UTT, Odessa, Ukraine	2355	Sitor-B Navtex bulletin XL99, in English
2474.00	PBB	Dutch Navy, Den Helder	0045	RTTY (75/850), channel availability marker and ID
2716.00	Lightning Strike	Possible U.S. Navy	0144	USB, calling AUTC Operations (U.S. Navy, Bahamas)
3245.00	5BR	U.S. Army MARS	0137	USB, net with AAA5IX, several others
3299.00	AFA4LR	USAF MARS	0117	USB net, asking for Tennessee stations
4331.00	4XZ	Israeli Navy, Haifa	2249	CW, usual marker "VVV DE 4XZ," parallel on 6607
4519.00	271	Russian Intelligence (G06)	1830	USB, German "271 149 52," message, and 2 Windows XP sounds
4583.00	DDK2	German Weather Ofc., Pinneberg	2256	RTTY (50/450), SYNOP observations for North Sea sites
4721.00	MCC	USAF, CA	1054	ALE, signal check text message for HIK, Hickam, HI
4916.00	574	Russian Intelligence (G06)	1158	USB, German null message "574 00000," then Windows XP sound
4996.00	RWM	Russian time station, Moscow	2340	CW, with ID and time pips
5316.00	Unid	Mexican Navy, Rosarito	0020	USB, Tadiran framed AVS voice scrambling
5385.50	AAR7JT	U.S. Army and USAF MARS	1403	USB, control of Region 7 net, then AAAR7RD in CW net
5407.00	RGT77	Russian Military group call	2002	CW, 5-letter-group strategic priority message in Russian
5544.00	"15"	Al Muharraq HFDL, Bahrain	2351	Working flight VN0011 (Vietnam Airlines A350 reg VN-A888)
5720.00	"03"	Reykjavik HFDL, Iceland	2200	HF ACARS weather at Rostov-Na-Donu for VP-BLP, Aeroflot A320
5732.00	TSC	COTHEN Technical Service Ctr., FL	1944	ALE, calling A70 (U.S. CBP UH-60 #82-23670)
5779.00	250	Polish Intelligence (E11a)	0315	USB, English callup "250/38 Attention" and message
5815.00	370	Polish Intelligence (S11a)	1955	USB, Russian "370/36 Vnmaniye," and 5-figure-group message
5887.00	830	Russian Intelligence (E07a)	1610	USB, English null message callup "830 000," again 1630 on 5387
6326.00	XSG	Shanghai Radio, China	2242	Sitor-A, CW ID "DE XSG" in burst marker
6417.00	Unid	Japanese Navy, Japan	2247	PSK, "Slot Machine" idler and data bursts, also 6445 and 8703.5
6450.00	RAPTOR	NATO Battle Group	1745	ALE sounding, also 8815, 9005, and 9038
7527.00	Z38	USCG, Humboldt Bay, OR	1828	ALE, calling K56, USCG MH-65D number 6556
7678.00	K1B4	Russian Military	0706	CW, working outstations TXT8, SGIW, 5SAR, KS2L
8066.00	BUHB	Uzbekistan net, Buxoro	1400	ALE, calling TASB, Tashkent
8291.00	XVG	Hai Phong Radio, Vietnam	1707	USB, with engineering security message
8580.00	Unid	South African Navy	2205	Saab Grintek MHF-50 idler, FSK/MFSK33, also on 8603
8812.00	TAH	Istanbul Radio, Turkey	1819	USB, English male voice with marine wx, signed "This is H"
8825.00	Santa Maria	Atlantic air control (NAT-E), Azores	1815	USB, working Kestrel 78CP (possible Thomas Cook Airlines)
8912.00	790	USCG HC-130H #1790	1835	ALE, calling Z32 (USCG Sector Honolulu, HI)
8992.00	Road Map	USAF HFGCS	2116	USB, EAM "JBEGSK," huge echoes and audio whine
9001.00	Papa	Unknown U.S. Navy	2033	USB, tracking with Whiskey, possible carrier battle group
9025.00	160022	USAF C-5 #86-0022	1515	ALE sounding
9386.00	Unid	Russian Military	2134	FSK Morse "XXX XXX" (high priority), then Russian 50/200
10000.00	PPE	Brazilian Observatorio Nacional	0053	USB, Portuguese ID and time of day, then single beep
10100.80	DDK9	German Weather Ofc., Pinneberg	2149	RTTY (50/450), "RY" loop and ID, also DDH9 on 11039
10713.00	LCR154	Polish Military, Janki	1142	ALE, working SPI324 (unknown)
11051.00	New York Radio	Atlantic Volmet, NY	0057	USB, male machine voice with aviation weather observations
11175.00	Dock Hand	U.S. Military aircraft	1800	USB, possible TACAMO LANT, traffic with Free Hand
11282.00	San Francisco	Pacific air control (CEP-2)	2134	USB, selcal check with Raider 09 (USMC KC-130 VMGR-352)
11360.00	78807	Russian Air Force IL-76MD	1317	USB, calling Davelenie (708th Air Transport, Taganrog)
12585.50	KPH	MRHS, Pt. Reyes, CA	1841	RTTY (45/170), loop with RYs and ID, also 6324.5
12695.50	KPH/KFS	MRHS, Pt. Reyes, CA	2302	CW ID in QSX loop, on vintage 1942 transmitter
13215.00	CRO	USAF HF-GCS, Croughton, UK	1345	ALE, calling KWX (Possible US State Dept.)
13371.00	352	Russian Intelligence (M12)	1400	CW callup "352 1 9631 51," and 5-figure-group message
13907.00	SHBNG	Indiana Army NG, Shelbyville	1906	ALE, working R23467, National Guard UH-60A #80-23467
14582.00	N18	USCG HC-144A #2318	2134	ALE, calling Z17, USCG Sector New Orleans
14637.00	Unid	Russian Intelligence (V07)	0129	USB, female machine voice with numbers in Spanish
15861.00	Unid	Russian Intelligence (XPA2)	0800	Polytone, MFSK (16/20 baud), with short message
16313.00	Unid	Russian Intelligence (FSK M42d)	0820	FSK (200/1000), null message on link 45075
17531.00	Unid	Polish Intelligence (FSK F11)	1250	FSK (100/625), null-message callup "0132 00000"
18594.00	EST	U.S. Customs & Border Protection	2100	ALE, calling D45 (CBP P-3 #N145CS)
19139.00	Unid	Russian Intelligence (FSK M42d)	1010	FSK (200/1000), null message on link 49202
20890.00	LNT	USCG Commcom, VA	1736	ALE, calling 503 (USCG HC-130H #1503)
20983.00	Unid	Russian Intelligence (FSK M42d)	1000	FSK (200/1000), null message on link 49202

DIGITALLY SPEAKING

By Cory GB Sickles WA3UVV

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The Advantages of DMR on VHF

Happy New Year and welcome to the first “Digitally Speaking” of 2017! I hope all of you have a wonderful year, full of great moments and fun. Plus, I hope you find the time to explore more of what up to the minute technology has to offer.

In the Eastern Pennsylvania, Southern New Jersey and Delaware area where I used to live, there is activity on a variety of repeaters that support all five of the methodologies in common use by hams. While System Fusion and D-STAR users represent the majority of activity. P25 and NXDN were gaining adopters as well, but DMR (Digital Mobile Radio) users were growing at a brisk pace.

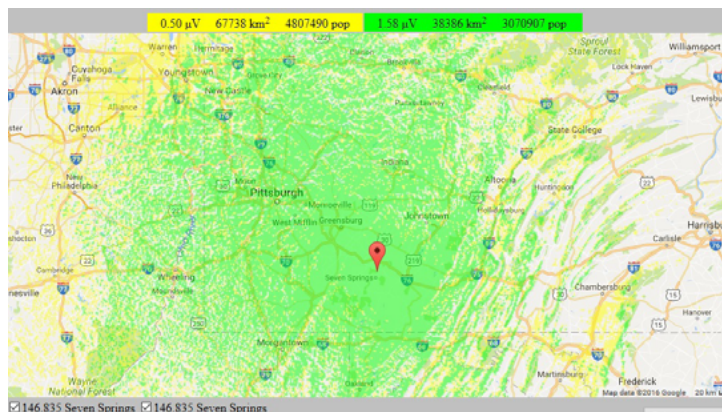
Many were hams who had already joined the DV (Digital Voice) community through other methodologies, but a significant population were new to the DV world and DMR was their gateway.

Much of the DV activity on the Philadelphia side of the Delaware River has been spurred on by the PDRA (Philadelphia Digital Radio Association), along with some of its avant-garde members. While individual clubs in the DE, EPA and SNJ sections also have been championing DV, having a club specifically dedicated to the advancement of these new technologies is a very valuable resource. DVRA members routinely set up displays at area hamfests (such as SNJ’s Gloucester County ARC – largest in the area) to demonstrate what’s new and exciting.

Even if a particular club has insufficient member interest in progressing with DV on at least one of their repeaters, valuable efforts by the PDRA allows area hams to become involved with a wider-ranging organization. Such groups exist in other parts of North America. They may serve as an inspiration to you, should you find yourself and a handful of friends who are looking to advance your communications.

Where I now live – in the WPA Section and near to the WV border – DV did not take off as long ago as in some other areas. It turns out there are many such areas – much as there were some 40+ years ago when FM was the up and coming “in” thing on the 144 MHz and 440 MHz bands.

This is of some advantage to me as it means that some of the excitement I felt a few years ago I can relive now – with significantly more experience. While D-STAR didn’t take off, except in some pockets of the section, System Fusion has enjoyed a more enthusiastic embrace – for many of the reasons I’ve written about in the past. DMR has yet to emerge as strong a DV contender, but that may have changed



A multi-state footprint is produced by the AHRA’s VHF DMR repeater. At the same ERP, UHF coverage in this area would be demonstrably less. (Courtesy: Allegheny Highlands Repeater Association)

with the introduction of just one repeater.

I was performing some research on www.repeaterbook.com the other day and decided to see what, if any, new DV repeaters might have been listed. Much to my happy surprise, there was a new entry in one of the nearby counties on 146.835 MHz. As DMR comes to us from the LMR (Land Mobile Radio) world and there still aren’t any “real” dual band radios on the market, this brings up an interesting point.

The majority of DMR repeaters are on UHF—appearing in the 440 MHz to 450 MHz range in North America. Back to Repeater Book for a moment, there are 824 UHF repeaters listed, as I type this. On VHF, the number drops to 106. Plus, there are a few hearty souls with gear on the 902 MHz band along with seven repeaters.

This means that most of the gear available to us is going to be UHF, as well. Gigaparts, for example, just announced a deal with one of the more serious Chinese DMR radio producers; Hytera. Gigaparts is now marketing a specific line of Hytera products that are intended for the amateur radio market. These radios offer user-friendly programming capabilities, unlike their Part 90 LMR counterparts. This is a notable breakthrough and I expect to see more of this. One model, the PD362UC, is a stylishly small 3-watt portable. With a built in antenna that’s enclosed in the case, much like FRS (Family Radio Service) transceivers—it’s a UHF only offering.

In fact, all of the radios they are selling are UHF. That makes sense from a business standpoint, with an almost 8:1 ratio of UHF to VHF repeaters. Perhaps they’ll also offer



Left: With linear capabilities, the Mirage B-34-G VHF amplifier is a good way to extend the range of your portable. It works well with DMR and other DV methodologies - plus SSB - for weak signal work. (Courtesy: Mirage Technologies)

some VHF models in the not too distant future. Not to worry, as there are already some nice VHF alternatives.

Powerwerx sells a line of TERA portable radios. Initially, the line was analog only. But now, you can get the TR-7400 for UHF and the TR-7200 for VHF. Kirisun is another brand of portables that are available for both bands. Distributed by Remtronix USA (the same folks that bring us Alinco radios) they are available from retailers such as Universal Radio. Look for the TP660U or TP660V.

Probably the most popular portable is the Tytera (TYT) MD-380, along with the more recent MD-390. Available in VHF with the same model number (so be very specific about ordering the “V” suffix), it is a well-supported radio. Experimenters will enjoy utilities such as MD-380 Tools, which allows you to dig into the radio for all sorts of fun. (As a word of caution, this is like front panels were to earlier computers – they can help get you out of the kind of trouble that front panels can help you get into.)

I was ready for the new repeater, since I picked up a VHF portable at the Dayton Hamvention earlier this year. My hometown club still has plans to upgrade an existing VHF analog machine to a Vertex Standard VXD-R70 repeater, which will double the number of DMR repeaters around. I figured I’d rather be ready when that happens. Plus, all of the DMR radios on the market have analog capabilities, so who can’t use another 2-meter portable?

While a used Motorola Astro Saber had been the least expensive route to “something” DV, then it was the Yaesu FTM-3200 and now it is currently the MD-380, with a typical street price of \$120.

If, instead of a VHF portable, you would rather find a VHF mobile, your choices are a bit more limited. However, there are a number of good options. While not a “ham friendly, keypad programmable” model, Hytera has the MD782. You can also find the Tytera MD-9600.

While you can always purchase an XPR series radio from MotoTRBO standard-bearer, Motorola, you’ll find more reasonable prices from Vertex Standard, a Motorola owned company that is another resource for DMR radios.



The Kirisun TP660V is another option in a solidly built VHF DMR portable. (Courtesy: Universal Radio)

Along with the venerable VXD series, there is also an EVX series of portables and mobiles. You’ll soon see that it is not a difficult task to find DMR radios for VHF.

Connect Systems, well known in the amateur radio world, was one of the first companies to offer DMR transceivers to hams. Of note, my first UHF DMR portable came from them. Here, take a look at the CS801 mobile (they also have three VHF portables for you to look over). This mobile is keypad programmable, so you won’t have to hook it up to your laptop for minor memory channel updates.

They have also announced the CS800D, which is a dual-band mobile. The specifics are supposed to be announced by the end of December 2016, with initial deliveries in the first quarter of the New Year. If it is priced as reasonably as I expect and the specs are consistent with what is already available, I think there will be a CS800D in my future. VHF may be all that’s available where I live, but I travel enough to other areas where UHF is still the default.

The VHF DMR repeater in my area is operated by the Allegheny Highlands Repeater Association and is located about 28 miles away. Two System Fusion repeaters are also on their list and are easily worked from home. All three of these operate as mixed-mode machines – meaning that they still support legacy analog activity. That’s a big plus.

The AHRA is more of a “special interest” club, in that its mission is to establish, maintain and support a variety of repeaters – from the 6-meter band all the way up to 902 MHz. Akin to the focus of the PDRA, AHRA is a valuable asset to the area. The choice of establishing a DMR presence was a welcome one. That brings up a worthwhile consideration for such groups.

If you already have good coverage from a System Fusion and D-STAR repeater in your area, then consider adding



The CS800D promises to be the first “real” dual-band DMR mobile available for the ham radio market. I should have more details on this by the time the February issue is released. (Courtesy: Connect Systems)

a DMR, NXDN or P25 repeater to support experimentation and technology alternatives. I think it’s more in the amateur spirit to make new resources available, whenever possible.

If you are starting from nothing, then the cost of a Yaesu DR-1X repeater—operating on VHF - plus the purchase of some FTM-3200’s are most often the least expensive way to get everyone on DV. With an MMDVM, you can then support DMR or P25, with the low cost portable options available—or embrace D-STAR, with portables costing a bit more. Plus, you still get to keep your legacy analog users happy.

Looking at the coverage map supplied by the AHRA, you can easily see how large a footprint just one nicely placed repeater on a mountaintop (technically hilltop) can offer. When the Uniontown (PA) ARC’s DMR repeater goes up, that coverage will overlap and extend DMR service – especially down into North Central West Virginia and Western Maryland. Just as importantly, both of these serve to extend DMR coverage into the Southwestern PA counties of Washington and Greene; currently something of a DV “black hole.”

While a 5-watt portable, with a good gain antenna, speaker microphone and external power connection can make an effective mobile station; sometimes you want a bit more power. All of the DV methodologies available to us can use just about any class C FM amplifier—except for DMR. Because of the rapid switching between slots, a linear design is really what you want. Here again, VHF operation puts you (and your wallet) at an advantage, over UHF.

For example, a Mirage B-34-G 2-meter amplifier will take 5 watts in and produce 35-watts out. Plus, it offers an 18-dB preamp, for increased and more consistent receive range. If you want even more power, then the B-310-G will take give you 100 watts out, for a mere 5 watts in. The B-34-G is priced at \$140, with the B-310-G at \$260. By comparison, the closest UHF offering sells for \$450, with a 5 watts in and 45 watts out rating.

If you are thinking more about a mobile than a portable,



Joining their line of the DV Dongle and DV Access Points for 144 and 440 MHz, Internet Labs is now selling a DVAP that operates in the 222-225 MHz band; no doubt in response to the successful introduction of the Kenwood TH-D74. (Courtesy: Internet Labs)

then it is ultimately less expensive to just get the mobile; by the time you add up radio, amplifier and all accessories. If you look at amortizing the costs against the advantage of essentially having two radio platforms, then the investment is substantially less. I typically have embraced each new DV methodology with a portable first, so I already have suitable amplifiers at my disposal. By the way, that linear amp works great with SSB rigs and the preamp is certainly welcome, which may be of even further consideration if you decide to try contesting in the future.

In any case, the terms “DV” and “UHF” are common, but not mutually inclusive. Consider the funding needed by your organization and what you are asking from your membership while factoring in how much of an adoption rate you desire. Given how much of a bump the FTM-3200 has given to System Fusion growth, those interested in DMR would be well advised to consider VHF operation as viable and attractive, especially in areas where there is no other DMR activity.

Hopefully, we will soon see some “real” dual band mobiles and portables on the market. As long as they’re built to the correct specifications, I think many will embrace them. In recent months, we’ve seen a number of announced failures with limited Tier I-only operation (we need Tier II).

Baofeng’s recent attempt at a dual band portable (DM-5R) has resulted in a number of DMR repeater owners announcing they will ban (for life) any users that show up on their machines or networks with one. That’s not simply a hatred of all things Baofeng or cheap Chinese radios – that’s a necessary directive in order to keep things, well, orderly. One of these radios stretches across both slots and ruins the environment for all concerned. I, for one, applaud their decision regarding this.

As there are other companies who made similar announcements with similarly flawed engineering and understanding of what a 2-slot DMR CAI (Common Air Interface) actually means, it is safe to say that the majority of those announcements have died a quiet death. Just as well. It is

quite unfortunate when some manufacturer tries to dump an inadequate product on the market. It is quite another thing when they do it at a low price, just to make a fast buck off of those who don't yet know all of the questions to ask in order to avoid being taken advantage of and making their first entry into DV radio a disaster. To summarize with a pop culture reference – stay away from the Dark Side...

With recent developments in the DV world, I may have to rethink some of how I refer to things. As I'm certain long-time readers have noticed, I tend to refer to frequency bands in the same way that it is commonly referred to by LMR manufacturers and users. While the term VHF is technically spectrum that lies between 30-300 MHz and there has long been a "VHF-Lo" (3-50 MHz), "VHF-Mid" (70-6 MHz) and "VHF-Hi" (136-74 MHz) bands, we tend to think of "VHF" as the latter, which includes the 2 meter ham band—running from 144-148 MHz. The 6-meter band occupies 50-4 MHz and the 4-meter band (not available in North America) runs from 72-6 MHz.

Also, there is a 1.25-meter band (222-25 MHz) that's more commonly known as "220," since died-in-the-wool folks like me remember when we had the full 5 MHz. While that sits within the confines of VHF, there hasn't been any DV activity here for us to concern ourselves about. Recently, however, that has changed.

When we speak of "UHF," it is commonly presumed the range is about 400-20 MHz, with low and high sub-bands of 400-70 MHz and 450-20 MHz. As the 70-cm ham band sits between 420-50 MHz, the former is more desirable when converted to our uses. Technically though, "UHF" denotes spectrum from 300 MHz-3 GHz. In the radio amateur's world, that includes the 33 cm (902-28 MHz) and 23 cm (1.24-1.3 GHz) bands. (Does your brain hurt yet?)

As there have been popular 700, 800 and 900 MHz LMR bands, you can find some gear for 33-cm that supports DMR, P25 and even NXDN. Further, D-STAR can be found on the 23-cm band—usually pushing high-speed data. That's something we haven't seen from any of the other methodologies, by the way.

I write with a North American audience in mind, but as I've received appreciative and informative emails from Europe and Australia, I know there are readers there, as well. As the 222-225 MHz and 902-928 MHz bands are unique to North America, I think I'll just keep referring to them as such and not try to bundle them into VHF and UHF. If you ever find yourself confused by the nomenclature I'm using, please let me know and I'll endeavor to clarify.

Touching on the 222 MHz band, third-party support of Kenwood's TH-D74 D-STAR portable is beginning to develop. First, we had the Bridgecom Systems' BCR-220 repeater and NW Digital Radio's UDRC combination. That provided an immediate path to a DV repeater for the band.

Now, Internet Labs has begun shipping the DV-AP 125-cm. This is the latest in their D-STAR DV Access Point and has an introductory street price of \$250. Thus, you can use your TH-D74 to gain access to the D-STAR reflector net-



Kenwood TH-D74 D-STAR (\$650) DV / DV Fast data / FM / NFM / WFM / AM (receive)(Courtesy: Universal Radio)

work. If you have need to do this in an area with a high level of signals on VHF and UHF, then the relative quiet of the 1.25-meter band may be just the place for you.

Rumors continue about the introduction of a Kenwood mobile to offer the D-STAR and APRS (Automatic Packet Reporting System) capabilities of the portable. I expect we'll see something announced in the first quarter of 2017—with a demo unit being displayed at the next Hamvention.

Will the 1.25-meter band become a new hotbed of D-STAR or some other DV activity? Stay tuned and see. One thing is for certain, 2017 looks to be another interesting and exciting year for DV, no matter where you are or what you use. PS: Be on the lookout for a new System Fusion portable from Yaesu - the FT-70DR. The new year is already off to a great start!"

Websites of interest:

Philadelphia Digital Radio Association:
www.k3pdr.org

AHRA: **www.ahra.fm**

Mirage Communications Equipment **www.mirageamp.com**

Internet Labs **www.dvapidangle.com**

VHF AND ABOVE

By Joe Lynch N6CL

VHFandabove@gmail.com

Aurorasaurus.org: Aurora Tracking in Real Time

In my February 2016 column, I covered aurora propagation. Here I present a seasoned website, **Aurorasaurus.org**, which gives real-time reporting for tracking live aurora sightings globally. Billed as a citizen-scientist website that relies on social media, particularly Twitter, and to a lesser extent Facebook, I believe this website can be a boon to my fellow amateur radio operators who like to use aurora as a propagation mode.

The first time you access the site you will be given the opportunity to take a tour of it. I highly recommend you do so. The first link takes you to a YouTube video on how to navigate the site: <https://www.youtube.com/watch?v=opk-LAoRdbHA>.

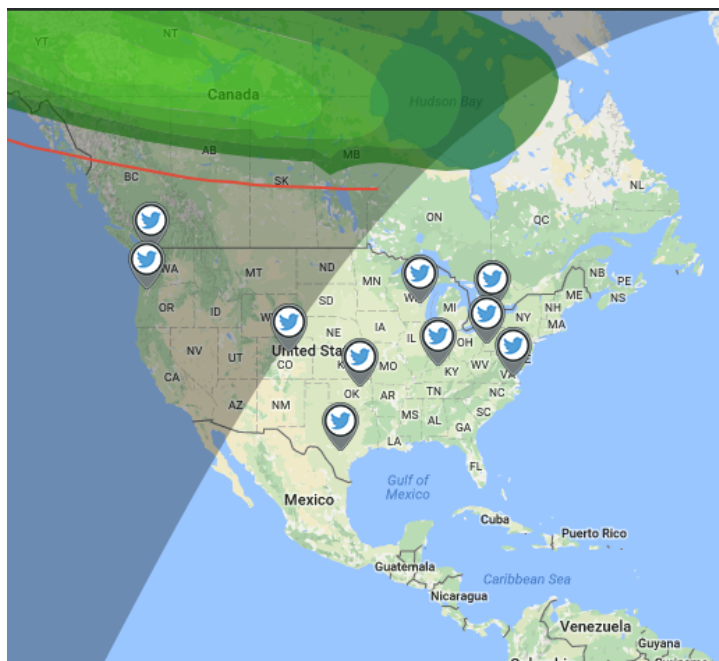
After viewing the video, click on the Rory Aurorasaurus link that will take you to its YouTube page, where you will find more than 30 videos. Among them is a 36-plus minute video titled, "Become an Aurora Hunter with Aurorasaurus!" (<https://www.youtube.com/watch?v=YWk80wLihBE>). The video is hosted by Kasha Patel and Liz MacDonald. That video will give you a lot of insight into how the website works. While this video is two years old, the materials the speakers refer to are downloadable from the website.

Keep in mind that when they talk about being able to view the aurora in the north of your location means that you as an amateur radio operator have the potential to use the aurora for propagation on the "VHF and Above" amateur radio frequencies. On the website you can see the aurora oval as a target where you can aim your antenna and potentially contact another amateur radio operator by bouncing your signal off the aurora curtain. Some amateur radio operators have observed their signals traveling a great distance along the edge of the aurora oval.

As you go through the remaining links, when you first access the aurorasaurus.org website, you will learn how to use it as a citizen-scientist and can potentially learn how to adapt it for amateur radio propagation applications. It remains to be seen as to whether we amateur radio operators should build a website alongside the aurorasaurus.org website or to find a way to integrate into the existing website.

While the website and video is aimed toward youth, please do not let that approach be a barrier to your learning from it. You can use its level of approach to work with youth in introducing amateur radio's connection to the aurora.

The Twitter account is: https://twitter.com/TweetAurora?ref_src=twsrc%5Egoogle%7Ctwcamp%5E



New useful tool for VHF & Above hams: aurorasaurus.org website tracks aurora in real time with Twitter feeds. (Courtesy: aurorasaurus.org)

serp%7Ctwgr%5Eauthor and the Facebook page is here: https://www.facebook.com/aurorasaurus.org?hc_location=ufi. For another website on aurora, go to: <http://aurora.sunspotwatch.com>

Amateur Radio Citizen-Scientists Take Part in AGU Meeting

According to the ARRL (<http://www.arrl.org/news/view/hamsci-members-showcase-amateur-radio-related-research-at-agu-fall-meeting>), members of HamSCI (Ham Radio Science Citizen Investigation (<http://hamsci.org>)) met at the Fall American Geophysical Union (AGU) meeting in San Francisco during the week of December 11-17, 2016. During the meeting, members of HamSCI presented amateur radio-based research, discussed possibilities for upcoming experiments, and networked with members of both citizen-science and space science communities. Representing HamSCI were Magda Moses KM4EGE, and Nathaniel Frissell W2NAF.

While it is important for the amateur radio community in general that these meetings and networking took place, it is also important to note that the focus of HamSCI is HF-re-



HamSci.org meeting at the American Geophysical Union San Francisco conference December 23, 2016. (Courtesy: HamSci.org)

lated research. While HamSCI networked with Liz MacDonald and Burcu Kosar of the Aurorasaurus Project (see above), it is highly unlikely that they discussed aurora propagation, thereby missing a huge opportunity to further VHF and Above communications interests with the citizen-scientists connected with that project. As I mentioned above, it is very important for us to take advantage of the work of the Aurorasaurus Project so as to enhance our ability to take advantage of aurora propagation.

Masters Level Amateur Radio Course Offered at Rice University

A masters-level course on amateur radio titled Physics of Ham Radio, PHYS 501 (<http://space.rice.edu/MST/PHYS501>), is currently being offered at Rice University. Taught by Professor Patricia Reiff W5TAR, the course content includes the following: Fundamentals of electromagnetic waves and propagation, the ionosphere and space weather. Basic electronics, antenna design and safety. Provides information necessary to earn the “Technician” level of FCC amateur (“ham”) radio license. Mathematics at a level below calculus. Other topics include: use of GPS, solar storms, magnetic reconnection and the MMS Mission, and geocaching. Special addition for 2017: Safe solar observing, especially for the solar eclipse August 21, 2017. Open to all undergraduate and graduate students.

I bring this course to our attention because it is something that can be modeled at other higher education institutions as a way of introducing amateur radio into curriculum of physics and electronic engineering departments. I see possibilities of both on ground and online versions of a similar class being offered.



The cargo transporter to the International Space Station, Kounotori 16 (HTV6) was captured with the robotic arm of the International Space Station (ISS) at 7:39 p.m. on December 13 (Japan Standard Time) and berthed to the ISS at 3:24 a.m. on December 14 (JST). (Courtesy: JAXA)

Tancredo-1 TubeSat Scheduled to be Launched from the ISS

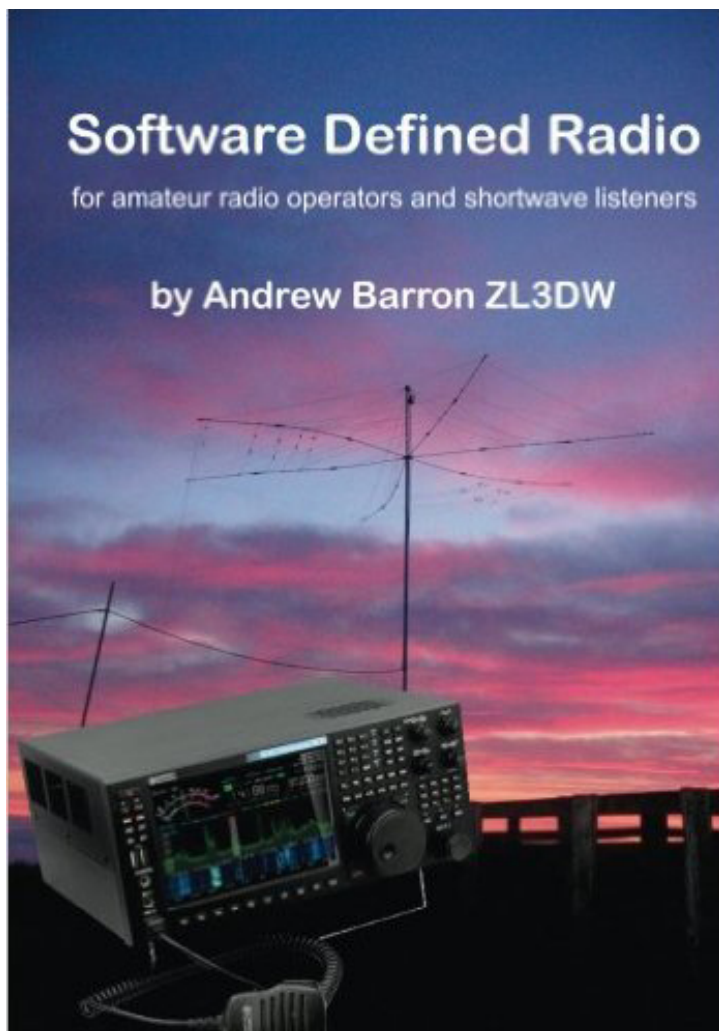
Brazilian middle school student built Tancredo-1 TubeSat, which was sent to the ISS onboard the Jaxa Kounotori 16 cargo ship HTV-6 mission on December 9, 2016. The satellite was scheduled to be deployed from the ISS last month. However, because of a conflict in scheduling, the launch was postponed to later this month. When launched, the satellite will transmit telemetry at 437.200 MHz 1200 bps AFSK AX.25 and voice messages recorded by the students who participated in the project. A video of the project can be seen here: https://www.youtube.com/watch?v=OuC7e_KPVqY. Please send reception reports to: py2sdr@gmail.com.

BY70-1 CubeSat in Lower Orbit

The Chinese 2U CubeSat project for school education and amateur radio, BY70-1, was scheduled to be launched into a 530-km circular SSO (sun-synchronous orbit) but seems to have ended up in a 524 x 212 km orbit. The result is a significantly shortened lifespan of around one or two months. Paul Stoetzer N8HM and Wyatt Dirks AC0RA, worked each other on December 28. A recording of the QSO can be heard here: <https://soundcloud.com/paul-stoetzer/by70-1-1706z-28-dec-2016>. The QSO takes place near the middle of the audio file. Twitter updates can be read here: <https://twitter.com/bg2bhc>

New Book on Software Defined Radios Published in November

Andrew Barron ZL3DW published Software Defined Radio: For Amateur Radio Operators and Short Wave Listeners in November last year. While the book is an easy read,



(Courtesy: Andrew Barron ZL3DW)

it is also full of current information on SDRs. It is available on Amazon.com both in paperback and Kindle. Speaking of Kindle, if you belong to the Kindle Unlimited service, you can download it for free. I obtained my copy here: <https://www.amazon.com/Software-Defined-Radio-Operators-Listeners/dp/1534992421>

UBSEDS21 Student BalloonSat Circumnavigates Earth

The student-built UBSEDS21 BalloonSat was launched on December 11. On December 23, it circumnavigated earth at a relatively stable altitude of 15.2 km. It carries 434 MHz and 144 MHz APRS transmitters. During its North American pass APRS creator Bob Bruninga WB4APR, was able to receive the APRS signal while mobile in Annapolis, Maryland. For more information on the BalloonSat, see this website: <http://www.bristol-seds.co.uk/hab/flight/2016/12/11/ub-seds21.html>

Raspberry Pi as a 2-Meter FM Repeater

Recently, Anto Janovsky ZR6AIC designed and built a 2-meter/70-cm cross band FM repeater using a Raspberry Pi (B) and an RTL-SDR dongle. He uses the RTL dongle



ARISS Amateur Radio on the International Space Station fund raiser campaign to replace onboard ham gear. (Courtesy: AMSAT ARISS)

to receive his input signal on 70-cm frequency configurable on the amateur 2-meter or 70-cm band. The receiver signal is then demodulated and retransmitted using a DSP Library simulating a FM Signal using a GPIO pin on the Raspberry Pi as a transmitter. For this configuration to work, the Raspberry Pi must be connected to the Internet. For more information, see his website: <http://zr6aic.blogspot.co.uk/2016/11/creating-2m-fm-repeater-with-raspberry.html>. Both the Raspberry Pi and RTL-SDR dongle can be obtained from Amazon.com.

More on ARISS: On-Orbit Hardware Capital Campaign

Last October the Ericsson MP-A VHF handheld transceiver that the International Space Station astronauts had been using for most of the school contacts failed. Eventually, it was determined that it and the whole station needed an upgrade to be able to better serve the growing interest in school contacts. Because of this evaluation, ARISS has developed a Capital Campaign. In the works is a crowd-funding website that will spell out the specific needs for funds. The most expensive need will be the hardware certification and testing, which is estimated to be around \$200,000. I will have more specific information in my next column. Even so, if you are like me and you want to get some money into ARISS's pot now, here is the website information: <http://www.ariss.org/donate.html>. Thanks to a pass-through arrangement with AMSAT-NA, all of your donations are tax deductible.

Current Contests

SSB FUNTEST: The following is from the 432 and Above EME newsletter for December 2016:

The1296 SSB Funtest will start at 1200 on 7 Jan and end at 1200 on the 8 Jan. This year there will not be a 432 SSB contest. Instead 13 cm SSB activity is encouraged around the 23-cm contest. If any significant QSO counts are received, they will be recognized with special certificates.

The International Meteor Organization (IMO) was founded in 1988 and has more than 250 members now. The IMO was created in response to an ever growing need for international cooperation of meteor amateur work. The collection of meteor observations by several methods from all around the world ensures the comprehensive study of meteor showers and their relation to comets and interplanetary dust. (Text and graphic courtesy of International Meteor Organization)

These events are intended to be fun. You do not need to transmit on SSB to participate. CW to SSB and vice versa exchanges are encouraged and count for points. (Only one QSO between stations is allowed, i.e., you cannot work a station SSB to SSB and SSB to CW for extra points). Scoring is contact points x number of two letter Grid Sectors (IO, JM, FN, EM ...) worked. SSB to SSB contacts count as 2 points. SSB to CW (or CW to SSB) count as 1 point. The exchange is your Sector (IO, JM, etc.).

Only the 2 sector letters need to be sent and copied by EME. The exchange of signal reports and/or 4 character grids is optional and not required. Operation may be by single or multiple operators from one location. No distinction for scoring will be made. Assisted operation is not encouraged.

All skeds/operational announcements should be made prior to the start of the contest. Logs should be sent to the 432 and Up EME NL by email to alkatz@tcnj.edu ASAP after the end of the contests. (All logs for contest awards should have been received within the month following the contest). The top scoring station on each band will receive an attractively framed certificate that will be presented at the next International EME Conference (Holland 2018).

ARRL January VHF Contest: The ARRL January VHF will be held between 1900 January 21 and 0359 UTC January 23. Complete rules can be downloaded from here: <http://www.arrl.org/files/file/Contest%20Rules%20PDFs/2016/2016%20ARRL%20January%20VHF%20Contest%20Rules.pdf>

Calls for Papers

Calls for papers are issued in advance of forthcoming conferences either for presenters to be speakers, or for papers to be published in the conferences' Proceedings, or both. For more information, questions about format, media, hardcopy, email, etc., please contact the person listed with the announcement. The following organization or conference organizer has announced a call for papers for its forthcoming conference:

The 2017 Eastern VHF/UHF/Microwave Conference:
First call for papers and presentations: 2017 Eastern VHF/UHF/Microwave Conference, April 21-23, 2017, Baymont

Inn, Manchester, Connecticut.

Papers sought on all VHF and up activities: Operating, Contests, Propagation, Antennas, Amplifiers, Low-noise Preamps, Homebrewing, Microwaves, EME, Arduinos, whatever you've been doing. Plenty of time to write up your winter projects—just take some pictures as you go. Inquiries to w1ghz@arrl.net.

Current Meteor Showers

The Quadrantids or Quads, is a brief, but very active meteor shower. The best activity will be overnight January 3-4, with up to 40 meteors per hour at its peaks. The actual peak can occur three hours before or after the predicted peak. The best paths are north-south. Long duration meteors can be expected about one hour after the predicted peak.

For more information on the above meteor shower predictions, please visit the International Meteor Organization's website: <http://www.imo.net>.

AMATEUR RADIO INSIGHTS

By Kirk Kleinschmidt NT0Z

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A Vertical in Winter

As described last month, because of unexpected delays in the closing process and a burgeoning honey-do list (thanks to a move to a new QTH), I was forced to make do until spring with a low dipole (doublet) antenna for use on 160-10 meters. It's a 102-foot flattop, fed with home-brew open-wire line. At 35 feet high, it's at least a half-wavelength above ground on 20 meters and up (good for domestic and DX QSOs), but gets progressively—and depressively—low on 40 through 160 (good for NVIS QSOs but not so good for DXing).

My usual “lazy ham’s approach to crazed band-hopping” called for an SGC autocoupler located somewhere in the back yard, with open-wire line running to the overhead antenna and coax running back to the shack. This has worked perfectly, with stunningly good results, for the past 20 years—when used with horizontal loop antennas—so what could go wrong?

Well, as it turned out, plenty! I had forgotten how horrible dipoles can be when used in DC-to-daylight service (one antenna, multiple bands, large frequency span). And how noisy! Yuck! My initial results were so disappointing that—despite two blizzards, a foot and a half of snow, and a healthy dose of Polar Vortex, which brought two days of -45°F wind chills—I put up a Hail Mary Fan Vertical in the midst of the madness (mostly mine).

I’m familiar with the basics, of course, but I’m not at all experienced in erecting and tuning vertical antennas, even in the summer. But under the motto of “Desperation Brings DX” (book title, anyone?), in between blizzards and deadly cold weather, I hastily put up a fan vertical. The process was informative, as were the results, although



This “hastily constructed in winter” fan inverted-L vertical antenna won’t win any beauty contests and its transmit functionality to date has been merely adequate. But its receive performance is magical—but we don’t know exactly why! Perhaps you do? (NT0Z photo)

both were sometimes unexpected, and several mysteries remain to be solved! I discuss it this month so you might be amused, benefit from my process, or even help me understand some of the weird stuff.

Starting With the Doublet

I detailed the doublet last month, mostly focusing on the low-loss nature of the antenna’s open-wire line feeders. The feeders are indeed low loss, but my usual setup just didn’t work. As always, I placed my trusty SGC autocoupler inside a weatherproof box underneath the doublet’s feed point, some 35 feet overhead, with about 50 feet of coax running back to the shack. Taped to the coax was a length of 14-gauge insulated wire to supply DC to the coupler (with the coax shield serving as the ground return).

A massive ferrite core choke balun (13 turns of the RG-6 feed line wound on an FT-240-43 toroid) was in line just where the coax connects to the autocoupler to keep common-mode crud off the feed line that runs back to the shack. A smaller choke balun handles the DC line and various optional control lines in a similar fashion. This “floats” the tuner at RF, which helps keep the output balanced when feeding balanced, open-wire feed lines. This arrangement had always worked well in the past, but it wasn’t able to find tuning solutions on several bands! What?

I quickly administered the Light Bulb Test by connecting the coupler’s output terminals to a 100-W incandescent light bulb (dummy load/RF power indicator) while successively feeding it RF on the bands in question. This test, recommended by the manufacturer, can be quite telling. If the coupler

can't match the light bulb it won't likely be able to match an antenna. And if the bulb doesn't glow brightest at the tuner's chosen "match point," something's probably goofy. The tuner passed with flying colors...

The next trick to securing a match across a wide range of frequencies with such a setup involves adding or subtracting five to 10 feet of open-wire feed line to the antenna system. If the coupler is fully functional but can't make a match, it almost always means that the impedance at the tuner end of the feed line is too extreme. And if you can't place the autocoupler right at the antenna's feed point—where it really wants to be—changing feed line lengths can help.

This isn't exactly intuitive, but in a nutshell, the impedance at the antenna's feed point is a certain value, but when an arbitrary length of feed line is connected, the impedance at the tuner end of the feed line could be quite different—better or worse. Antenna designers use this to their advantage, which is why coaxial cable matching sections can work their magic. But things can also go the other direction, too.

So, on my doublet, the impedance presented to the tuner was just fine on some bands, but too extreme on some others. What to do?

First, I could mount the autocoupler at the top of the tower, which would place it at the antenna's feed point. This would probably solve any impedance-matching issues, but physically climbing the tower and making a secure, weather-proof installation during the aforementioned winter weather just wasn't going to happen!

I could goof around with various feed line lengths in a seat-of-the-pants effort to find a "magic" length that kept the coupler happy from DC to daylight. I actually tried this, but gave up when blizzard warnings were issued and a satisfactory solution wasn't at hand.

I could, as some hardcore coupler users do, remotely switch several additional lengths of open-wire line in and out of the system to make happy matches on all bands. But that was just too much of a kludge for me, even if winter wasn't approaching a breakneck speed.

In the end, I placed the autocoupler in my shack, which forced me to bring the open-wire feed line into the basement through a Plexiglas casement window. I made three standoff insulators from short lengths of PVC pipe mounted under the eaves of the house. Yes, it was snowing and it was during the middle of the night! From an impedance-matching perspective this worked well. I can tune the antenna in a jiffy from 160 through 10 meters, with only a couple relatively narrow "weird" spots.

But why the hassle with a doublet but not a horizontal loop? I suspect it has to do with the fact that doublets/dipoles are resonant at their fundamental frequencies and on every subsequent odd harmonic. That's why 40-meter dipoles also load up near 15 meters, which is the third harmonic of 40 meters. The progression is 1, 3, 5, 7, etc. But loops, whether horizontal or vertical, have harmonic resonances on every subsequent harmonic (1, 2, 3, 4, 5, etc), which probably



Installing a ferrite core choke balun at the feed point of every HF antenna is a true secret weapon that almost every ham should use on almost every antenna. It keeps common-mode crud from making its way back to the shack and often makes a huge difference in received noise levels. The first time I heard the difference I was stunned. Perhaps this choke balun (12 turns of the RG-6 feed line wound onto an FT-240-43 ferrite toroid) is part of why the author's vertical is so unexpectedly quiet? (NT0Z photo)

makes it a lot easier to present a tolerable impedance to an antenna tuner when using the antenna across a wide frequency range.

So, now that I could get a decent match on all bands, everyone lived happily ever after, right? Well, no, unfortunately. Loops also tend to be less susceptible to locally generated electrical noise and other unwanted garbage—and this doublet was noisy!

I had gotten so used to the "sound" and performance of various horizontal loops over the past 25 years, which I had used exclusively on HF, that I had forgotten how poorly low dipoles tend to perform and how noisy the critters can be.

Perhaps this doublet is some sort of karmic payback for being such an unabashed "loop evangelist" since the 1980s? Whatever the reason, I can tell you without reservation that, in every test case I've seen, a low loop dramatically outperforms a low dipole (low being less than the magic half-wave-length in elevation required for horizontally polarized antennas to perform as expected).

And in the spring I will immediately "loopify" this doublet and enjoy the benefits (additional skyhooks are required or I would have already done it).

But with the promise of winter DX, combined with having had to use indoor antennas for the past 12 years, the "noisy doublet," agile as it was with the SGC coupler, just couldn't hold me over until Spring. So, despite winter's maximal onslaught, I decided that I had to put up something else as well, if only to offer a band-by-band choice of antennas. And that something was a fan vertical for the low bands (the doublet should be fine on 20 meters and up, if there's ever

any propagation up there!).

A Cheap and Dirty Vertical

Oh, I had big plans for a big vertical in my big back yard! I managed to find a source of 30-foot lengths of 5-inch aluminum irrigation pipe for “next to nothing” prices. This stuff is what low-band verticals want to be made from! Unfortunately, the source is 100 miles away and I couldn’t manage to scrounge transport before winter... I looked around for local sources, but the only practical materials on hand were 21-foot lengths of steel chain link fence “top rail.” These do “work,” but aluminum works better and is much more lightweight.

I bugged the gang on various reflectors, and a quick inverted-L was the most-recommended solution. I concurred, but I had to add a twist and make it a “fan” inverted-L, with quarter-wave wire elements for 80, 60, 40 and 30 meters. I wanted 160, but I didn’t have room for the 135-foot wire element. I’d have to make a loading coil or place another autotuner at the vertical’s feed point to work the Gentleman’s Band with any efficiency! Besides, having multiple resonant antennas that required no tuners or couplers would be something new.

Septic System, Meet Antenna System!

When I was still planning to install a “real” aluminum vertical, I had planned to dig a hole for the antenna’s 4x4 wooden mounting post. My initial thoughts were to cement a pressure-treated timber into the ground (about five feet) and, once it was set, fabricate a tilt-over antenna mount. But research showed that cementing posts—even pressure-treated posts—into the ground wasn’t a good plan for long-term success, so I needed something else.

As it turns out, setting the mounting post in cement isn’t necessary. The same 10- to 12-inch-diameter hole filled with crushed limestone (or another type of medium-size, sharp-edged rock), will “lock” the post in place just fine. The process is simple: Dig the hole, line the bottom with a few inches of crushed rock for drainage, center the post in the middle of the hole, and use 2x4 lumber to keep the post perfectly vertical while you fill the hole with rock, tamping/ramming the rock down with another 2x4 each time a few more inches have been added.

A friend and fellow ham verified that this does indeed work. The rock drains well and the pressure-treated post won’t eventually rot as it would if set in cement.

A local garden center still had a supply of crushed limestone, so I threw an old steel garbage can into my utility trailer and filled it up. Well, a tiny front-end loader filled it up! The can weighed about 400 pounds, as I discovered when I tried to remove it from the trailer! I had to “yank” it/ slide it off the back of the trailer, letting the can drop straight down 18 inches or so to the ground. Boom!

At this point, winter was being assertive enough that



What’s a Minnesota ham to do when the onset of winter gets in the way of planting 32 radials instead of just 16? Fight back with a shovel, of course! Even though the wind chill was -45F two days before this photo was taken, the ground under the snow wasn’t frozen, so landscaping “pins” worked just fine to secure the ends of the radials, eliminating the need to use 4-inch deck screws and a power driver. Please do not call the authorities! (NT0Z photo)

I had to change plans. Digging the hole for a conventional mounting post wasn’t going to be possible. And besides, I wanted to install the antenna closer to an L-shaped group of trees so I could loft each inverted-L wire into a separate treetop.

That location, however, was right on top of my septic system’s drain field, which I hadn’t yet mapped, so digging any kind of hole was out of the question. If there was only a way to keep a mast supported vertically without digging! Well, there was!

Considering that the rock-filled garbage can was sufficiently heavy, I figured that it would easily keep a 15-foot wooden mast straight up and down through thick and thin, and I was now willing to give it a try!

I removed the rock from the metal garbage can, placed a 4x4 in the center and lashed it vertical while I filled the can with the limestone. I figured it would take a lot of rock to keep the post in place, but I was wrong. With only 6-12 inches of rock surrounding the post, it was surprisingly solid. And when the can was nearly full, it was immovably solid!

I placed a scrap piece of 3/4-inch plywood on the ground and shimmed it level, placing the rock/can/post on top. Moving the rock-filled can required strapping it to a heavy hand truck with a vehicle tow strap and enlisting the help of a neighbor. That post wasn’t going anywhere!

My Four-Masted Sloop

Now that I had a mounting post, I needed a mast or a vertical radiator(s). In hindsight, I probably should have used

a short aluminum vertical element and connected the individual inverted-L wires to the top of the common element before sending them to their respective treetops. But what I did was to bolt a 12-foot length of wooden stair railing to the post, adding four sets of electric fence insulators to each “quadrant” of the mast. This would let me bring each wire down the mast to a common connection point, which would make tuning each wire—or the whole mess at once—easier. Theoretically!

With my compromised arrangement I could tune the wires at the base of the vertical. With a common aluminum element I’d have to trim the wires at their “tree” ends. Did I mention that it was snowing and it was 2 AM?

Each vertical element was made from 14-gauge THHN house wire topped with a PVC end insulator. I used a sling-shot to place a length of string trimmer monofilament line over four treetops, the tallest for the 80-meter wire, the shortest for the 30-meter wire. I started with the 40-meter wire for testing purposes.

There are two weather-resistant boxes at the base of the mast. One houses a screw-in bus bar for the antenna elements while the other houses a screw-in bus bar for the radials (these are intended for AC breaker boxes).

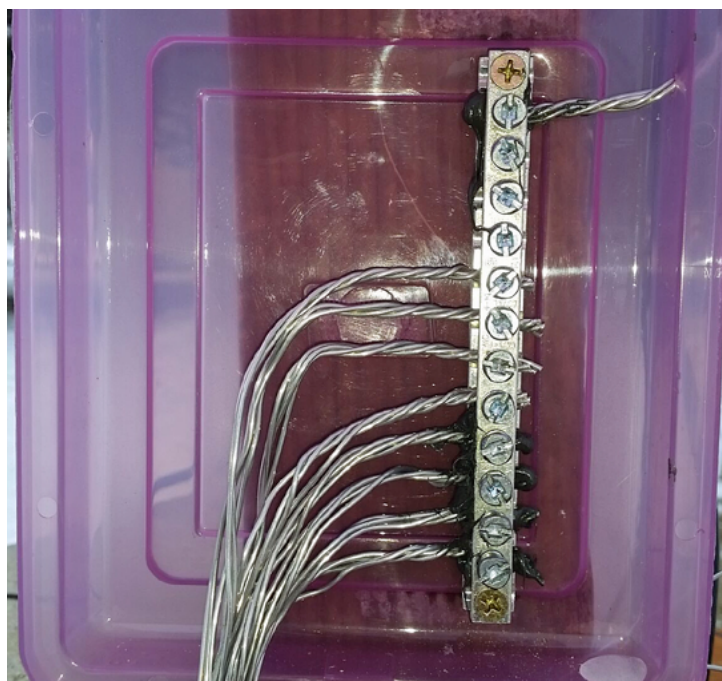
The feed line is a 110-foot run of RG-6, quad-shield, 75-ohm coax, with 13 turns of the feed line wound onto a large ferrite core (choke balun) where the coax meets the vertical antenna wires.

Radials

I didn’t have the supports or the time to install tuned, elevated radials; so on-ground radials were the order of the day. Because this was a temporary vertical, I didn’t want to spend tons of money for radials (or anything else). Insulated copper wire is usually considered to be the best choice for on-ground or in-ground radials, but I was hoping to use about 1800 feet of wire for the radials, so that left only one affordable solution: 17-gauge aluminum electric fence wire from the local farm store. Total cost? About \$25.

Purists may roll their eyes, as bare aluminum wire can start to corrode pretty quickly in some on-ground environments (especially under pine trees), but in the cold and the snow there was no way that these wires wouldn’t survive the winter season intact. In fact, they’d probably survive for two to three seasons here in Minnesota. For a “real” vertical installation I’d use insulated copper wire; 14 to 18 gauge, sourced in 2,500- or 5,000-foot rolls from a suitable surplus store. These cost between \$100 and \$250, but will save tons of cash compared to most locally sourced copper wire.

Over the years there have been quite a few “rules of thumb” when it comes to on-ground radials. The oldest suggests that 120 on-ground, quarter-wave radials—a venerable broadcasting standard—are required for good performance. On 160 meters, that’s 16,000 feet of wire (but a mere 8,000 feet on 80)! It’s true that such a radial system would indeed produce good results, but it’s not really practical or neces-



Groups of four radial wires are twisted together and screwed into an AC “breaker box” ground bus. Note that the top four bundles need antioxidant goop. Sunlight will destroy this inexpensive plastic box, so for more permanent installations, use something better. An adjacent box houses a bus bar for the wire antenna elements. (NT0Z photo)

sary.

Another “rule,” perhaps to counter the broadcast standard, suggests that four on-ground, quarter-wave radials will still get the job done. Although a four-radial system will work after a fashion—and is commensurately better than a one- or two-radial system—it still requires a huge amount of space and can easily be outperformed.

According to a variety of vertical antenna gurus who have tested hundreds of radial systems and measured their performance, “a lot of shorter radials will outperform a few longer radials.” Bingo. I would lay down 32, 50-foot radials. According to measured test systems, going beyond 32 wouldn’t provide much/any real benefit. Going from 16 to 32 probably wouldn’t be necessary, either, but in my mind the antenna would have 32 radials, so it did. Eventually!

Because this was my first time actually installing a ground-mounted vertical, I wanted to gather as much data as I could to see how it jibed with the data published by the experts. To that end, then, I would start with the 40-meter wire and take periodic measurements with my MiniVNA as I added radials to see how the resonant frequency and impedance might vary, and to see whether the ground underneath my vertical was as good as it’s supposed to be here in Southeastern Minnesota. Besides, the fact that the antenna is directly on top of my septic system’s drain field has to make it even better!

I started with a 40-meter wire element that was purposefully cut a bit long so I could do the final adjustments later, after all of the other elements had been added. The low-SWR point should be between 6.5 and 6.8 MHz. Just

for a benchmark, I took the first measurement with only a single radial on the ground. I have talked to hams over the years who swear that a single radial “works,” and now I had a chance to see for myself.

As shown in the figure, my single-radial system didn’t seem to work at all! My MiniVNA showed the main resonance point to be near 20 MHz, with a secondary resonance above 8 MHz. Huh? I swapped the MiniVNA for a friend’s MFJ antenna analyzer. It showed similar, but slightly different readings, but it didn’t show any readings that were even close to what was expected.

I added a second radial and tested again. Things were better, but still skewed. Unfortunately, either I didn’t successfully save the scan to my tablet or the data fell into a crack somewhere along the way, because I don’t have it and can’t find it.

With four radials attached, the resonance point was clearly just under 40 meters, but the lowest SWR reading was a lot higher than I was expecting: about 2.5:1. Again, no VNA scan data was saved.

Pushing forward, fingers crossed, I added another four radials to make eight, total. As shown in the figure, with eight radials, the antenna was now “real.” Resonance was indicated at 6.3 MHz with a low-SWR reading of 1.57:1. The third-harmonic resonance near 21 MHz was also well formed. Whew. It would be an actual antenna after all! With 16 radials, as shown in the figure, the resonance “dips” were even more pronounced, although the changes weren’t huge. Beyond a certain point (that may vary between installations), adding more radials only garners incremental changes.

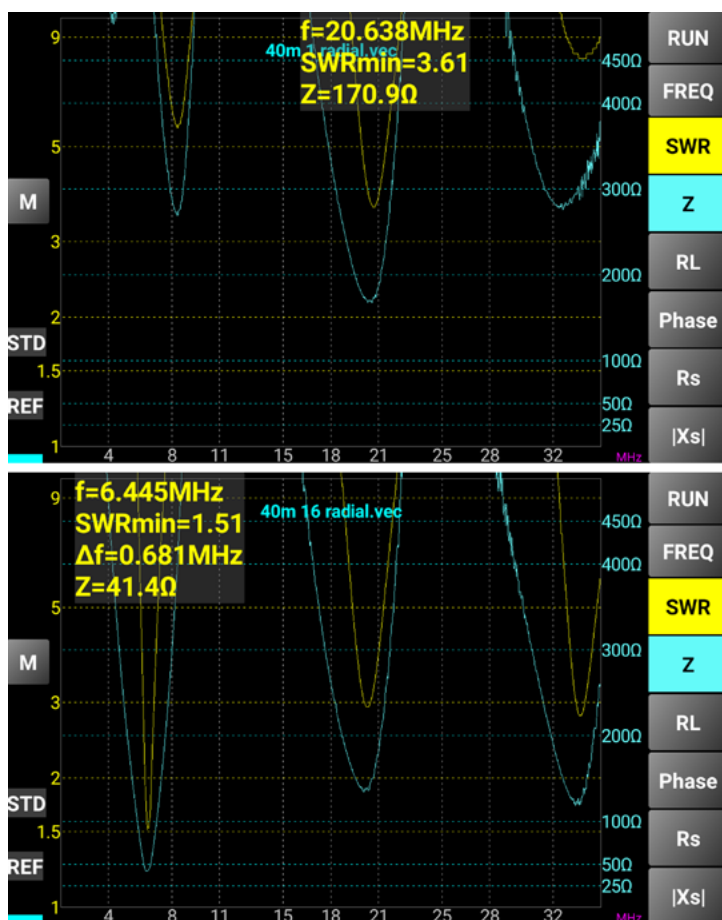
More Wires!

With 16 radials underfoot and pinned to the ground with large wire landscaping staples, it was naturally time to add more wires. After all, 40 meters is a fine band, but I wanted 80, 60 and 30, to boot. I wanted 160, too, but I knew I wouldn’t get it gracefully...

I’d like to report that, after adding quarter-wave wires for the rest of the bands, tuning up the verticals came off without a hitch. In reality, it was a bit of a nightmare, especially considering that it was dark, cold, and snowy. Are you seeing a pattern here?

Initially, nothing seemed to tune up as expected, and the wires seemed to be interacting to a significant, detrimental degree. I started tuning the lowest bands first, as recommended, but in the end the 60-meter wire had to be removed. It was just messing everything up!

I should have removed the 30-meter wire, too, but I was stubborn. Eventually, I got things squared away, with 80-, 40- and 30-meter inverted-L wire elements working against 16, 50-foot ground radials. The differences between the MFJ antenna analyzer and my MiniVNA were still apparent, and I actually found it easier to tune the elements with the MFJ, even though it lacked a graphical display—more on that later.



When does a 40-meter ground-mounted vertical resonate at 20.6 MHz, its third harmonic? As shown in the top VNA scan of the HF spectrum, when it has only one radial! With four radials things began shaping up. And with 16 radials (bottom scan), everything was good. The wire element was purposefully cut long, hence the low-SWR point at 6.4 MHz. As expected, going from 16 to 32 radials changed very little. (NT0Z photo)

It was time for an on-air test, and the CQ World Wide CW contest would provide a good opportunity. I wound as many turns of coax as I could onto a large ferrite core to make a choke balun, and routed the other end of the 110-foot cable into the shack through the access port I’d cut into a Plexiglas casement window.

As measured by my KX3 transceiver, SWRs closely matched those of the MFJ analyzer, which was previously examining the antenna right at the feed point. If the SWR curves were significantly broader in the shack, that would almost certainly indicate that too much power was being lost between the shack and the antenna, that there was something wrong with the feed line, that there was a bad connector, etc. But the SWR curves on 80, 40, 30, and 15 meters were matching the readings taken at the feed point. Whew!

Look Ma! No Tuner!

The DX contest was already underway when I fired up the QRP rig at 1100Z. Verticals tend to be noisy, especially on the low bands, so I was prepared for the worst. As I tested mine, however, I found quite the opposite to be true. This

thing was really quiet, and the signal-to-noise ratios of the received signals were beautiful—much higher than I had been used to with my attic loop for the past 12 years.

I was excited, so I began working stations on 80 and 40 CW. I could change bands with impunity, as no tuners or autotransformers were required. This was a real novelty, as I have been using my trusty SGC autotransformer since 1999!

The contest superstations from Central and South America were pounding in, and they had massive SNRs, with practically no band noise whatsoever. I called PJ2T on 80 meters with my usual 5-W signal. Although we completed the QSO, he could barely hear me! The same went for 6Y3T, TI5W, and HK1NA. Hmmm.

After using an attic-mounted horizontal loop for 12 years, I was excruciatingly used to its performance pros and cons. And although I was absolutely loving the superior receive performance of my new inverted-L, its transmit performance had me greatly concerned. Over the years it was apparent that I could have probably received HK1NA by hooking a short wire to a filling in my tooth! And having worked the Colombian superstation on 80 and 40 meters dozens of times, this time was actually more difficult than previous QSOs with an indoor antenna! Yikes!

Although this statistical sample of one isn't terribly relevant in the big picture, I was concerned. I experienced the same thing with most of the remaining contest QSOs: I could hear them massively, while they could hear me minimally or not at all. I was running only 5 W, but I had been running 5 W primarily for the past 20 years, so it wasn't unusual. With a bit of fooling around in the contest I worked a bunch of Caribbean and South American stations on 80 and 40, plus KH6LC on 80 and 40, with S51YI on 40 meters as my only EU QSO.

This isn't horrible for QRP, but I could tell that it was "rough sledding" compared to the indoor loop. Why was RX so quiet and awesome, but TX so not-so-awesome? I still don't know for sure, but I'm investigating!

Down Under

My next test outing was on the Gentleman's Band—160 meters—and I now had the doublet's open-wire feed line routed all the way to the shack. This meant that I could switch back and forth between antennas (even though both antennas were way less than optimal on 160).

You may remember that the new vertical isn't resonant on 160. I couldn't see my way to make and tune a loading coil for 160 (added to the 80-meter wire?) with the weather conditions that were present, so I did the next worst thing: I used an antenna tuner in the shack to wrangle a 160-meter signal on an 80-meter vertical.

This, of course, is something I regularly preach against! It's actually one of the worst possible ways to get on any band. Using an existing vertical or dipole on "the next band down in frequency" with a shack-mounted tuner and a long feed line couldn't be less recommended.

Knowing that, and knowing I could switch to the low dipole for comparison (or commiseration), I did it anyway! Resistive losses at 1.8 MHz, even over a long feed line, are minimal. Added SWR losses because of the 10:1 SWR on the feed line when running an 80-meter antenna on 160 meters, however, are big. I estimated those extra losses at 6-12 dB! Oh, and did I mention that I was running QRP?

Here and there over the two-day ARRL 160-meter CW contest, using both antennas as necessary, I worked about 75 stations from coast to coast with my 5-W signal. I didn't work any DX, although I heard several Caribbean stations pleadingly calling CQ (with BIG signals) and no takers. I did work UT5UDX...although he was "portable 8" in Michigan! I'm actually going to submit my log in case nobody worked the 160-meter contest QRP from my region!

Over the course of the contest the "mystery of the quiet vertical" only deepened. Most QSOs were made by TXing on the doublet while RXing on the vertical. The vertical was super quiet, and stations were very easy to hear because there was essentially no noise on the vertical.

The noise on the doublet was crushing, at S7 to S9 almost all of the time. Other stations could hear me much better on the doublet, but I could hear them massively better on the vertical! I had to manually switch back and forth for most QSOs, although I did work a few stations while TXing on the vertical.

This is rather bass-ackwards from the norm. Most ops who have low-band verticals have to use other, quieter antennas for reception (Beverages, loops, pennants, etc). Why this one is so quiet and whether that means something's actually wrong has yet to be determined.

QRO!

When you're operating on the sly from a townhouse with an indoor antenna, it's QRP or the highway. But now that I was enjoying an RF-friendly QTH, it was time to heat up the filaments. Well, the emitters, anyway. For the Stew Perry 160 contest I fired up a Kenwood transceiver and worked 160 with 50 W—10 dB more than my usual (same antennas).

The results were essentially identical, but this time I could automatically TX on the doublet while RXing on the vertical. The older Kenwood XCVR had provisions for a separate RX antenna, which made things simple. Interestingly, the extra 10 dB didn't seem to make much difference, which is why QRP "works" in the first place.

High SWR on 80

Outside the contests I worked some DX on 80, 40 and 30 during the wee hours of the morning. I did manage to work some Caribbean and South American stations on 80-meter CW (QRP) with the vertical, so I knew it was "working." But the low-SWR point (about 2.4:1) isn't nearly as low as I'd expect, nor is it as low as it is on 40 and 30

(which both get down to 1.3:1 or 1.4:1).

Because I want to really make some progress—or even close out—DXCC on 80 this winter, I wanted to see if I could get a “proper” SWR response on 80 meters. One possibility was that the radials were all “too short” for 80 meters. A quarter-wave on 80 is about 67 feet, and my radials were all about 50 feet. Although it went against the grain and was unlikely to solve the problem, to at least eliminate it, I added four 75-foot radials to the mix. Unfortunately, it didn’t have any effect on the 80-meter SWR situation. Unlike elevated radials, proximity to the earth dramatically detunes radials, so there’s really no point in trying to make them “resonant.” Oh, well.

Another possibility, also remote, was that the 80-meter match could be improved by adding more radials. I had 16 and wanted 32, so I was determined to make this happen. Two blizzards had swept through earlier in the week, however, and although it was now “warm” (33 degrees), there was still a lot of snow on the ground.

Exhibiting true Minnesota spirit (?), I shoveled paths for 16 additional radials (see the photo) and pinned them in place. Despite two days of -22°F air temps and -45°F wind chills, the ground beneath the snow was not frozen! Just for the record, the shoveling was by day, but the radials were planted at night. I have now successfully acclimated the neighbors to my super-powered LED headlamp. Law enforcement was not called (nor was Social Services)!

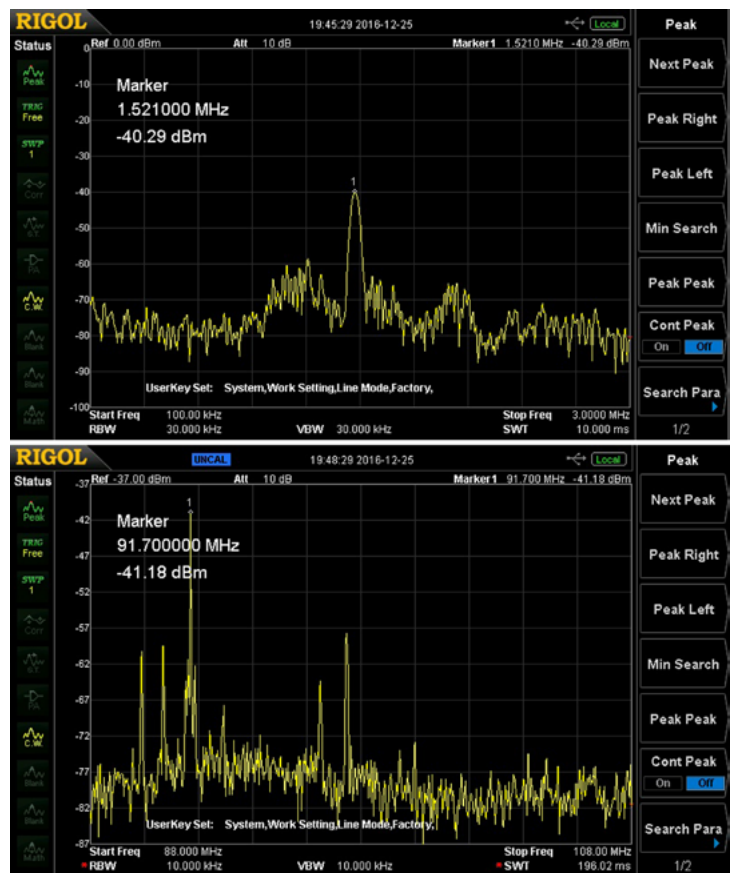
The radials, again, did nothing to improve the SWR curves on 80 meters, but they undoubtedly improved the antenna’s overall signal by at least a smidgen. I use a tuner in the shack to clean things up. The SWR on 80 runs between 2.4:1 and 5:1 depending on where I am in the rather wide band. The SWR losses with the tuner are acceptable, for now.

So, why is the SWR not behaving as expected on 80? I suspect that the antenna’s interacting with one or more of the other antenna wires in the yard (the 60-meter wire HAD to go), or something else in the environment. It could also have something to do with the fact that the 80-meter wire runs “too horizontal” to the ground and isn’t actually “vertical” enough. The center mast is only about 15 feet high, and the “80-meter tree” is a ways off, so the wire slopes a bit and is closer to the ground than I’d prefer for much of its run. The 40 and 30 wires do not have this problem.

Tidbits

During the antenna testing process I noticed that the MiniVNA was producing some squirrely SWR curves while the MFJ antenna analyzer was much more solid. What’s up with that? Well, as near as I can figure, unwanted RF in the environment is probably messing with the VNA, which is more sensitive to low-level RF than the MFJ. This is a real problem that doesn’t get a lot of discussion.

And there’s plenty of RF in the neighborhood (other than mine). The spectrum analyzer scans shown in the figure



Are local broadcast signals interfering with VNA and antenna analyzer results? Probably (see text). The top scan shows the main culprit, AM 1520, located 3 miles to the North. It puts an S9+50 dB signal into a 2-foot wire antenna, even when located in the basement! The bottom scan shows FM 91.7, also with a big signal, but farther removed from the HF bands. (NT0Z photo)

were taken in my basement shack using a 2-foot piece of wire as an antenna, with a 10-dB attenuator in line. The scan of the AM band shows one neighborhood nemesis, AM 1520, which is a bit more than three miles to the North.

If we add 10 dB by removing the analyzer’s inline attenuator, that puts KOLM—sports talk radio of all things—at a whopping -30 dBm as received on a short piece of wire while underground! At the time of the scan, KOLM was running its 1-kW nighttime power. During the day we can add yet another 10 dB, as the power level then is 10 kW! That’s roughly equivalent to an S9+50dB signal with no real antenna attached.

The other scan shows a bunch of local FM stations, the strongest of which is a whopper at 91.7 MHz. Again, if the internal attenuator is turned off, that station is putting in a -30 dBm signal into a two-foot-long underground antenna. (The difference between 90 MHz and the low HF bands is far greater than the difference between 1520 kHz, however, so I’m not nearly as worried about the FM signals.)

Because I didn’t have a suitable external attenuator on hand, I didn’t dare connect the spectrum analyzer to either outdoor antenna, especially the big doublet. The analyzer will “die” at input levels greater than 100 mW or so. I don’t have figures on hand, but I seem to recall that, when mea-

sured on resonant 160-meter antennas, nearby AM broadcast stations can put that, and more, at the antenna port of a receiver. I wasn't willing to risk it without at least a 40-dB tap.

I think that's why the MiniVNA was being weird at frequencies that the MFJ analyzer wasn't. The VNA is much more sensitive and uses less "transmit power" from its signal generator. The unwanted energy on the antenna and feed line can overload the VNA and cause distorted readings. The MFJ analyzer has a less-sensitive detector. Why? Because its internal "transmitter" puts out a lot more power. More power from the test signal means that the unwanted "received" RF makes up a smaller proportion of the RF as seen by the analyzer's front end, which is a good thing in this application.

How could we improve this even more? One awesome way would be to use an antenna analyzer that puts out 10 to 100 W. That way, any unwanted RF would be so small as to be irrelevant. Because such an analyzer doesn't yet exist, the next best thing would be to connect a ham transceiver directly to the antenna and radial connections at the base of the vertical. My KX3, which puts out 12 W max, also has a massively crunch-proof front end and an accurate, built-in SWR meter. On the next 40-degree day I will give the KX3-analyzer a try.

The bus bars at the antenna feed point (one for the radials, one for the antenna elements) are both reasonably insulated inside their respective plastic boxes, but the two screws that secure each bar (and each box) to the wooden post are drilled straight through. I can't imagine that this poses any problems for the ground radials, but maybe it's enough to have at least a small effect on the antenna elements? I will test this in the near future by unscrewing the antenna bus from the post and applying RF.

The interaction between the 30-meter wire and the rest of the antenna is pretty severe. When the wind is blowing even moderately, the 30-meter SWR swings up and down! It does the same thing if I tug on the wires on the side of the mast. Oops.

For most low-band signals, the vertical outperforms the doublet, at least on receive. But on 40 and up, where the doublet is higher and longer, even long enough to produce some gain and directivity, the doublet is sometimes a lot stronger than the vertical (which has a low-enough SWR on 17, 15 and 10 meters). But the doublet is almost always noisier, and the two aren't that far apart in the yard.

The doublet is a lot closer to an AC mains pole, however, and one leg does parallel my AC service drop. I switched off every light (CFM and LED) in the house and made sure nothing else was running, but nothing I do has made much difference when it comes to low-band noise as received by the doublet. The neighboring houses are at least 300 feet away, so the crud may indeed be coming from the AC power pole.

And with 50 W output, the vertical seems to transmit "better." Ten dB is 10 dB, after all. At 500 W—yet another 10 dB—the vertical may even start to match its weird, wonderful RX performance. But I don't have a 500-W amplifier



MFJ 259-C Antenna analyzer. (Courtesy: MFJ Enterprises)

at present, and if I did it might take some coaxing to get me to use it.

If you, dear reader, can shed any light on either antenna mystery, please don't be shy. As it stands, I have a DC-to-daylight doublet fed with open-wire line. It transmits tolerably well, all things considered, but is a bit (or horribly) deaf because of noise and height above ground issues. And I have a multiband vertical that hears like crazy but doesn't transmit with much reciprocity.

So, that's my latest tale of wonder, woe and winter madness. It's an unusual antenna combo, but it gives me something to fool around with as winter marches on. But once spring has sprung, it's loopy time, ASAP. I will gleefully rip that doublet apart and turn it into a beautiful equilateral triangle!

RADIO 101

By Ken Reitz KS4ZR

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FTA Satellite TV Part II: “Hidden” Signals on Satellite TV (All photos courtesy of the author)

The same year that I first put in a C-band TVRO system (1984) two of the biggest satellite-TV gurus at the time, Tom Harrington and Bob Cooper, released a book published by SAMS titled, “The Hidden Signals on Satellite TV.” Used copies sell today for just under \$4 and new copies sell for as high as \$77, through third-party sellers on Amazon. At the time, the 238-page 8.5 x 11 format book was considered crucial reading for satellite-TV enthusiasts.

The publisher, Universal Electronics, noted that the book was, “devoted entirely to hidden, non-video services such as teletext, telephone, computer and audio signals, relayed via satellite.” For today’s FTA enthusiast it has historical interest alone—publications from that period don’t relate much to today’s satellite realities.

Cooper (see last month’s Radio 101 column) would later get tangled up in the hacking of VideoCipherII technology, an early TVRO encryption system, and Harrington, through Universal Electronics, would go on to provide satellite SCPC (Single Channel Per Carrier) receivers for the broadcast industry and satellite-TV enthusiasts, among other products.

At the time, there was virtually no encryption of any services, video, audio or data. TVRO tinkerers (many of whom were hams) found that, using a combination of receivers, early computer programs and off-the-shelf devices such as scanners and dedicated RTTY terminals, they could listen to narrow-band FM audio services, very narrow-bandwidth, audio services (SCPC) and read Teletype press services from around the world. In fact, an earlier 380-page book, “The Home Satellite-TV Book,” by Anthony Easton, published by Wideview/Perigee in 1982, detailed how these services were transmitted in his chapter, “The ‘Secret’ Signals on the Birds.” It’s one of the few TVRO books from the era that I still have. The fact is that there was no secret to how all of these services were transmitted or received or even where they were—they just weren’t widely known.

It was reminiscent of the glory days of shortwave radio when serious shortwave enthusiasts knew where the radio Teletype news feeds were and what the broadcast schedule was for AFTRS, which rebroadcast many US-based commercial radio network programs at the time. They were certainly not “hidden” either.

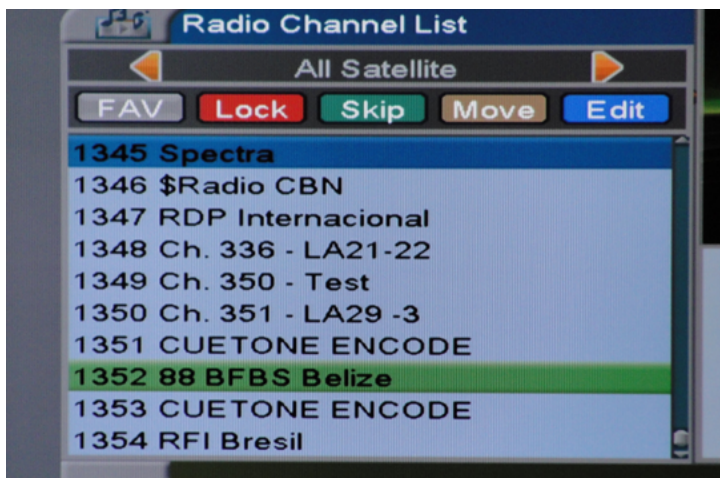


Last remaining NTSC analog FTA channel still found on C-band satellite in all its 4:3 aspect ratio glory.

Bob Heil K9EID, the microphone king of amateur radio, was also an early TVRO pioneer and discovered that cheap, analog-tuned multi-band portable radios could be turned into crude but effective SCPC receivers. Most satellite receivers had a “baseband” RCA jack output, which could be attached to such a receiver’s antenna input and those narrowband SCPC signals could be heard as you tuned through the VHF band. Harrington’s company made a much more sophisticated, digitally tuned, rack-mount receiver for the broadcast industry.

This was the peak of the home satellite-TV industry, which was driven by sales to folks in mostly rural areas who had no access to cable-TV and barely received any OTA-TV signals. Hobbyists, interested more in non-cable programming, were the beneficiaries of mass production of TVRO equipment, which meant that prices for essential equipment (dishes, actuators, LNBs, and receivers) were constantly declining.

During the next ten years some 3-5 million C-band satellite-TV systems were in use throughout North America and the technology remained pretty much unchanged for years. But by the mid-1990s what’s now called Free-to-Air satellite-TV had dramatically changed. The Pay-TV small-dish revolution derailed the entire big-dish TVRO industry



FTA receiver screen shows a segment of the audio services available on SES-6, including BFBS Belize, one of many British Forces Broadcasting Service channels on this C-band satellite. Note also RDP International (Portugal), RFI Brazil (Radio France International in Portuguese for Brazil) and several VOA channels indicated as Ch 336 and 35 in this portion of the list. The \$ indicates an encrypted audio service.

as digital technology swept through—allowing a far greater number of channels to be transmitted under far more secure conditions. But it wasn't just satellite broadcasting that changed. Fiber optic cable, which dwarfed the capacity of copper cable, was cheaper to use than satellite and more secure. One good example is transoceanic telephony, a good portion of which had been carried on discreet narrow-band analog channels in SSB on domestic communications satellites. Many of the burgeoning new cable-TV networks also switched to fiber optic cable for backhauls and network distribution that had previously been done on satellite in an unencrypted format.

Digital technology, with its proprietary transmission schemes also changed the landscape in SCPC distribution, rendering all those analog receivers useless. It had earlier been possible to listen to any sports network, college or pro, during live events via analog SCPC receiver. That all disappeared. But, by 2001 Sirius and XM satellite radio became available, allowing sports fans to enjoy out of market broadcasts of their favorite teams without the use of the big dish and makeshift equipment. While listeners pay for the privilege, it's also portable, something big-dish SCPC never was. Sirius/XM, which became a single company/monopoly with FCC blessings, also includes many of the former analog subcarrier audio services that had been staples of big-dish satellite from the beginning of the industry, such as BBC World Service, CBC Radio, even an Old Time Radio channel.

Unlike amateur radio, if you came across a museum quality 1986 big-dish satellite-TV set up today, aside from the dish itself and the actuator motor to drive it, there would likely be nothing to salvage, even in brand new condition. Like many longtime TVRO enthusiasts, I've taken at least a ton of outdated, but perfectly good, equipment to recycling over the years. That doesn't mean that the big dish is use-



MPEG4 FTA version of CSPAN-HD is found as part of the VOA channels on SES-6.

less—far from it. It's just that all the analog gear, even if it is still functioning, won't have any value. That includes what may be mounted on the feed support. Most C-band LNB/LNA downconverters of the period are electronically inferior to what's available today. The actual feed horn will still be useful if a modern LNBF is mounted in its place.

The domestic broadcast satellites used to be structured, in the good ol' analog days, so that each satellite had 24 transponders, each of which could be used to broadcast one video channel with separate subcarriers for left and right program stereo audio and one or two unrelated audio subcarrier channels as well. All video and audio programming found on that channel rode a single carrier up to the satellite. Many of the shortwave broadcasters of the period, such as BBCWS, could be found on such subcarriers. Many major market FM radio stations were also found on these subcarriers 24/7. They were there because cable-TV systems offered them as audio services in their programming packages.

Some video channels could earn extra money by charging for the use of their subcarriers while other channels gave the space away to non-profits, which is how "Yesterday USA Superstation" got started in the mid-1980s. The all Old Time Radio format station was a staple for big dish listeners for decades and can still be found online at <http://www.yesterdayusa.com>.

Today, thanks to the benefits of digital compression technology, a typical domestic broadcast satellite used for cable-TV programming can cram upwards of 120 high-definition video channels into one satellite. Or one channel can transmit 53 separate channels of stereo audio programming, which music services do on a number of satellites, though not necessarily available on FTA receivers.

And, that brings me to the purpose of FTA satellite-TV receivers—to receive only those channels that are "Free-to-Air" without any subscription fee. That number is quite significant when seen across the entire viewable region of the North American sky, which is from basically 30 degrees to 130 degrees W.

Among current and former shortwave radio broadcasters there are many very familiar names that I have found broadcasting regular schedules in English and other language-



(Left) WSM-AM on TV? Yes, “Coffee, Country and Cody,” on-the-air with WSM-AM personality Bill Cody on FTA-TV. (Right) VOA-TV news program. While known mostly for their radio news programs VOA has TV news in various languages.



es on satellite: BBC World Service, BFBS (British Forces Broadcasting Service), China Radio International, Deutsche Welle, RFI (France), RNE (Spain), Radio Havana, Radio Japan, Radio Nacional (Columbia), Radio Nacional Argentina, Radio Nacional Peru, RDP International (Portugal), Sputnik (formerly Radio Moscow) and VOA.

Don't forget World Radio Network (WRN), which is found on Ku-band Galaxy 19 at 97 degrees west. WRN broadcasts current programming from former and current shortwave broadcasters such as Radio Prague, Polish Radio External Service, KBS World Radio (Korea), Radio Sweden and many old shortwave favorites that you thought had disappeared. They are all found here 24/7. Babcock International Group acquired WRN, according to a posting on Wikipedia, in March 2015. Since then, WRN programming has run as ever before. And, even though on-air promotions insist you can get a schedule of programming from their website, www.wrn.org, that website has been inexplicably down for several months. Still, you can listen to all WRN programming by putting “WRN” in your Wi-Fi radio's search function. Oddly, the Wi-Fi radio display seems to always be out of sync with the programming. For example, during Radio Sweden programming the display showed the Deutsche Welle logo.

The far western section of the Clarke Belt over North America is known as the “cable neighborhood” because almost all of the transponders on all the satellites from 119 degrees W to 135 degrees W are used for the distribution of cable-TV programming. They are virtually all encrypted but there are some FTA exceptions. If you can see far enough to the western most domestic broadcast satellite, AMC 8 at 139 degrees W (I can't), you might be able to receive FTA radio feeds for Radio Disney, ESPN sports radio, ESPN Deportes Radio (Spanish version) as well as Fox Sports Radio.

Galaxy 13 127 degrees W

NASA-TV There are three channels broadcasting NASA-TV. These channels have bounced around C-band for decades. It's anyone's guess how long they'll be at this

location, but it's always compelling video—if you're interested in space. The press conferences are really interesting. One channel, labeled “NASA-TV Public” is in MPEG2/ HD; the second is labeled “NASA-TV Media” and is in MPEG4/ HD and the other is labeled “NASA-TV UHD” and is in MPEG4/Ultra High Definition. NASA-TV was one of the first channels to use the HD 16:9 format many years ago and is one of the first to air in the new UHD format. To my knowledge, there is not yet an FTA satellite receiver capable of displaying UHD channels.

Galaxy 23 121 degrees W

Spain continues to transmit content via satellite around the world, despite other countries' cutting back. They have a presence on both C and Ku-bands receivable in North America. The video is mostly encrypted but the audio services (below) are not.

Radio Nacional Exterior (Spain)
RNE Clasica (classical music)
RNE Radio 3 (popular music Spanish and English)
Radio Exterior (various programs in Spanish and English)
RNE Radio 5

Eutelsat 117 116.8 degrees W

This is one of two main satellites for Mexico, but a number of other Latin American countries can also be found here including Dominican Republic, Guatemala, Honduras and Ecuador. The Mexican government has quite a few channels—some for educational purposes and some for administrative use. Most are FTA in either SD or HD formats.

TV-UNAM La Universidad Nacional Autonoma de Mexico “Looking at the universe with the eyes of the university,” features cultural programming from Mexico.

Deutsche Welle TV in Spanish with Más Radio as a second audio subcarrier playing rock en Inglés. It's always useful to check the various audio subcarriers on any FTA channel, you never know what you'll hear.



CBC News Network on Anik F1R at 107.3 degrees W

Anik F1R 107.3 degrees W

There are lots of Canadian TV Network (CTV) stations from Halifax to British Columbia found here. CTV is a Canadian commercial network and airs a lot of US network programs with plenty of local Canadian news. You'll also find Radio France Internationale (in French, of course) on an audio subcarrier and the Weather Network, similar to the US' Weather Channel. While all of the CBC-TV channels on this satellite are encrypted, you will find CBC-TV news feeds on various channels on this satellite if you look around.

SES-3 103 degrees W

Deutsche Welle English TV service in English and German is found here. DW may be second only to China in FTA satellite delivery.

Ant1 Satellite (Greece) Here's a country that, despite financial problems, keeps its diaspora entertained (Greek dramas) and informed (news from Greece), all in Greek.

PBS (East coast feed) in SD and HD resolution. This channel is mandated by Congress to provide an unencrypted feed of PBS. It's a throwback to the days of the 1980s and 90s when many of us were out of range of cable didn't want to sign up for expensive small-dish satellite-TV in order to watch PBS—there's been an unencrypted C-band PBS feed for at least 30 years and it lives here.

SES-1 101 degrees W

Home of Me-TV a network of nostalgic American TV programming with iconic series' from the 1950s, 60s and 70s. Additional oldies TV programs are found on "Heroes & Icons," "Decades," and "Movies," three other FTA channels on this satellite. For something more up-to-date, you can watch Mnet America, which airs K-pop music and K-dramas and documentaries following your favorite K-pop stars and bands.

Galaxy-16 99 degrees W

Home of American Forces Network TV and radio,



NASA-TV on Galaxy 13 at 127 degrees, relays the launch of a Japanese satellite from the Tanegashima Space Center Japanese spaceport.

which for many years was FTA but now all encrypted, G-16 does have some FTA including all of the LESEA radio and TV channels (World Harvest TV and shortwave radio programming).

Galaxy-19 97 degrees W

While the Ku-band side of this satellite may be the most watched by FTA fans, the C-band side has its share of interesting programming too, including Azteca Trece (Mexico City's channel 13).

SES-2 87 degrees W

ZNS Network (Religious)

The House of Assembly (Religious)

1540 AM ZNS-1 (Radio Bahamas) This station was an easy catch at night for a kid listening in Central Florida during the mid-60s. It's been at this satellite location for decades still playing pop music with a Caribbean flavor. The video channels have badly over modulated audio.

AMC-9 83 degrees W

Ever wonder where a lot of the nostalgic TV shows come from? A few of them originate on this satellite from Luken Communications and they are all FTA. Channels such as Retro-TV (old US TV shows), Heartland (country music and farm related), Rev'n (automotive shows), The Action Channel (outdoor sports such as winter skateboarding and water skiing, for example) and more are found on this satellite.

Simón Bolívar 78 degrees W

Devoted almost entirely to video and audio programming from Venezuela. Radio Nacional de Venezuela has four radio channels, which include all types of Latin American



“O Preço Certo,” with Fernando Mendes, Portugal’s answer to Bob Barker in their version of “The Price is Right!”

music.

Atlantic Ocean Region Satellites

To me, the most interesting video and audio channels are found on what’s called the Atlantic Ocean Region (AOR) that extends from 8 degrees West to 61 degrees West and includes both C and Ku-band offerings. How far east you will be able to see will depend on your terrain and your proximity to the US east coast. The way my 10-foot C-band dish is set up, I can see down to 47.5 degrees West (NSS 806). I would have to change the position of the actuator motor in order to push the dish further to the east, but by then I would be looking into a solid forest. On Ku-band, using a stand-alone Ku-band dish, I can see as far as 30 West (Hispasat 30W), by relocating the dish support so that it has a better look at the eastern horizon than the big dish. Looking at a footprint map of this satellite shows that it will be impossible to see this satellite on the US west coast.

Intelsat 21 58 degrees W

If I were to be able to receive only one C-band satellite, Intelsat 21 would be it. It’s an international news junkies’ one-satellite delivery system. Check out this FTA channel line-up:

Deutsche Welle Latinoamerica (Spanish and German)
 DW Amerika
 CCTV 9 Documentary
 CCTV 4 America
 CCTV News
 CCTV Français
 CCTV Español
 China Radio International (in several languages)
 YTN World (South Korea in Korean only)
 Arirang World (South Korea in English/Spanish/Korean)
 MPT (North Korea in Korean only)



ARTS channel: all-classical music videos with snippets from vintage and modern ballet and opera with no commercials.

France 24 English
 France 24 Français
 Russia Today Español
 NHK World TV (English)
 Radio Japan
 RAI Radio 1 (Italy in Italian)
 Duna World TV (Turkey in Turkish)

Intelsat 34 55.5 degrees W

BBC World Service feeds in a variety of languages, including English, Portuguese and Arabic are found here and a number of things you’re unlikely to see anywhere else, such as Nicaragua’s channels 9 and 2; Costa Rica’s channels 4 and 6, and RTP International TV and radio (from Portugal).

SES 6 at 40.5 W

Home of a very wide assortment of radio and TV services including VOA radio and TV for Latin America and VOA-TV Persian, Radio and TV Martí, CSPAN-TV, British Forces Broadcasting Service (BFBS), and Russia Today (RT) in English. This satellite uses left-hand/right-hand circular polarity instead of horizontal/vertical linear polarity. It will help to have a C-band feed horn capable of tuning circular polarity. If you don’t, you can place a Teflon dielectric insert in the feed horn throat to allow left and right circular polarity. Such inserts used to be sold at every satellite-TV website, now they are hard to come by.

Hispasat 30W

Much of this satellite is spot beamed to Europe, but a significant number of channels are beamed to the Americas including an interesting suite of TV and radio channels from Cuba: Cubavision International, Cubavision Nacional, Canal Educativo, Canal Educativo 2, Senal ACN (news



(Left) Channel ID for Nicaragua Channel 9, which carries Plaza Sésamo, the Spanish language version of Sesame Street. (Right) Nicaragua Channel 2, which is celebrating 50 years broadcasting, airs national news.



channels with text with still photos), as well as all official national radio channels, including Radio Progreso, Radio Rebelde, Radio Habana Cuba, Radio Reloj, Radio Taino, Radio Encyclopedia, CMBF Radio Musical Nacional, Radio Rebelde AM and RHC2. Even if you don't understand Spanish, CMBF is worth listening to—excellent classical music during the day and jazz at night. It's one of the few radio stations you'll hear today that still plays vinyl records—well used vinyl records.

Unlike most of the Latin American stations heard on FTA satellite, Cuban stations play a very wide range of music. TV programming includes homegrown police dramas, historic dramas and live music shows with all types of music. There are also quite a few US produced TV shows, vintage black and white American movies (dubbed in Spanish) as well as current network talent shows. Best of all, just as most of the northern parts of the US are still in the throes of snowstorms in January and February, you can watch the best Cuban Béisbol on Cubavision International.

Wild Feeds

One of the interesting aspects of the FTA satellite hobby has been watching “wild feeds,” news and sports feeds from the field that appear randomly on both C and Ku-band channels. News networks, and most TV stations that have actual news teams, employ their own or rented satellite uplink trucks to transmit such feeds. You see these trucks parked at various sporting and news events, often outside courthouses if there's an important legal story unfolding, for example. If they're not actually leasing a full-time frequency on a transponder, they can buy spot time on a particular satellite transponder from a broker. You'll typically see a slate with color bars announcing the organization or station and sometimes details about their location.

Big news organizations, such as those with major networks (CBS, NBC, ABC, etc.) have contracts on certain transponders on specific satellites. For example, the entire

Ku-band side of AMC 9 at 83 degrees W is used in this manner, with NBC feeds found here along with various random feeds. Since there is usually nothing on the transponders, you'll have to do a “blind scan” of such a satellite to see if anything is on. Even when you do see a picture, it can be just the front of an unidentified building, for example. The crew could be waiting for the network to do a live feed from wherever it is; concerning whatever the crew is there for.

In the old days, you could watch nearly any college or professional sporting event on the live uplink from the stadium. While those feeds still exist, and you will occasionally come across such feeds, they are typically encrypted. Associated Press had C-band feeds on SES-2 at 87 degrees that produced news packages for use by news organization subscribers. They are still there but encrypted today. CBS feeds are said to be found on the C-band side of Galaxy 28 at 89 degrees W, with ABC feeds on the Ku-band side. ABC feeds are also found on Galaxy 17 at 91 degrees W. CBS and Fox feeds are said to be found on Galaxy 16 at 99 degrees W. NBC feeds are found on SES 3 at 103 degrees W. A good motorized Ku-band dish is the cheapest way to explore this facet of FTA-TV.

DW-TV (logo upper left) on Mexican satellite (logo upper right) with audio subcarrier playing unrelated music channel.



TSM

RADIO PROPAGATION

By Tomas Hood NW7US

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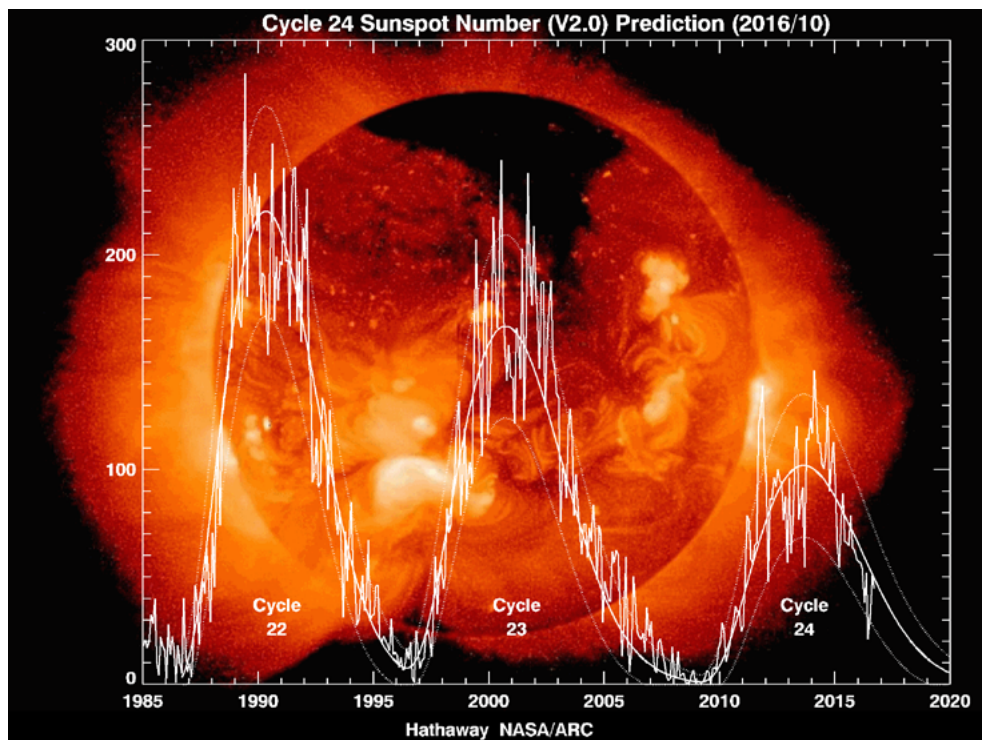
Solar Cycle 24 Downgraded (Again)

This past November (2016), this column reported a number of periods during which there were no sunspots visible on the solar disc. Since that publication, through this column's deadline on December 29, 2016, there have been an additional six periods of no sunspots. Seemingly, more frequently we see these spotless periods. Clearly, this is confirming the decline of Solar Cycle 24, as the Sun becomes ever more quiet until the solar cycle minimum.

The official NASA Solar Cycle 24 prediction discussion, updated on October 6, 2016, states that the smoothed sunspot number V2.0 reached a peak of 116.4 in April 2014. The consensus now is that this is the candidate for official Cycle 24 maximum. April's smoothed sunspot count is a second peak that surpassed the level of the first peak of 98.3 for March 2012.

Note that in June 2015, the World Data Center, Sunspot Index and Long-term Solar Observations (WDC-SILSO), Royal Observatory of Belgium, Brussels, adjusted their original observed sunspot numbers (Version 1.0) to a Version 2.0 series in which the sunspot numbers are higher. The number crunchers discovered weighted sunspot numbers in the Version 1.0 (V1.0) data series, throwing the series.

The new (V2.0) sunspot numbers are unweighted sunspot number counts (for more information see: <http://www.sidc.be/silso/home>). The Bureau of Meteorology Space Weather Services solar cycle prediction now uses the V2.0 values. Because of the WDC-SILSO recalibration, the observed monthly sunspot numbers are higher. Current tables of smoothed sunspot numbers and



The plot of three sunspot cycles; Cycle 22, Cycle 23, and the current Cycle 24. Cycle 24 is projected out to 2020, the year we anticipate the statistical solar cycle minimum. There are a few years remaining of sunspot activity. Credit: Hathaway, NASA ARC

equivalent 10.7 cm solar flux and the solar cycle graph, posted on various space weather websites, now use the V2.0 values.

Many cycles are double peaked, but Cycle 24 is the first in which the second peak in smoothed sunspot number is larger than the first. Over seven years ago, Cycle 24 officially began, and we now can see that the current predicted and observed size makes this the smallest sunspot cycle since Cycle 14, which had a maximum smoothed sunspot number V2.0 of 107.2 in February of 1906.

We are not yet at the very bottom of the cycle, so while there are more frequent periods with no sunspots, there is plenty of space weather. Space weather is a term used to describe a collection of physical processes, beginning at the Sun and ultimately affecting (in part) radio propagation conditions. The Sun is always emitting energy. These emissions come in the form of flares of electromagnetic radiation (though more infrequent now, with so few sunspot regions), including radio waves, infrared, light, ultraviolet, and X-rays, and as energetic electrically charged particles through coronal mass ejections and plasma streams. These solar particles travel outwards away from the Sun in a constantly fluctuating solar wind.

The solar wind carries pieces of the Sun's magnetic field with it. The electromagnetic radiation travels at the speed of light and takes about eight minutes to move from Sun to Earth, whereas the charged particles travel more slowly, taking a

few hours to several days to move from Sun to Earth. The radiation and particles interact with the Earth's geomagnetic field and outer atmosphere in complex ways, causing concentrations of energetic particles to collect and electric currents to flow in regions of the outer atmosphere, the magnetosphere and ionosphere. These can result in geomagnetic variations, Aurora, and can affect radio signal propagation.

Through the end of 2016, there were some days of storm-level geomagnetic activity, due to coronal hole activity and the resulting bombardment of the Earth's geomagnetic field of solar plasma particles.

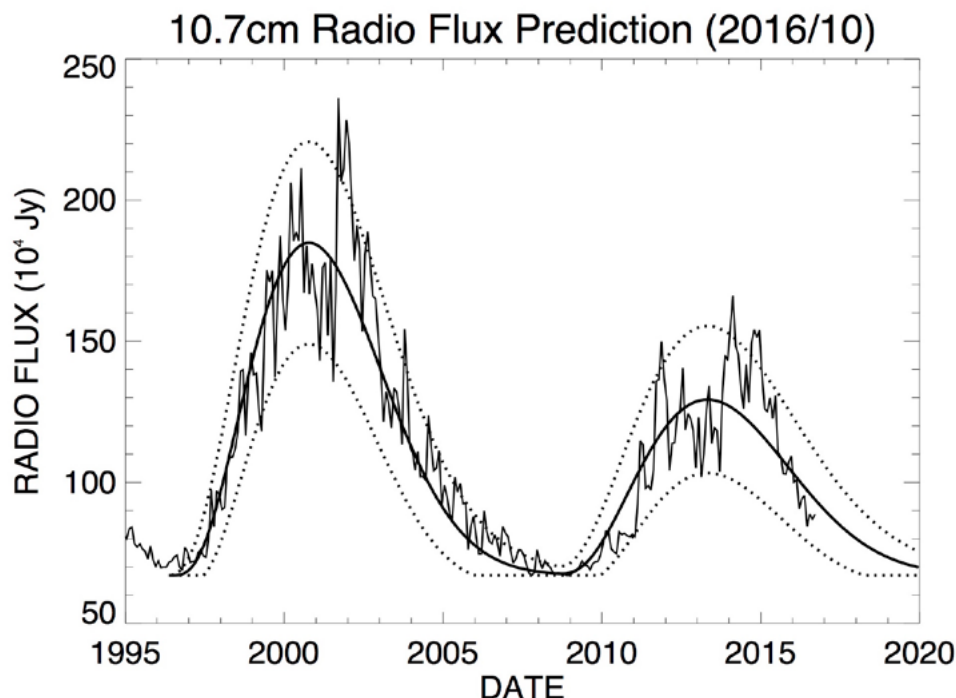
Where's the DX?

With a low number of sunspots, you might think that radio propagation on shortwave frequencies is all but non-existent. The reports coming in show that there is plenty of DX. Furthermore, we know now from the last solar cycle minimum (a prolonged period as compared to other past solar minimums) that plenty of DX occurs, just on lower shortwave frequency bands.

Some of this DX activity happens because geomagnetic field disturbances can result in some blocked radio signal paths, while other paths remain open. Another blessing hidden in geomagnetic storms is the possible aurora that can occur when the solar particles enter Earth's atmosphere in the polar regions (in the aurora oval). The E-region of the ionosphere can become highly ionized during an aurora. These clouds or patches of highly energized ions reflect radio signals, providing a great radio propagation path on higher frequencies (upper shortwave through low-VHF). Overall, though, DX is better when the geomagnetic activity is low.

HF Propagation

Expect a moderate to low level of solar activity during January, with 10.7-cm flux levels peaking around 60, at most, dipping down to 40. That's not too bad, considering that we see the Sun moving toward the solar minimum



Another indicator of the level of solar activity is the flux of radio emission from the Sun at a wavelength of 10.7 cm (2.8 GHz frequency). This flux has been measured daily since 1947. (Text and graphic courtesy of NASA/MFSC)

period—which we expect to happen around 2020.

The great thing about the winter season is that the density of ionization in the Northern Hemisphere is expected to increase more rapidly after sunrise than during other seasons. Additionally, static and atmospheric noise levels will be at seasonally low values during the month of January. Reasonably strong signal levels are expected on most of the lower shortwave bands (lower in frequency), while the higher bands will not be as hot as during the peak years.

The medium wave (MW) broadcast band, also known in the United States as the AM Broadcast Band (or AM band) currently extends from 525 to 1700 kHz. In the United States and Canada, channels are spaced in even 10 kHz increments starting at 530 kHz. Elsewhere, channels are spaced in 9 kHz increments starting at 531 kHz.

The hunt for signals from far away AM broadcasting stations is an exciting activity, especially during the late fall and winter seasons. The distant stations you can hear depend largely upon signal propagation. Propagation at these frequencies is very different than for frequencies in the high-frequency range (3 MHz through 30 MHz). Propagation of medium wave signals varies depending on the time of day, the season, and other factors.

For medium-frequency propagation conditions, the most obvious factor for good DX is the time of day. The D-layer of the ionosphere almost always absorbs medium wave radio signals during the daylight hours. Thus, nearly all medium wave signals received during midday hours will arrive by ground wave propagation, rather than by sky waves refracted off of the ionosphere. Groundwave propagation makes reception of signals over a few hundred miles away unusual in daylight. At night, however, the ionosphere refracts these medium wave signals, making it possible for radio stations to be heard at much greater distances, sometimes as far away as Australia, Europe, and Asia.

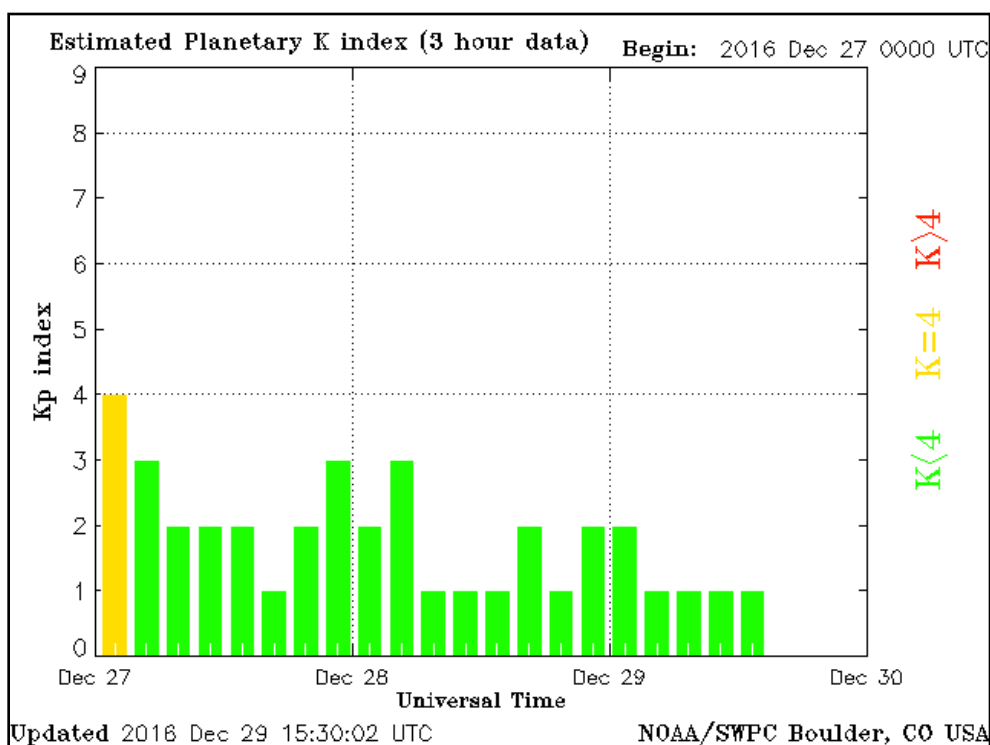
Reception of medium wave signals tends to be better in winter than in summer, due to lower levels of atmospheric noise and longer hours of darkness. During

times of severe geomagnetic storms, when the Planetary-K index (Kp) is above 4, auroral ionization can absorb the skywave medium wave signals, causing any higher-latitude broadcast signals to disappear which would allow detection of weaker mid- and low-latitude stations. At the same time, because of ionospheric tilting and other phenomena, expect some enhancement of mid- and low-latitude skywave signals. DXing of stations from south of the equator is often possible during highly active geomagnetic storms.

One of the most exciting aspects of medium wave DXing is known as the “sunrise and sunset DXing window.” The most fruitful times to reap distant MW signals are from just before sunset to a few hours after sunset and again just before sunrise to a few hours afterward. The sunset skip period is particularly useful to DXers in the eastern part of North America because stations in time zones farther west become audible after local daytime stations have stopped transmitting. Western DXers, on the other hand, have an advantage in being able to pick up many eastern stations as they begin their broadcast days in the morning.

Because of the seasonal decrease in geomagnetic activity during December and January, and because of the longer hours of darkness in the northern hemisphere, you will find a rich selection of medium wave AM signals from as far away as Europe, South America, Asia, and even the South Pacific. Let me know your own experiences.

During the winter months, the Maximum Usable Frequencies (MUFs) are generally higher during the daylight hours than during the summer daylight hours, resulting in short but strong openings on higher shortwave bands during the winter day. Then, at night, the MUF dips down much lower than during the summer nights. Summertime MUFs are generally higher during the night hours than during the winter nights, due in part because the ionosphere stays energized through the short nights. Winter nights are longer, so greater recombination of the ionosphere (which results in a lowering of



From December 29, 2016. The K-index, and by extension the Planetary K-index, are used to characterize the magnitude of geomagnetic storms. Kp is an excellent indicator of disturbances in the Earth's magnetic field and is used by SWPC to decide whether geomagnetic alerts and warnings need to be issued for users who are affected by these disturbances. The principal users affected by geomagnetic storms are the electrical power grid, spacecraft operations, users of radio signals that reflect off of or pass through the ionosphere, and observers of the aurora. (Text and graphic courtesy: Space Weather Prediction Center)

the MUF) is during this season than during the summer season.

Paths on 31 through 15 meters remain in their seasonal peak, especially between North America and Europe in the morning, and between North America and Asia during the late afternoon hours. Twenty-two and 19 meters continue to be the best daytime DX bands, with 31 and 25 running a close second. Plenty of surprises are possible on 31 meters during the morning and evening hours, and well into the hours of darkness. North/south paths on 25 through 15 meters will be reliable and open for most of the daylight hours, especially where paths terminate in the southern hemisphere. Nighttime conditions on these higher frequencies remain short and weak, with mostly north/south path openings since the southern hemisphere has longer daylight hours.

Signals are strong on 90 through 41 meters this year, and seasonally they are at their nighttime peak. DX activity tends to increase later in the evening toward midnight. Look for Africa and South Pacific (Australia, Papua New Guinea, and so on) on 90 through 60 meters throughout the night. On 41, 49 and 60 meters, long path DX is possible along the gray line.

Seventy-five through 120 meters continue to remain stable, with very low noise levels. Some high noise may occur during regional snowstorms, but on average you can expect great nighttime DX conditions with the longer hours of darkness. Look for Europe and Africa around sunset until the middle of the night, and then Asia, the Pacific, and the South Pacific as morning approaches. Signals below 120 meters are also greatly improved unless we experience those intense CME events, where conditions will become degraded. Medium Wave DX is really hot during this season.

Product: 27-day Space Weather Outlook Table 27DO.txt
Issued: 2016 Dec 26 0416 UTC
Prepared by the US Dept. of Commerce, NOAA, Space Weather Prediction Center
Product description and SWPC contact on the Web
<http://www.swpc.noaa.gov/wwire.html>
27-day Space Weather Outlook Table
Issued 2016-12-26

UTC Date	Radio Flux 10.7 cm	Planetary A Index	Largest Kp Index
2016 Dec 26	73	12	3
2016 Dec 27	73	5	2
2016 Dec 28	75	5	2
2016 Dec 29	75	5	2
2016 Dec 30	75	15	4
2016 Dec 31	75	10	3
2017 Jan 01	77	5	2
2017 Jan 02	77	8	3
2017 Jan 03	77	10	3
2017 Jan 04	77	20	5
2017 Jan 05	77	22	5
2017 Jan 06	79	16	4
2017 Jan 07	79	14	4
2017 Jan 08	79	6	3
2017 Jan 09	79	5	2
2017 Jan 10	77	5	2
2017 Jan 11	77	5	2
2017 Jan 12	77	5	2
2017 Jan 13	77	5	2
2017 Jan 14	75	10	3
2017 Jan 15	75	5	2
2017 Jan 16	75	5	2
2017 Jan 17	75	25	5
2017 Jan 18	75	20	5
2017 Jan 19	75	25	5
2017 Jan 20	73	18	4
2017 Jan 21	73	18	4

27-Day Space Weather Outlook (Courtesy: SWPC/NOAA)

Propagation on VHF and Above

With the coronal hole activity we've already seen during the late part of 2016, it is possible for some strong aurora activity occurring, making VHF DX possible. I'd like to hear from you if you catch such propagation.

Sporadic-E (Es) activity can appear three to four days during January on the low VHF frequencies for stations in the Northern Hemisphere. The average opening may last an hour or two with distances of up to 1000 km.

The Quarantrids meteor shower is the major meteor shower for January, and it can appear any time during the first week of January. This shower can sometimes be quite intense, so it may be a good idea for setting up some 2- and 6-meter schedules. Morning meteor openings may be the best bet during this month.

Solar Cycle 24 Today

The Royal Observatory of Belgium, the world's official keeper of sunspot records, reports a monthly mean sunspot number of 12.8 for November 2016, down from 20.2 for October. The mean value for November results in a 12-month running smoothed sunspot number of 26.9 centered on May 2016, down from April's 28.7. Following the curve of the 13-month running smoothed values, expect a smoothed sunspot level of 27 for January 2017, plus or minus 14 points.

Canada's Dominion Radio Astrophysical Observatory at Penticton, British Columbia reports a 10.7-cm observed monthly mean solar flux of 78.7 for November 2016, down from 86.1 for October. The twelve-month smoothed 10.7-cm flux centered on May 2016 is 93.2, down slightly from April's 95.3. The January 2017 predicted smoothed 10.7-cm solar flux is about 85.

The geomagnetic activity as measured by the Planetary-A index (Ap) for November 2016 is 10, down from October's 16. The twelve-month smoothed Ap index centered on May 2016 is 11.7, about the same as April's 11.8. Geomagnetic activity this month should be about the same as for December 2016. Refer to the Last Minute Forecast for the outlook on what days that this might occur. The Last Minute Forecast is on the main page, in the left column at <http://sunspotwatch.com>.

Feedback Requested

Do you have propagation-related questions, or a topic related to the Sun, the Ionosphere, or the Sun-Earth connection, that you'd like answered? Please send in your questions and comments, for possible inclusion in this column.

Do you want to dive deeper into radio propagation and the Sun-Earth connection? Are you interested in space weather influences on radio propagation? If so, check out the self-study course offered at <http://nw7us.us/swc> --a course designed to equip you with skills that will enhance your ability to forecast and analyze communications on shortwave frequencies.

Your columnist has a website dedicated to space weather, at <http://SunSpotWatch.com> and also provided a Facebook page at <https://www.facebook.com/spacewx.hfradio> which features daily updates with solar images, space weather graphs, data, and educational tidbits, all day long, so please take a look. There are quite a few space weather and radio videos on this columnist's YouTube channel at <https://YouTube.com/NW7US>. Be sure to check out the Tumblr blog, <http://blog.nw7us.us>, in which daily space weather posts are available.

On Twitter, radio propagation and space weather Tweets are provided in regular updates by @hfradiospacewx (<https://Twitter.com/hfradiospacewx>). Your columnist is on Twitter, as @NW7US (<https://Twitter.com/NW7US>).

TSM

THE WORLD OF SHORTWAVE LISTENING

By Jeff White, General Manager, WRMI

info@wrmi.net

SW Coordination Comes to Florida: HFCC B16 Conference in Miami and Okeechobee



Los Ranchos, a group dinner at a Nicaraguan restaurant in Miami. (Photo by Mireya Martinez)

The HFCC, or High Frequency Coordination Conference, took place in Miami for a week at the end of August 2016. It was the second time in the history of the HFCC that the association has had a conference in the US, and the first time in Miami. (The first U.S. HFCC conference was in Dallas, Texas in 2011.) Some 90 representatives of shortwave stations from nearly 40 countries participated, including almost all major countries using shortwave for international transmissions.

The purpose of the conference, which takes place twice each year in different countries around the world, was to coordinate stations' transmission schedules before the start of the B16 broadcasting season, which began on October 30. The idea of the HFCC is to eliminate potential interference between stations before the start of each season.

The fact that so many people from so many countries came to Miami to coordinate their shortwave broadcast schedules for the B16 broadcast season shows that shortwave continues to be an important medium worldwide and that the mutual coordination efforts by the stations continue to be

necessary to avoid interference and to make sure that everyone's programming can be well heard in their intended target areas.

The largest delegations at HFCC-Miami were those of the United States and China. The U.S. has a delegation from IBB, the International Broadcasting Bureau, which manages frequencies for the Voice of America, Radio Free Asia, Radio Marti and the other U.S. government shortwave broadcasters. The Chinese, meanwhile, sent a delegation of six persons to coordinate their massive frequency schedule. China is the largest user of the shortwave spectrum these days and they always have a lot of "collisions" with other shortwave broadcasters in the initial planned schedule at the beginning of HFCC week. Other stations negotiate with them during the week to try to eliminate these clashes. Sometimes they are successful in convincing the Chinese to make changes, and sometimes they aren't. Certainly the fact that everyone is all together in one room makes it easier to try to work these things out. In the end, someone usually has to change times or frequencies or antenna patterns in order to eliminate the



Ludo Maes (of Broadcast Belgium, third from left) and me (fourth from left) with the Chinese delegation at the HFCC Conference in Miami.

interference before the schedule actually begins. That's the whole purpose of these HFCC conferences.

Besides the broadcasters and telecommunication authorities present, there was also a representative from the International Telecommunication Union (ITU) in Geneva. Ms. Ilham Ghazi, head of the ITU's Radiocommunications Bureau, talked to the HFCC delegates about shortwave frequency coordination efforts and how to improve cooperation even more between the ITU and the HFCC.

The Miami HFCC Conference was co-hosted by Radio Miami International and Broadcast Belgium. Miami-Dade County mayoral candidate Alfred Santamaria, a Colombian-American who is interested in the field of telecommunications, opened the conference. Santamaria said that Miami is the gateway to the Americas in many ways, so it was a natural venue for a global meeting of broadcasters like the HFCC.

At the beginning of the conference, the president of Trans World Radio, Lauren Libby, and Mike Stone of PantronX, a Panamanian company, unveiled a new DRM (Digital Radio Mondiale) receiver which PantronX is manufacturing in China. It is a tablet computer with a DRM application, and its operation was demonstrated with special transmissions of Vatican Radio that were made specifically for the event. The receiver, called Titus II, picked up the Vatican signal with no problem and with excellent sound quality. PantronX expects to have the first regular production of receivers out during the first quarter of 2017, and the price will be less than 100 dollars, according to Mike Stone. Information on ordering the radios is available on the website of the HFCC, which is www.hfcc.org. As of Christmas 2016, pre-orders for about 2000 receivers had already been placed, many of them by shortwave listeners.

Other presenters at the conference included engineer Kevin Chambers of World Christian Broadcasting with an exhibition on the construction of their new station Madagascar World Voice on that island off the southeast coast of Africa. Ray Robinson of the organization Voice of Hope talked about his new station Voice of Hope-Africa in Zambia. Dr. Kim Elliott of the Voice of America prepared a special program for WRMI in Okeechobee showcasing the ability of regular analog shortwave transmitters to transmit digital signals that can be decoded with special computer programs, and the rather impressive results of this test were demonstrated at the meeting. Calvin Carter of Continental Electronics, which builds shortwave transmitters at its plant in Dallas, Texas, gave a speech on the 70th anniversary of his company.

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Charles Caudill (left) and Lauren Libby (right) presidents of World Christian Broadcasting and TWR International respectively. (Photo by Jeff White)

For many of the HFCC delegates, it was their first experience in Miami, and perhaps their first trip to the US. So, during the conference, a tour of Miami was offered in an open double-decker bus, as well as dinner at a Nicaraguan restaurant, and a chance to enjoy Latin music and entertainment in Miami Beach.

When the HFCC finished on Friday, August 26, part of the group stayed on an extra day and a half to take an excursion to WRMI in Okeechobee, the Western Hemisphere's largest shortwave plant, for a visit and dinner at the ranch where the station is located, some three hours north of Miami by bus. The tour returned to Miami the next day, after an air boat ride in the Florida swamps where delegates were able to observe alligators and other animals and plants typical of the area. The next HFCC conference will take place on the shore of the Dead Sea in Jordan in February 2017, and the August 2017 meeting is planned for Cape Town in South Africa.

Excerpts from Opening Remarks to HFCC-Miami by Ludo Maes of Broadcast Belgium

"As you well know, I have a personal passion for shortwave radio, which drove me into co-organizing this conference. However, Broadcast Belgium being a small company, we looked for a co-organizer, which is Radio Miami International. We came up then with the idea of hosting HFCC in the City of Miami for the first time in history. Not just metaphorically speaking, indeed literally a warm friendly city that offers us the required infrastructure, facilities and services to assure a successful coordination meeting.

"Facing challenges seems to be the case day by day. We are moving in a dynamic world of technologies where new elements and sophisticated systems are attracting the new generations. Does that mean for shortwave radio a survival challenge? What it is, concrete and precise, is the need of millions of people to be reached by the shortwave broadcasters with the valuable and versatile content of their programs. And we are here as members of the HFCC to make it possible for those shortwave listeners to receive our programs. For some people, these programs could be a basic need.

"I want to thank you for the decision all of you have made to take part in B16. The presence of each of you will enhance the better understanding between the Frequency Management Organizations, and definitely the time we share during this week will contribute to our professional performance in a friendly environment.

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HFCC group photo in front of WMRI. (Photo by Calvin Carter)

Dear members of the HFCC, we are not only performing our jobs; we are fulfilling a social mission as well. Once again, my very warm welcome to all of you.”

**Address to HFCC B16 by Lauren Libby, President/
CEO—TWR International
Miami, Florida - August 22, 2016**

“Good morning fellow shortwave media providers. It is a privilege to be with you during this key time of global coordination. This is a unique gathering of media content deliverers.

“I say shortwave media providers, because shortwave these days is more than just a RF platform for audio transmission. Shortwave broadcasting is on the cusp of becoming a much larger platform than we could have imagined.

“The future is dependent on how well shortwave content is cross-promoted on digital delivery systems, social media and even local FM outlets. Shortwave enjoys advantages that local and digital platforms don’t. Namely: Shortwave offers the intrigue of cross-cultural experience, which is so important in a world that wants global information and experience in an increasingly isolationistic environment.

“Shortwave, when employing digital delivery techniques, offers unique delivery methods that could unlock an entire future of content distribution far beyond just audio.

“Shortwave opens up experiencing the world in a new way. I have been asked penetrating questions by listeners who have experienced new cultures and thinking that wouldn’t have been possible outside of their shortwave experiences.

“But, if this world is to materialize several things will have to occur.

“A realistic economic model of implementation will have to evolve. Frankly, a “quick payback scheme” is not working and never will! Digital technology will have to move toward a “long term rate of return,” lowering receiver unit costs that make them accessible to a majority of the pop-



Main HFCC meeting room. (Photo by Thais White)

ulation is a sustainable business strategy and model.

“The very fact that we still do not have an affordable receiver is a testimony to the failure of the ‘get the money quick and up front’ strategy—and it has greatly contributed to the “almost killing of a great platform.” Shortwave is gone in Europe. We still have a base in Africa and Asia and in the Americas. A realization and shift of this model will bring consumption and payback, albeit at a slower rate than some would like, but it is a sustainable way of doing business.

“We, as media providers, will have to look for new ways of firing the imagination and excitement of the shortwave experience...people are seeking ‘experience.’ The smart phone is a ‘personal experience,’ not just a platform for communication and consuming content. Why not introduce via shortwave, a ‘Global Community’ experience?

“The promotion of a global dialogue, so desperately needed, in a world that is turning toward isolationism. Shortwave is a platform that can stimulate this multi-dimensionally. Not just with 140 characters or posting pictures. Social media works because it is relatively cheap...we need relatively inexpensive means to access the shortwave experience. I have been impressed with India promoting medium wave and shortwave content consumption, going so far as a complete rebuild of their broadcast platforms.

“Shortwave file-casting is a development that holds great promise of delivering content in non-audio formats. This new medium is just the first as we enter into re-utilization of the shortwave spectrum. The “long range” digital file casting via the HF frequency spectrum is a new frontier!

“So, what do we do?

“Our organization (TWR International) has been involved with a technical research firm to develop a reception platform for shortwave content. This has been in large part because we do not want to see an important delivery platform (shortwave) go by the wayside. The time for talk is over and it is time for us to address a new destiny for shortwave.

“At this meeting you can observe new thinking high-



HFCC group touring WRMI plant. (Photo by Thais White)

lighting new digital consumption techniques. We believe these opportunities hold promise.

“TWR has deliberately and pro-actively been fostering and partnering with PantronX to develop a low cost platform for shortwave, medium wave, DAB, DAB+, DRM, FM and most digital and analog forms of delivery.

“Mike Stone, of PantronX, has been working on a solution for the last three years. PantronX has developed a solution that is affordable, techie enough to grab a new generation, is viable and simple to use.

“And now, may I introduce Mike Stone of PantronX... for the purpose of debuting the Titus 2 media delivery experience? Thank you!”

Titus II Technical and Ordering Information

The Titus II—an Android tablet computer with wideband SDR receiver—was unveiled for the first time at the B16 HFCC/ASBU conference in Miami, Florida, 22-26 August 2016. The receiver has been the result of cooperation between Trans World Radio (TWR) and PantronX. The HFCC is assisting in collecting pre-orders. Availability is expected during the first quarter of 2017. Price: Under \$100 (US) plus shipping (local duty/taxes if any not included). Payment methods: Wire transfer for larger quantities, PayPal works too, but the buyers would need to add PayPal bank fees.

An initial order sufficient to start the production has already been placed and production will start irrespective of the amount pre-ordered via the HFCC. Pre-order is not binding and you are NOT asked to send any advance payment or credit card number to secure the pre-order. You can place your pre-order at the HFCC web page: www.hfcc.org

Tablet Features: • Quad-core ARM A53 processor @ 1.2 GHz • Android 5+/6+/Remix • 1 GByte RAM • 8 GBytes FLASH • 7” TFT (1024 x 600) • 5 point Capacitive touch panel, full color, high brightness • 5 Watt Stereo Audio • High capacity Li-poly battery • HDMI output •



Part of the HFCC group touring the WRMI plant. (Photo by Thais White)

• μUSB OTG Connector • WiFi/Bluetooth • Optional Camera • μSD Slot. The base is also a protective cover for the touch screen.

Built-in RF tuner: • High sensitivity • Low noise • Wideband: (100KHz to 2 GHz) • Balanced tuned ferrite antenna (MW) • Built-in Whip • Jack for external antenna Software: • Demodulation software for AM, FM, Digital and SSB • Open source software Radio libraries • WiFi hotspot – Filecasting: Share RF broadcast and files. Miscellaneous: External function buttons: Volume+, Volume-, Tune+, Tune-, Set. Top mounted for easy access even with cover in place. Built in microphone. External jack for earphone/microphone Power: +5 VDC, Worldwide adapters available

Excerpt from the Manufacturer’s Brochure:

“Titus II The Complete SDR Solution. Digital Radio—no longer just a Dream! The computing power of a quad-core tablet, the sensitivity of a high performance RF tuner and a high fidelity audio amplifier—all combined in one portable and affordable package. Runs any Android app: web browsing, email, games and educational software. Plus, load standardized plug-ins for enhanced RF functions. Titus II, the world’s first consumer-ready SDR package. Actual size: 290mm x 150mm x 45mm. Android tablet computer with wideband digital RF receiver”

My Personal Thoughts about the Future of Shortwave

A recent article in *Radio World* magazine—a trade journal for radio broadcasters—took up the endless controversy about the future of shortwave. Canadian author James Careless, a longtime shortwave listener himself, thoughtfully titled the article “The Evolution of Shortwave,” which is a very appropriate way to put it. He talked about how many people have been asking for decades whether shortwave is dead or dying. As James pointed out, shortwave is not dead, or dying, but rather evolving.



Mike Stone presenting the Titus II receiver at the HFCC conference in Miami. (Photo by Mireya Martinez)

Since the end of the Cold War, government-operated shortwave stations—and a few others—have been eliminating or reducing shortwave broadcasts in favor of less expensive platforms such as the Internet. Yet the shortwave frequency spectrum is still quite full. Many of the frequencies left open by those stations abandoning shortwave are now occupied by private broadcasters, or by government broadcasters who still see the value in using this medium—stations like China Radio International, the Voice of the Islamic Republic of Iran or Radio Havana Cuba. Unfortunately, many Western nations have lost interest in promoting themselves via shortwave, leaving the spectrum wide open for other countries to use.

James' article in *Radio World* contained a list compiled by well-known shortwave researcher Kim Elliott of the Voice of America of a couple of dozen major stations that have reduced or eliminated shortwave broadcasts since 2006—mostly government stations like Radio Austria International, Radio Budapest, the Voice of Russia and RDP Portugal. There were a handful of religious stations as well, such as HCJB in Ecuador and Voz Cristiana in Chile.

Two thoughts came to my mind while reading the *Radio World* article:

First, I don't think it has to be an "all or nothing" approach. Government-sponsored international broadcasters would not have to cut out shortwave totally and move entirely to Internet/satellite/local rebroadcasts. For decades, the large government-run stations were transmitting—and some still are—multiple high-powered (frequently 500 kilowatt) signals into each target area. They could reduce costs greatly by aiming one frequency at each target and not using more than 100 kilowatts, which is generally sufficient. If they don't want to operate a transmitter site of their own, they can easily—and probably less expensively—buy airtime on a station that covers the target area or areas that they want to



Titus II DRM SDR shortwave receiver. (Courtesy: PantronX)

reach. Then they could "air" their programs via the Internet to those who can access it, and they would still have shortwave available to those who don't have Internet access or who prefer to listen to programs on the radio.

The other thing is that, if you examine Kim Elliott's list of stations that have left shortwave or reduced shortwave broadcasts since 2006, it's very sad that not only did many of these stations leave shortwave; they also disappeared altogether. That is, they didn't move to Internet platforms and continue to offer programs about their countries via this medium; they just folded completely, leaving those countries with no international radio voice at all; at least no government or "public" voice. So nowadays, there is no way to hear news and features radio/audio programming from places like Serbia, Israel, Austria, Belgium, Hungary, Singapore and Italy. That is indeed unfortunate.

Two Final Things Worth Noting

Some of the stations on Kim's list have actually continued broadcasting on shortwave using relays from stations outside their countries. These include Radio Slovakia International, Radio Prague and Radio Ukraine International. And although Christian Vision closed its shortwave station in Zambia, it has recently been opened again under the new ownership of the Voice of Hope-Africa.

It would be interesting to see a list of new stations or programming services that have begun to use shortwave since 2006. I am quite sure that it would be much longer than the list of those who have abandoned shortwave. So we have to keep things in perspective. While governments have been reducing or eliminating their use of shortwave, this has resulted in the privatization of some of their broadcast facilities and it has opened the way for many private broadcasters to begin using the medium, and at much lower prices than were being charged before. The shortwave frequency allocations registered at the HFCC are still voluminous. So shortwave is far from dead.

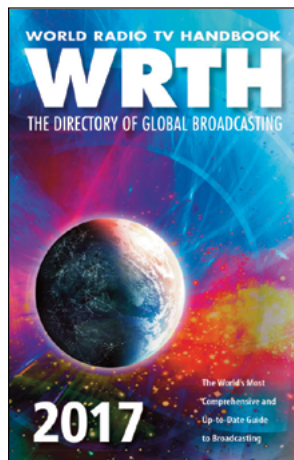


We are very pleased to announce the publication of the 2017 edition of *World Radio TV Handbook*, the bestselling directory of global broadcasting on LW, MW, SW & FM

The Features section for this 71st edition contains articles on Remote Receivers, A Pacific Radio Adventure, The Mighty KBC Station, CKZN St Johns, and the International Radio for Disaster Relief Project, as well as equipment reviews and other articles of interest

The remaining pages are, as usual, full of information on:

- National and International broadcasts and broadcasters by country with frequencies, powers, languages, contacts, and more, including Clandestine and other target broadcasters
- MW frequency listings by region. International and domestic SW frequency listings, as well as DRM listings
- International SW broadcasts in English, French, German, Portuguese & Spanish.
- Reference section with Transmitter locations, DX clubs, and much more



Available December 2016

SOME COMMENTS ON WRTH 2016

The WRTH continues to be the key source of information for a shortwave listener. I've been purchasing my copies annually since the 1960s. Your publication is a essential factor in enjoying shortwave listening, whether that be for station information or equipment reviews. Your efforts are very much appreciated – William Matthews, USA

The WRTH is perfect. The yearly publication of this book is one of the biggest events in the DXing calendar – Clint Gouveia, United Kingdom

The 70th is another great edition of the World Radio TV Handbook. Though I use online frequency databases there is just no replacement for a good printed frequency guide. Not only does WRTH contain more in-depth information on broadcasters and schedules, but it makes for quick reference, and doesn't require a computer or Internet connection—much like, well, your shortwave radio – Thomas Witherspoon, SWLing, USA

I would like to congratulate you for the outstanding job regarding the content of the WRTH. I buy the WRTH since 1973 – André De Block, Belgium

WRTH is still an indispensable resource for the short wave listener or Industry professional – David Harris, Radiouser, UK

Best book to read about radio – Aaron Fawcett, USA

I think WRTH is as good as it gets! I have collected all but three editions of the Handbook so am obviously a strong supporter – Bryan Clark, New Zealand

Thanks for the splendid issues of WRTH; I have bought the WRTH each year since 1969 – Robert Kipp, Germany

THE SHORTWAVE LISTENER

By Fred Waterer

programming_matters@yahoo.ca

Radio Australia Leaves Shortwave

Welcome to the January edition of The Shortwave Listener. A new year often promises new beginnings and we will talk about some of those. But this year it also means endings and we will explore some of those as well. We'll visit Australia, Cuba and many other places this month.

Radio Australia has been one of the most reliable broadcasters in the world, a mainstay for decades on 9580 kHz during the early morning hours here in North America. Radio Australia provides a lot of great programming, much of it originating with Radio National, the Australian Broadcasting Corporation. Any day of the week, one can hear interesting programming on a wide variety of topics. Music, politics, history, culture, science, one can hear it all on Radio Australia.

In December it was announced that Radio Australia would cease broadcasting in English to the Northern Territories and to the Pacific at the end of January 2017. At the beginning of December the ABC quietly closed its Vietnamese, Khmer and Burmese language services. In February, French will join them.

The argument seems to be that the broadcasts are not cost effective but many listeners in remote places still rely on them for information, especially in emergencies. The trend in recent years has been for many nations to abandon the shortwave bands. Canada for instance, has dismantled its transmitter site in Sackville, New Brunswick.

My friend, Australian broadcaster, Jarrad Brooke, notes, "There's been much discussion regarding this down under in the 'convict settlement' over the last few days!

The ABC here has a new managing director, who has made some questionable decisions... this may be one of them." If I recall correctly, there was a cyclone a year or so ago that devastated Vanuatu. The people in Vanuatu relied on shortwave broadcasts from Australia and New Zealand for news, developments and forecasts.

Bearing in mind that we just have about a month left to listen to Radio Australia, let's take a look at some of their programs. Since they are on the other side of the world, Sunday mornings on Radio Australia are dominated by the program Sunday Nights with John Cleary. The program examines issues of faith and religion. Recent episodes featured Tom Roberts, the editor-at-large of the National Catholic Register in the US, talked about developments in the Cath-



(Courtesy: Radio Australia)

olic world; and issues of faith in the Aboriginal community. Fascinating stuff. You can reach the host via Twitter @john-cleary. The program is also available as a podcast at the RA website. It is certainly a popular show as two of my Facebook friends point out: "Sunday Nights with John Cleary has always been a favorite of mine. Fascinating how religion can be a topic of serious discussion and not just an excuse to scare people, scam them out of money, and 'bump the Bible' in semi-psychotic ramblings!" (Lily Zichi). Another friend points out: "I like Sunday Nights as well. I am a fairly active Catholic, but I am not so far gone that I cannot appreciate the intelligent banter that goes on. It often re-affirms that my work in a nursing home and our local hospital is truly doing God's work." (Mark Coady)

Mondays at 1000 UTC one can hear Away! A program of indigenous affairs. Away! "brings you diverse and vibrant Aboriginal arts and culture from across Australia and the best from Indigenous radio broadcasters around the world." This is a fascinating program full of surprises. Lots of reports on arts and culture from an aboriginal perspective. One recent topic looked at the issue of who owns the stories of Indigenous Australia? Are those stories authentic if they don't come from Indigenous authors and do they lose their integrity if they're written or adapted primarily for a non-Indigenous audience? At 1100, listen to The World, in which Beverly O'Connor brings you the day's top national and international news with in-depth insight from correspondents around the world, and studio guests. At 1200, listen to the

daily program Late Night Live, with Philip Adams—cutting edge talk radio discussing the latest in politics, culture, science and philosophy.

Tuesdays at 1000 UTC Background Briefing is the featured program. It explores the issues of the day in a documentary style. Very similar to CBC Radio One's Sunday Morning. The program is hosted by veteran journalist, Jonathan Green and is followed by The World and Late Night Live.

Wednesdays one can hear The Spirit of Things hosted by Dr. Rachael Kohn. It explores "contemporary values and beliefs as expressed through ritual, art, music and sacred texts." That's followed by The World and Late Night Live.

Thursdays at 1000 UTC is the time to hear The Science Show. This is one of the better science shows around and is similar to Canada's Quirks and Quarks on CBC Radio One. In fact the two programs have done some joint programming over the years. The Science Show is an interesting exploration of the latest developments in science and it's well worth a listen! As always, it is followed by The World and Late Night Live.

On Fridays the 1000 UTC hour is split in two parts. The first half hour is devoted to A Big Country, which keeps you up to date on Australia's rural issues. The second half hour is Oz Country Style, featuring the best of Australia's country music scene—great music from down under. At 1100 The World airs, followed by Live and Local at 1200, featuring live performances and interviews with musicians from around the country.

Saturdays it is the turn of Felicity Urquhart to present Saturday Night Country—great country music and interviews and often with live music from guests. Check it out! "Felicity Urquhart and I are Facebook friends. She really appreciates listeners in North America which is the home of country music." (Mark Coady)

Rear Vision is another fantastic program. Unfortunately it airs at a time when shortwave reception from Australia is very difficult but, thanks to the Internet, the audio of the program is just a click away. I recently listened to an edition of the program via the CBC Radio One Overnight programming block. This particular program traced the history of the Republican Party in the United States. The program is a really cool concept. The idea is to present current events in historical context. Often things happen but we don't understand why. The program examines where we have been, where we are today and where we may be going in the future. The show about the Republican Party looked at the party from its abolitionist roots before the Civil War to its evolution into the voice of conservatism, and also examined the various factions, which have struggled to dominate the party.

Rear Vision is on UTC Sundays at 1830. Check out the audio and the podcast at www.abc.net.au/radionational/programs/rearvision

For another fix of Australian radio check out Radio Hobart International.

Hobart Radio International is a shortwave community



(Courtesy: Hobart Radio International)

service relayed across Europe, North America, South America and New Zealand. Billed as the voice for Tasmania, it's been on the air since 2004, telling the unknown and investigating what's important. Check out Radio Hobart International on the following stations, times and frequencies. RHI can be heard via WRMI on Saturdays at 11580 kHz from 2030-2100 and 2330-0000 UTC and on UTC Sundays on 9955 kHz from 0330-0400 and on UTC Tuesdays at 2230-2300. On UTC Mondays it hops over to WBCQ on 5130 kHz also at 0330-0400. Check out their Facebook page and their website at www.hriradio.org.

In November, Cuban leader Fidel Castro finally shuffled off his mortal coil. Obviously, this was big news in Cuba and around the world. Radio Habana Cuba coverage was interesting to say the least, with reports on many of the significant milestones of his life, and the ceremonies surrounding his death. RHC can be heard daily on 6000 kHz from 01-07 UTC. Fidel was a thorn in the side of the United States for decades and it will be interesting to see how Cuban-American relations will develop in light of his death and the election in the US. Speaking of this...

New beginnings include those in Washington, DC, as a new President, cabinet and Congress take up their tasks in January. The new President is certainly doing politics differently. Around January 20 it will be fascinating to tune around the bands and see what different countries are saying about the new Administration. China has already had some unflattering things to say about President-Elect Trump and his gravitas. It would be really interesting to tune around and get the views from Beijing, Havana, Australia, New Zealand, the BBC and many more as events unfold. International broadcasters on shortwave and via the Internet give us a unique perspective on world events. It will be interesting as well to tune in to US private radio stations for their take. Many

if not most programs tend to tilt rightwards so it will be instructive to see how they take the new administration. I often think that whoever is elected President will face opposition from the shortwave crowd. The “patriots” didn’t have much nice to say about previous Republican presidents, but I am curious to see what they make of Donald Trump. My guess is that people who distrust government will never embrace a president. We shall see. Stay tuned.

From my friend William “Bill” Tilford and his show From the Isle of Music:

“We have a new winter schedule - Tuesdays 0100-0200 UTC WBCQ 7490 kHz (Monday Night US time) Fridays 1100-1200 UTC Channel 292 6070 kHz Saturdays 1600-1700 UTC on Channel 292 6070 kHz. The week of NYE (and our Channel 292 transmission added Saturdays so we will be on early NYE from 1600-1700) will be Cuban popular dance music, no interviews. I do plan to put together a killer Cuban dance set for the end of the year.”

From: BBC World Service programming in January

“The Documentary: Dalida – A Life Unbearable - While researching his acclaimed biography of Marianne Faithfull, journalist and broadcaster Mark Hodgkinson heard her compared to a singer called Dalida. Unfamiliar with Dalida, he wanted to find out more and he discovered one of music’s most tragic stories.

“Over her 40-year career Dalida sold 170 million records, won 55 Gold Record awards and had 19 number one singles in Europe, Middle East, Canada, Russia and Japan.

“When Le Monde newspaper published a poll in 1988 of personalities who had made the ‘greatest impact on French society,’ Dalida was voted second to General de Gaulle.

“Despite her success, the former Miss Egypt is remembered for a personal life mired in tragedy. In January 1967 she entered the San Remo Festival with her fiancée, Luigi Tenco. Together, they sang Ciao Amore Ciao (Bye Love, Bye). Tenco committed suicide after being eliminated from the final competition. Dalida attempted suicide one month later.

“In 1970, her friend and former husband Lucien Morisse, shot himself. Another friend jumped from his Paris apartment. In 1983, an ex-lover committed suicide. In 1987, following the death of her beloved bulldog, Dalida took her own life. Her suicide note read: ‘La vie m’est insupportable... pardonnez-moi’ meaning ‘life has become unbearable for me... forgive me.’ Dalida’s brother and producer, Orlando, speaks of her Italian heritage, early life in Egypt and extraordinary recording career.” [A Smooth Operations Production for BBC World Service. Tuesday, January 3 2130 UTC]

“Assignment: Poland - Behind the Black Protests - Millions of women took to the streets in Poland recently in protest against attempts to ban all abortions – and the issue seems to have crystallized a growing unease with the country’s move to the right and the power of the Catholic Church.



(Courtesy: WBCQ)

“‘We are not putting our umbrellas away,’ went one of the slogans as women stood in the pouring rain to voice their concerns. The size of the protest surprised even the participants; organized by the feminist movement, it attracted women and men from many different backgrounds.

“Where did this surge of activism come from? Some argue that the revolution that began with Solidarnosc in the 1980s ignored the needs and voices of Polish women. Communism may have been defeated, they say, but it’s been replaced by a different kind of repression. Maria Margaronis investigates. Thursday January 5 2130 UTC (BBC Press Office)

BBG Press Release:

“Washington, D.C. — As disinformation and misinformation extend their global reach and influence, Voice of America (VOA) and Radio Free Europe/Radio Liberty (RFE/RL) are teaming up to offer a new fact-checking resource. Polygraph.info, a globally aware and nonpartisan website, is a timely response to the deluge of often false or misleading information confounding audiences around the world...

“Polygraph.info’s team of RFE/RL and VOA journalists researches and analyzes statements from government officials and other high-profile individuals to assess their veracity. The site currently focuses on statements involving relations between Russia and the West, but its analysis will expand to other areas of the world.” (Board of Broadcast Governors Press Release)

TSM

MARITIME MONITORING

By Ron Walsh VE3GO

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The Old and the New

“CE2AWW de VE3GO, tnx for 599 #103, you are 599 in Ontario.” This CW QSO with Chile in a contest got me to thinking about the old and the new in radio communications.

As we approach the New Year, the new always replaces the old. I have used radio monitoring to be able to photograph some ships as they pass for the last time and will look forward to photographing new vessels as they make their first trip in the New Year. A friend of mine Tim VA3TIC, was talking to me about using the remote amateur radio station set up by the Kingston Amateur Radio Club. Ham Radio Deluxe and Skype can now be used to operate an amateur station many miles away. Rick VE3ORY even operated the station from Florida. How far the technology has come really made me take notice. I remember when the local marine station VBH was remotely connected to VDQ Cardinal Radio in the 1970s. Now we can do the same thing on amateur radio.

Tonight, the snow is falling, the temperature has dropped and the winds are Gale force on Lake Ontario. Ships have gone to anchor, the weather radio had a snowfall warning for Kingston and VBR Prescott radio had a Gale Warning for Eastern Lake Ontario. USCG Buffalo was broadcasting a special marine warning and ships were asking about visibility in the American Narrows Section of the Seaway. Bermuda Radio could be heard on 2582 kHz. Another shipping season on the great lakes is coming to a close. Here I was listening to the marine traffic, monitoring an amateur radio repeater for any emergency and sending Morse code in a contest. I had already charged the emergency radio batteries, fueled the snow blower and put a flashlight beside the radio desk. It is that time of year when power outages are always possible.

A visit to VBR Prescott Coast Guard Radio also made me realize how far things have come since I wrote an article on the station for Monitoring Times, nine years ago. The changes happening in that time frame had to be seen to be believed. I will mention some details here but want to do an article on the station again as there is a great deal of interesting information to mention. I found Frank Dwyer, the officer in charge, to be very interesting and informative.

I received an email bulletin from the Marine Radio Historical Society about the return of Marine Coast Station KPH to the air. The station had been closed in 1997 but brought back to life by a dedicated group of marine radio enthusiasts. This is unique when you consider that the Canadian Broadcasting Corporation (CBC) transmitter site for Radio Canada



American seaway tug Robinson Bay, that services the aids to navigation up to Lake Ontario every spring and fall. Talks are that she will soon be replaced. (VE3GO photo)

International at Sackville, NB has literally disappeared.

The comparison and contrast between these two marine stations left me pondering how time and technology have changed many things. I am 71 years old and have seen a lot of radio equipment in my time. The radio call I use belonged to the late Chuck Millar for 60 years. I can remember his station in the 1960s and then I look at my Icom 756 Pro III that he could have only dreamed of. I have only seen a photo showing a bit of his equipment from the 1940s.

The revival of the call KPH brings back a station that was established in 1905. The receive station at Point Reyes and the transmitters at Bolinas went silent on June 30, 1997, and marine Morse code seemed to have become something of history. The dedicated group of operators kept the station intact and alive by eventually obtaining the call KSM.

Negotiations finally got the KPH call back and the transmitters were returned to their original frequencies. On Oct 8, 2016, Ray Smith, who had tapped out the last message from KPH, sent out the first message from the resurrected station. I have followed the MRHS through their emails and correspondence with Richard Dillman. I am proud to have had a couple of contacts with K6KPH, which is manned at the station site. I try to listen to their CW and RTTY signals on Saturdays and CW on Sundays when possible. It is good to see press, weather information and messages still sent by Morse. VBH Kingston also started out as a CW signal from a Marconi station. The station came on the air in 1914 and was soon taken over by the Canadian Government. CW here lasted until after the Second World War when new radiotele-



This is a historical photo I collected. It shows the Royal Military College and Fort Henry in 1924. In the background is VBH with the high wooden towers and wire antennas at the top of the photo. (VE3GO collection)

phones made voice communications possible. These were in the 2 MHz MF band and could be easily operated by ship officers. The radio operator was no longer needed. Some of the great lakes shipping companies even had their own shore stations. The last was XJP52 of the Upper Lakes Shipping Company, which disappeared in the 1990s.

These radios used a dynamotor to transform the ship's DC voltage into the higher voltage needed for the transmitters final tubes. Every time you pressed the transmit button on the telephone-style handset, these rigs emitted a great high-pitched whine in the ship's wheelhouse. It is interesting to note that tankers on the lakes had to carry wireless as well.

The BA Peerless, which was built in the mid-1950s, had Marconi HF equipment installed. A friend, Larry Stewart, worked on the ship when she was the Coastal Canada and the old equipment was still there but just shoved away in a cabin, long out of use. Weather was broadcast four times a day by a string of stations from one end of the lakes to the other.

VBA Port Arthur, VBB Sault Ste. Marie, VBC Warton, VBE Sarnia, VBF Port Burwell, VBG Toronto, VBH Kingston and later VDQ Cardinal broadcast the weather in sequence. They did the forecast for all the lakes so if a ship missed one they could get it from another station. As a high school student, I did my homework listening to the lakes traffic and heard many of these broadcasts. In the late 1950s, the FM VHF rigs began to appear on the lake ships.

AM MF transmission were replaced by SSB and 2598 kHz became the weather broadcast channel. The station VBH was closed and moved to the Kingston Airport in 1970s. HF was gone in 1978 from the lakes and VHF FM was used. The station became a remote site for VDQ in 1978

and the call VBH disappeared. All of these stations are now remote terminals for VBR Prescott Coast Guard Radio or Sarnia Coast Guard Radio.

To allow VHF to work many extra VHF remote sites have been established to cover dead spots in the coverage area. Prescott has 8 towers they can use—all are digitally controlled from the Prescott site. The weather became a continuous broadcast on two VHF channels. The forecast came in and the operator read it into a recording device before it was transmitted to the ships. They always used a code of numbers for the forecasts on HF. This was replaced by the MAFOR (MARine FORecast) code in the late 1960s.

I remember several ships calling in and asking what was the forecast because the new code had not been readily distributed before the season. The new equipment now has the text sent to the station and it is automatically changed to a computer operated voice and sent out on the air. As of this year, they announce that the MAFOR codes for the forecast will be given on request showing that the voice broadcast can be heard throughout the lakes. I would guess if they get few requests the MAFOR, coding would disappear.

It is interesting to see that KPH is still using the 426 and 500 kHz long wave frequencies. 500 kHz has become synonymous with Marine Morse as a calling frequency as 2182 kHz became the calling frequency for MF. The recent decision of the USCG to no longer monitor this frequency should be noted. The last American HF station on the lakes was WLC Rogers City and with it all HF on the lakes ended. I remember the broadcasts from WMI Lorraine, Ohio, as they gave the weather conditions for many locations on all the lakes twice a day. The long wave tradition is of course still maintained by the Navtex transmissions on 518 kHz.



Left: My radio shack with equipment to monitor marine traffic and more. Right: Yours truly at the key. (VE3GO photo)

KPH remains as an example of specific marine coast stations. The Canadian stations have all been consolidated so that many remote sites are operated from a central station. I am happy to see we still use HF on the east and west coasts as well as the arctic regions. NBDP (Narrow Band Direct Printing) as well as voice are used to distribute notices, etc.

KPH still sends marine messages and reminds us of the telephone services that HF used to supply. The radio-telephone service at Canadian Great Lakes stations has been stopped.

Cell phones and satellite services have replaced the radiotelephone service. I no longer hear the interesting grocery orders for the ships as they pass by. I recently met a retired technician who told me he was installing a satellite system on the Cape Breton Miner, in I believe, New Orleans, and was getting instructions on how to do this from XJP52 on HF.

I enjoy the photographs of KPH showing the receiving sites with actual receivers and equipment on the racks and consoles. Computer screens have replaced all the consoles at VBR this year. Each operator can control all the towers, etc., by touching the screen. I was given one of the switches from the old console. I respect and admire the new technology but I still want to turn the dial or twist the knob to adjust my equipment. I visited VBH in the early 1960s and wish I had a photo of the station. KPH reminds me of what it looked like although on a smaller scale.

I still want to hear the voice or the Morse characters over the speaker or through the earphones. PSK31 and JT65 are examples of new modes of amateur transmission. I have tried them enjoy them and marvel at their efficiency, but I just can't tear myself away from using CW. I do not claim to be a fast operator but do claim to be a good one! The photo of Jack Martini, Richard Dillman, Denise Stoops and Stephen King watching Ray Smith send the first message on CW from KPH shows just how much some dedicated people can accomplish. I congratulate the people behind KPH who have maintained a genuine piece of history!

As I listen to VHF, the ocean vessels all hurry to escape

the lakes before winter freeze-up, the lakes vessels trying to carry one last cargo and the messages from the Seaway as to conditions in the Montreal Lake Ontario section. I will also be trying to copy KPH and get a contact with K6KPH during the winter months. As I celebrate 40 years as an amateur, I plan to operate more CW, in contests and in contacts, on most HF amateur bands, to build my proficiency back up to where I want it. As I relive 57 years of shortwave listening, my listening will be mainly on the marine HF bands. From looking at the new equipment coming on the market, an SDR unit will eventually find its way into my radio shack.

The coherer gave way to tubes, transistors, and solid-state rigs, so Morse gave way to voice and digital modes. I have to remember I use a laptop to write the column not pen and paper. I can't forget that my marine radio bible, "Radio Aids to Marine Navigation," as well as the monthly Notices to Shipping are now downloaded, not sent out in print form.

The equipment, frequencies and modes may be different but I still admire the operators of these stations as they help the mariners stay safe. They are professionals in every sense of the word.

I had a look at my bucket list for the future. One big item is a visit to KPH to see the station and meet some of the people involved. A more realistic goal is to return to South Carolina this spring and operate again from one of the naval museum ships in the area. That is both a thrill and an honor. I also want to visit the CSS Hunley display. Marine history still fascinates me.

A request to speak to a local historical society really got me thinking. The local marine radio history and the fact that the first voice radio transmission by Reginald Fessenden was made on Christmas Eve 110 years ago really determined my presentation topic.

I hope all the readers of The Spectrum Monitor had a Merry Christmas, or a happy holiday celebration. May the New Year will bring health, happiness and perhaps some new radio gear!

THE LONGWAVE ZONE

By Kevin O'Hern Carey WB2QMY

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More LW Information Sources and Readers' LW Logs

Welcome to the New Year! In recent issues we've been looking at information resources for the longwave enthusiast. Our needs differ from those of the HF or VHF crowd, so it pays to have some specialized resources available that can help you get the most out of your listening experience. Our focus so far has been on printed materials, which are important, but this month we'll also explore online sources of information. Whether you simply refer to these sites when needed, or print out the material for ready reference or archiving is up to you, but it's important to know they exist and what they contain so you can get the most out of your listening time.

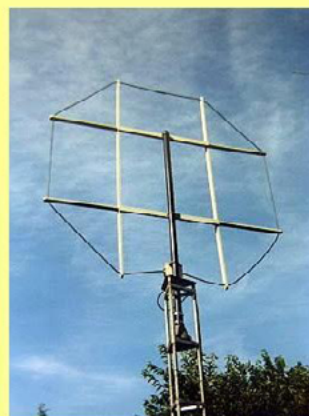
When I started in the longwave game, online information was unheard of. It wasn't until some dial-up electronic Bulletin Board Systems (BBS) came online that we began to see some electronic resources—most of it text-based. It was a great start, but it wasn't until the advent of the publicly available Internet that we began to see this method of information sharing really take off. Today many of us take it for granted, but it would serve every radio enthusiast well to take a few moments to realize just how good we've got it. Nearly anything you want to know about LW listening or DXing has probably been addressed on multiple websites, which you can access immediately with a PC and Internet connection.

From time to time I still hear from listeners who do not have Internet access, and do not want it. That is fine. However, anyone who simply lacks the ability to go online should realize that such resources are as close as the nearest public library. If you don't take advantage of them, you're cutting out a significant pool of information on our hobby. I realize that virtually all TSM readers are connected by virtue of this being an electronic publication. However, consider helping someone who has not made the jump to online exploration. They'll thank you for it, and you might even interest them in coming aboard with *TSM*!

Here, in no particular order, are some of my favorite websites for online information related to LW. The list is by no means exhaustive, so please send me your favorites, and we can share them in future columns. Happy surfing in 2017!

The VE7SL Radio Notebook

A BROADBAND SHIELDED
RECEIVING LOOP
FOR LOW-FREQUENCY DX WORK



The VE7SL Radio Notebook Page offers a huge amount of information on longwave and vintage radio topics, with the emphasis on hands-on building.

Longwave-Oriented Websites

The VE7SL Radio Notebook: <http://qsl.net/ve7sl>
DXing, building, operating, antennas, and history

The Longwave Club of America: (LWCA): www.lwca.org
The “granddaddy” of all longwave clubs in North America, founded in 1974

Auroral Chorus: <http://www.auroralchorus.com>

Natural VLF Radio Phenomena, including essential reading, sound samples, recording information, and history of natural radio reception. There is also some information on low power transmitting in the experimental 160-190 kHz “Lower” band and other NDB topics.



Clifton Z1501 active antenna shown here installed with a short mast and medium length whip. (Courtesy: Clifton Antennas)

The NDB List Website: <http://www.ndblist.info>

This is a very active group interested in non-directional beacon reception and DXing, including the promotion of “Coordinated Listening Events” (CLEs) that provide a detailed look at a specific frequency range.

NDBRNA Website: www.classaxe.com/dx/ndb/rna/signal_list

This site provides an advanced lookup tool for signals received in the Americas, plus Hawaii. You can enter a frequency (or freq. range), ID, or other criteria to search for stations heard. You will get a summary of who has heard a particular station, when it was last heard, and an exact definition of the ID tone in Hz. It is a highly recommended site, especially for DXers.

Radio Waves Below 22 kHz: <http://www.vlf.it>

Renato Romero’s home page exploring the ULF-ELF and VLF radio spectrum.

ARGO QRSS Software Page: <http://digilander.libero.it/i2phd/argo/index.html>

Free download and information about ARGO software, used to decode the very popular weak-signal mode, QRSS

The screenshot shows the 'Signals Received in N & C America + Hawaii' page. It includes a navigation bar with links like 'Signals', 'Seeklist', 'Listeners', 'CLE', 'Maps', 'Tools', 'Weather', 'Stats', 'Awards', 'Polls', 'Log On', 'Help', and 'Donate'. Below the navigation bar, there's a 'Signal List' section with instructions on how to use the site. A 'Reporting NDBs' section provides a link to William Hepburn's LF List. The main part of the page is a 'Customise RNA Report' form with various filters for 'Show', 'Types', 'Call / ID', 'Locations', 'Distance', 'Heard by', 'Heard here', 'Last Heard', 'Sort By', and 'Custom Filter'. To the right of the form are two summary tables: 'Signals' and 'RNA Listeners'.

Signals	
RNA only	3324
REU only	7848
RNA + REU	1474
RWW	14684

RNA Listeners	
Locations	282
Loggings	372003
First log	15 Feb 1986
Last log	26 Dec 2016

The NDBRNA website is an unparalleled resource for identifying non-directional beacons, and provides numerous ways to search for stations heard.

(super slow CW). This mode is extremely popular among experimental/ham operators on longwave.

WD2XSH 500 kHz Experiment Page: <http://500kc.com>

600-meter and vicinity operations, with a focus on the 465-515 kHz Range. You can even log an online reception report at this website.

ARRL LF Info: <http://www.arrl.org/lf-low-frequency>

A “launching pad” site which lists several links of interest, particularly on experimental transmitting on 1750 meters, and at 136 kHz.

Selected NDB Loggings

Our contributors this month are Richard Palmer (MO), Tom Root (MI), Russ Hill (MI) and Tom Filecco (WY). Contributors are identified by their initials with their state in the right-most column. Bolded entries indicated favorite catches, and these are explained in the contributor’s comments. My thanks to all for submitting logs for this issue. Loggings are always welcome; please send them to my e-mail address at the top of this column. Ask for our free loggings template.

kHz	ID	Location	By
198	DIW	Dixon, NC	T.F. (WY)
200	UAB	Anahim Lake, BC	T.F. (WY)
200	YDL	Dease Lake, BC	R.P. (MO)
201	IP	Mobile Lufthansa, AZ	T.F. (WY)
206	AP	Alpena, MI	R.P. (MO)
212	CFV	Coffeyville, KS	T.F. (WY)
212	LIU	Littlefield, TX	R.P. (MO)
216	ME	Matane, QC	R.P. (MO)
218	PR	Prince Rupert, BC	R.P. (MO)

218	RL	Red lake, ON	T.R. (MI)	346	YXL	Sioux Lookout, ON	R.H. (MI)
219	TO	Toledo, OH	R.P. (MO)	350	D7	Kincardine, ON	R.P. (MO)
220	HUR	Roxboro, NC	R.P. (MO)	350	NY	Enderby, BC	T.F. (WY)
223	YKA	Kamloops, BC	R.P. (MO)	350	RG	Oklahoma City, OK	T.F. (WY)
223	YYW	Armstrong, ON	T.R. (MI)	353	IN	Int'l Falls, MN	T.F. (WY)
224	BK	Baker Lake, NU	R.P. (MO)	353	IN	Int'l Falls, MN	R.H. (MI)
225	YIK	Ivujivik, QC	R.P. (MO)	356	ZF	Yellowknife, NT	R.P. (MO)
230	NRN	Norton, KS	R.P. (MO)	358	CKC	Grand Marais, MN	R.P. (MO)
230	VQ	Detroit, MI	R.P. (MO)	360	PN	Port Menier, QC	T.R. (MI)
240	MJL	Mejillones, CHL	R.P. (MO)	362	RPX	Roundup, MT	T.F. (WY)
241	HF	Hearst, ON	T.R. (MI)	362	SB	Sudbury, ON	R.H. (MI)
242	XC	Cranbrook, BC	T.F. (WY)	362	YZS	Coral Harbour, NU	R.P. (MO)
245	FS	Sioux Falls, SD	T.F. (WY)	365	AA	Fargo, MN	T.F. (WY)
245	MG	Montgomery, AL	R.P. (MO)	365	PAL	Palma, EQA	R.P. (MO)
248	WG	Winnipeg, MB	T.F. (WY)	365	YGZ	Grise Fiord, NU	R.P. (MO)
250	FO	Flin Flon, MB	T.F. (WY)	366	YMW	Maniwaki, QC	T.R. (MI)
254	EV	Inuvik, NT	R.P. (MO)	368	SX	Cranbrook, BC	T.F. (WY)
254	MB	Manistee, MI	R.P. (MO)	369	ZDX	St. Johns, ATG	R.P. (MO)
257	MB	Saginaw, MI	R.P. (MO)	370	YBV	Berens River, MB	T.F. (WY)
257	YXR	Earlton, ON	T.R. (MI)	371	ITU	Great Falls, MT	T.F. (WY)
260	AP	Denver, CO	T.F. (WY)	371	UK	Ukiah, CA	T.F. (WY)
260	SNE	Santa Elena, TX	R.P. (MO)	372	YCO	Kugluktuk, NU	R.P. (MO)
266	VR	Vancouver, BC	R.P. (MO)	374	EX	Kelowna, BC	R.P. (MO)
272	XS	Prince George, BC	R.P. (MO)	375	CP	Casper, WY	R.P. (MO)
275	R1	Thetford Mines, QC	R.P. (MO)	375	OGT	Unknown	R.P. (MO)
278	HFF	Camp Mackall, NC	R.P. (MO)	376	K2	Olds-Didsbury, AB	R.P. (MO)
287	YSF	Stony Rapids, SK	R.P. (MO)	378	RJ	Roberval, QC	T.R. (MI)
290	YYF	Penticton, BC	T.F. (WY)	378	UX	Hall Beach, NU	R.P. (MO)
295	EEK	Unknown*	R.P. (MO)	382	YPL	Pickle Lake, ON	R.H. (MI)
302	HO	Huron, SD	R.P. (MO)	382	YPL	Pickle lake, ON	T.R. (MI)
308	ZZD	Edmonton, AB	R.P. (MO)	383	CN	Chappell, NE	T.F. (WY)
312	UNT	Penticton, BC	R.P. (MO)	384	JB	Lumberton, NC	R.P. (MO)
317	VC	La Ronge, SK	T.F. (WY)	388	MM	Fort McMurray, AB	R.P. (MO)
320	9V2542	West Intrepid, Gulf	R.P. (MO)	390	JT	Stephenville, NL	R.H. (MI)
323	GR	Fort Hood, TX	R.P. (MO)	392	ML	Charlevoix	T.R. (MI)
326	FC	Fredericton, NB	R.P. (MO)	392	ML	LaMalbaie, QC	R.H. (MI)
326	UOT	Union, SC	R.P. (MO)	396	UV	Martinsville, VA	R.P. (MO)
329	CH	Charleston, SC	T.R. (MI)	397	AIT	Aitkin, MN	R.P. (MO)
329	YHN	Hornepayne, ON	T.F. (WY)	400	CI	Sault Ste. Marie, MI	R.H. (MI)
329	YHN	Hornepayne, ON	T.R. (MI)	401	YPO	Peawanuck, ON	R.H. (MI)
332	PH	Port Huron, MI	R.P. (MO)	401	YPO	Peawanuck, ON	T.R. (MI)
332	QT	Thunder Bay, ON	T.R. (MI)	404	MOG	Montague, CA	T.F. (WY)
334	UU	Corinth, MS	R.P. (MO)	407	HCD	Hutchison, MN	R.P. (MO)
335	CVP	Helena, MT	T.F. (WY)	407	ZHU	Montreal (H-B), QC	T.R. (MI)
335	YLD	Chapleau, ON	T.R. (MI)	407	ZHU	Montreal, QC	R.H. (MI)
338	TU	Tulsa, OK	R.P. (MO)	408	MW	Moses Lake, WA	T.F. (WY)
339	6X	York Landing, MB	R.P. (MO)	410	EGQ	Emmetsburg, IA	T.R. (MI)
340	JES	Jesup, GA	R.P. (MO)	413	YHD	Dryden Regional, ON	T.R. (MI)
340	YY	Mont Joli, QC	T.R. (MI)	413	YHD	Dryden, ON	R.H. (MI)
340	YY	Mont-Joli, QC	R.H. (MI)	414	FDW	Winnsboro, SC	R.P. (MO)
341	DXX	Madison, MN	R.P. (MO)	420	FQ	Fairmont, MN	T.F. (WY)
341	YYU	Kapuskasing, ON	T.R. (MI)	521	RPK	Middlesboro, KY	R.P. (MO)
341	YYU	Kapuskasing, ON	R.H. (MI)	523	JJH	Johnstown, NY	R.P. (MO)
344	FCH	Fresno, CA	T.F. (WY)				
346	JXT	Morristown, TN	R.P. (MO)				
346	YXL	Sioux Lookout, ON	T.R. (MI)				

* Location unknown. Heard in Illinois and Missouri.

Contributor's Information

Richard D. Palmer (MO)

Receiver(s) Used: ICOM R-75

Antenna(s) Used: Clifton Z1501 active, base up 25 foot, 10 foot whip

Audio Processors: Timewave DSP-599zx and a Ratzlaff 9Hz in series

Comments: Logged 727 beacons this month, 192 more than last month. Ten all-time new beacons and 46 more for the year, brings my total to 923. I have found that November is one of the better months for hearing beacons and this month was no exception. MJL from Chile was my best catch at 4,463 miles.

Russ Hill (MI)

Receiver(s) Used: Kenwood R5000

Antenna(s) Used: Palomar Loop

Tom Root (MI)

Receiver(s): ICOM R-75

Antenna: Clifton Z1501F active antenna with a 10' whip; the antenna base is ~12'7" above earth ground.

Comments: Winter DXing is truly fun, but my listening time this season has been limited by an extended Thanksgiving family trip, a lasting cold, and holiday preparation activities. And while I snagged better DX this period, my favorite is another personal newbie, 410 EGQ Emmetsburg, IA at 549 miles.

Tom Filecco (WY)

Receiver(s) Used: Icom R-75

Antenna(s) Used: 150 foot longwire

I also received the late-breaking logs below from Arthur Peterson (CA). The format shown is Frequency, ID, and Location. For these intercepts, Arthur used a Sony ICF-2002 receiver, and a Radio Plus+ Quantum Loop antenna.

200	UAB	Anahim Lake, BC
227	CG	Castlegar, BC
305	ONO	Ontario, OR
317	VC	La Ronge, SK
320	YQF	Red Deer, AB
332	POA	Pahoa, HWA
332	QT	Thunder Bay, ON
332	XT	Terrace, BC
333	STI	Mountain Home/Sturgeon, ID
350	SWE	Idaho Falls/Sweden, ID
353	LLD	Lanai, HI
355	YWP	Webequie, ON
382	YPL	Pickle Lake, ON
391	DDP	Dorado, PR
395	ULS	Ulysses, KS
397	SB	San Bernardino/Pettis, CA
410	GDV	Glendive, MT

516	YWA	Petawawa, ON
518	NAVTEX	Kodiak, AK
518	NAVTEX	Astoria, OR
518	NAVTEX	Honolulu, HI
521	INE	Missoula, MT

Arthur comments that his best catch by far this time was DDP, Puerto Rico at 3,600 miles. He is also hearing his first Ontario station this season.

Happy New Year to all TLZ readers and see you next month!

TSM



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ADVENTURES IN RADIO RESTORATION

By Rich Post KB8TAD

kb8tad@gmail.com

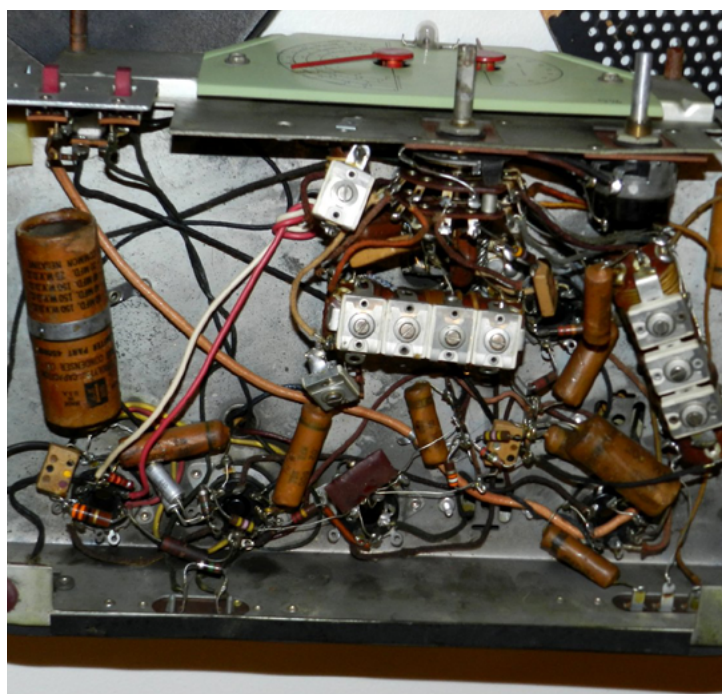
Hallicrafters S-38B: The UL-Approved Basket Case

Prior to World War II, Hallicrafters introduced a small AC-DC broadcast and shortwave set complete with bandspread and a real BFO, the Echophone EC-1, priced at \$19.95 when introduced in 1940. Hallicrafters had purchased the Echophone name but had avoided making low-end AC-DC sets under its own brand prior to the war, the exceptions being for the S-29 Sky Traveler three-way battery-AC-DC portable and the S-22 and S-22R Skyrider Marine models for use on board ships that only had 120 volts DC power. The little Echophone EC-1 turned out to be a very successful little radio that was advertised as available for purchase by US troops all during WWII.

After the war in 1946, Hallicrafters decided to build a small 4 band AC-DC set under its own brand. The result was the S-38, a 6-tube AC-DC set first advertised in June 1946. It was a typical “All-American Five” set with a sixth tube used as a tunable BFO, like the EC-1. The design with its two half-moon dials by famous industrial designer Raynond Loewy was an instant hit at a price of \$39.50. It was introduced at a time when American troops were still stationed overseas in occupied Germany and Japan and a small tough shortwave set was in demand for both those soldiers and US civilians who had not been able to buy radios during the war.

The Minerva Tropic Master, a competing but less capable set sold to GIs in post-exchange stores was almost twice the price. Both the Hallicrafters reputation and the price easily sold the new set. The 1946 Allied catalog ad also lists a line cord adapter for operating the set off 220 volts for an additional 85 cents, something a GI overseas might need.

Due to inflation immediately after the war, the set price jumped to \$47.50 in the 1947 Allied catalog. That very successful S-38 was followed by the S-38A in August 1949, which reduced the tube count by one, substituting regenerative IF to act in place of the active BFO, and also dropped the price back down to \$39.95. The S-38B came one year later, increasing the price to \$49.50 and changing the satin black finish of the S-38 and S-38A to a flat black slightly-wrinkled finish, likely in a later run since some of the model, probably early in the production, still have



S-38B basket case chassis before restoration. (KB8TAD photo)

the smoother satin finish. Hallicrafters added an interlock connector, which removed the power connection when the hardboard back was taken off. The S-38B advertisements note “UL approved” (Underwriters Laboratories), which I suspect was the reason for the interlock. The earlier S-38 and S38A ads make no mention of UL.

Hot Chassis Designs and UL

The interlock was needed because the S-38B, as well as the earlier EC-1, S-38, and S-38A were all hot chassis designs with one side of the power line switched directly to the chassis. That meant the chassis was live with the 115 volts AC line either directly when switched on or when switched off by way of the cold tube filaments. The sets all came with insulation between the chassis and the metal cabinet, but the cardboard backs had to be removed to change tubes and were



Hallicrafters All-Wave Receiver S-38B

New model of a world-famous shortwave receiver—the S-38B has features found only in much higher-priced sets, but at a price to fit any budget. Unbeatable for value per dollar . . . a sensitive, low-cost Amateur receiver . . . a thrilling All-wave treat for the entire family!

Features: Four bands; sensitive AM or CW reception; fine tuning; 5" PM speaker; AC or DC operation; smart, up-to-date styling; "Big Set" performance!

Wide-Range Coverage. Band 1, 540-1650 kc; band 2, 1.65-5.1 mc; Band 3, 5-13.5 mc; Band 4, 13-32 mc. Tuning range starts with standard AM broadcast band and continues without a break up through all important shortwave frequencies to 32 mc. Electrical bandspread separates crowded shortwave stations.

Simplified Controls. Anyone can operate the new S-38B! Main dial is marked with all important shortwave channels. Colored dots on controls make tuning and adjustment easy.

AC-DC Superhet Circuit. Uses 12SA7 converter; 12SK7 IF and BFO; 12SQ7 det-AVC-1st audio; 50L6GT power output (1.6 watts). Well designed 455 kc IF amplifier provides excellent selectivity. Uses 35Z5GT rectifier, headphone tip jacks.

Handsome Cabinet. Rich satin black finish with light gray panel lettering. Airodized speaker grille, green finish dial. Size, 12 7/8" x 7 1/4". For 105-125 volts DC, or 40-60 cycles AC; also from 210-250 volts DC, or 40-60 cycles AC using line cord below. With instructions. U.L. approved. Shpg. wt., 14 lbs.

97-508. NET **49.50**

Terms: 4.95 down, 5.25 monthly for 9 months

220-volt adapter line cord. Permits operation of S-38B from 220 volts AC or DC. Shpg. wt., 5 oz.

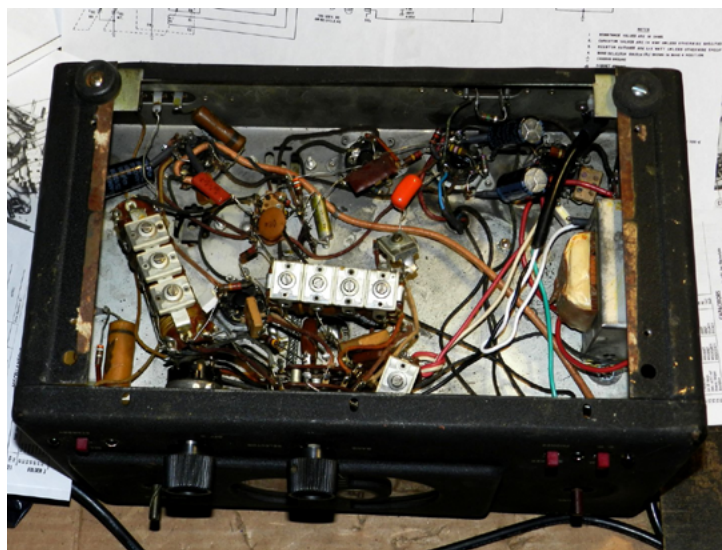
49-580. NET **1.41**

Hallicrafters S-38B ad in the 1951 Allied catalog. (From KB8TAD collection) [Editor's note: While the advertised price sounds reasonable by today's standards, according to the Bureau of Labor Statistics inflation calculator, the cost of the S-38B in today's money would be \$459.50.]

sometimes not replaced. That would certainly not pass UL approval. The interlock on the S-38B assured that the back would be replaced. For all these sets, the chassis-to-cabinet insulation and the back must remain intact if using the radios as originally designed. A ground terminal connection for each of these sets is by way of a capacitor, which should be replaced by a "Y" type, as should the chassis-to-cabinet capacitor. Many hams and shortwave listeners of the era started out with one of these radios, being aware of and sometimes bitten by the hot-chassis.

The S-38C, introduced in the 1953 Allied catalog, changed the color scheme to a metallic grey and changed the wiring to a floating ground with a capacitor between the line-connected B- and the chassis. It was also advertised as "UL approved." The cabinet was still insulated from the chassis, but the interlock as used on the S-38B was no longer required. The floating ground option was much safer than the direct-switched connection to the chassis although one could still get bitten with AC by way of the capacitor and resistor but at a current level that was unlikely to be lethal.

All the examples of the S-38C that I have seen have the safer floating ground, but be sure to check for any low resistance continuity between either side of the line cord and the chassis. Resistance between the line cord prongs and the chassis should be at least 470K ohm in an S-38C and obviously the 0.05 uFD capacitor in parallel with the line-to-chassis resistor should be replaced by a "Y" type cap as should any cap that is connected between a line source and any point that can be touched by an operator. The S-38D and E models changed from the Loewy half-moon design to

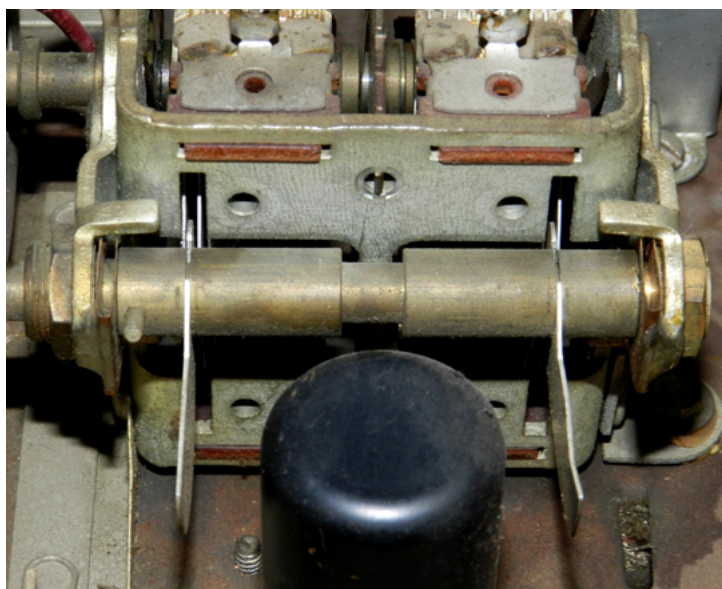


Above: Hallicrafters S-38B showing chassis bottom after installing the isolation transformer and new components. Note the two original wax caps, which are now unnecessary but can be left intact. (KB8TAD photo)

slide-rule dials and continued to use the safer floating-ground circuitry.

A Near Basket Case

I purchased this S-38B with knobs missing, the chassis loose and all mounting screws, feet, and three tubes missing. The box in which it came contained the hardboard back but the cord was sliced off right at the interlock connector. The



The two blades of the S-38B bandspread capacitor, the right blade is bent, shorting out the tuning. (KB8TAD photo)

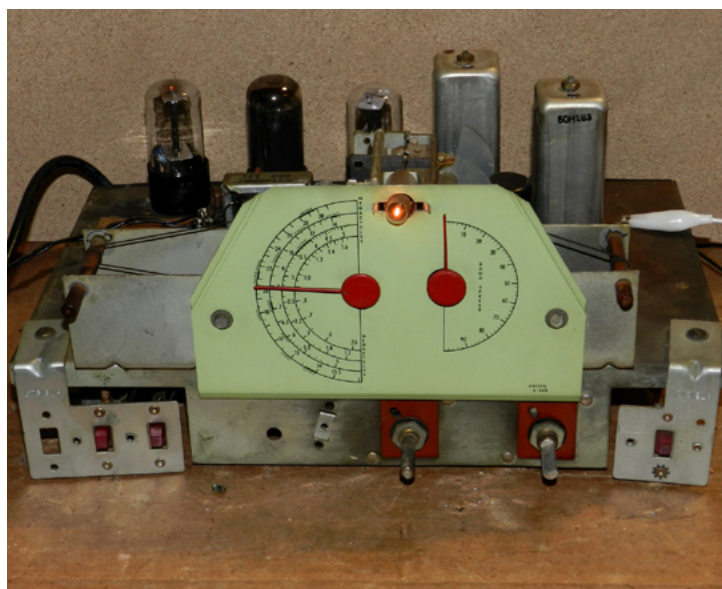
bandsread knob shaft, like the main tuning shaft, is made of phenolic, unique to the S-38B and likely also needed to satisfy UL. Nearly half an inch had been cracked off, likely due to a too-vigorous attempt to remove the knob. It looked as if someone had thought about restoring the set but had given up early, possibly because of the broken bandsread shaft. The capacitors were still the original waxed paper types along with the large paper-covered electrolytic. I purchased the set mainly because the cabinet was still in decent condition.

With all the problems, I began to think about making it perform again but this time modifying it for safety. With the same cabinet and chassis size as the original S-38 but one less tube, was there enough room to mount an isolation transformer inside? That would make the need for the interlock, new mounting insulators, “Y” type capacitors, and phenolic bandsread shaft moot. With the cabinet in such nice condition, I was determined to find out if the set could both be restored and made safe at the same time. Both the Sams Photofact and the Hallicrafters manual are available on the Internet.⁽¹⁾ The Photofact has useful pictures, but the original Hallicrafters schematic is preferable.

Replacing the Electrolytic

I didn’t even bother to check out the large four-section cardboard-sleeve electrolytic. In my experience, with the low 150-volt rating and paper sleeve, that type is almost invariably bad. I could easily replace the 4-section unit with four much smaller caps. I also looked at the large space it was occupying under the chassis. It looked like there might be enough room with that cap out of the way to mount either a Stancor P-6412 or a Triad N-68X isolation transformer.

I happened to have both in the well stocked “boxe de junque.” Mine are new old stock, but a quick online check confirmed that both are still available. The P-6412 is rated at



S-38B chassis playing on the bench. (KB8TAD photo)

35 VA (volt-amperes) and sells for \$22.61 at Allied Electronics⁽²⁾. The Triad N-68X rated at 50 VA is \$16.00 from Mouser and only \$12.74 from Online Components⁽³⁾. At those prices, the Triad is a true bargain, especially with its heavier VA rating and capability of being hooked up to either a 115 or 230-volt line. Both the Stancor and the Triad are nearly the same size. In checking whether these would fit under the chassis in what had been the electrolytic location, I found that either one would fit comfortably. I only needed to drill two mounting holes. While I hesitate to drill holes in vintage equipment, such a change for safety’s sake is an exception.

Before mounting the isolation transformer, which was designed for 115 volts, I checked the forward and back ratios. Tested as designed, the output was 137 volts with 120 in. In reverse, 120 in resulted in 105 out. When tested with a 25-watt light bulb, its output was 102 volts. An isolation transformer is designed so that a proper load would cause a voltage drop to the expected voltage at its output. However, since the transformer was designed for 115, I was concerned that with 122 or more in, the output would not only be too high for the filaments but might cause some saturation heating of the transformer itself.

I decided to reverse the transformer to drop the voltage and see if that would be adequate for the radio. It was worth a try and could always be changed if needed. I re-wired the on-off switch on the volume control to switch the line input to the isolation transformer. A terminal strip was added under one of the transformer mounting bolts for the new connections. Since I was modifying the set for safety, I removed the broken interlock connector and replaced the entire line cord assembly with a permanent three-wire grounded power cord.

The electrolytic was replaced with individual caps in different but convenient locations. The 20 uFD at 25-volt cathode bypass cap for the 50L6 was so small it easily fit right on the 50L6 socket. Before mounting the electrolytics, I checked the resistors, finding several off-value, which were



S-38B ready for more service. (KB8TAD photo)

replaced. All the tubular paper caps were replaced except two, those being the 0.01-uFD cap from the ground screw terminal on the antenna terminal strip to chassis and the 0.1 uFD cap that had been placed between the cabinet and chassis. Those were now unnecessary with a safety-grounded chassis, but I left the originals in place for appearance. I figured I could simply run a shorting wire around them if needed.

As usual, I took notes on each component and the points such as the tube socket pins where it was connected before replacement in case I was interrupted in the process, checking off each note as the capacitor or resistor was replaced. I learned that practice from building Heathkits. Of course, there is always the schematic, but careful notes eliminate a lot of wire tracing.

First Power Up?

It was time to check my work. For most radios, I replace critical caps first and then try to power up the set to determine if there are any major repair needs. But this was an AC-DC set with low voltage caps that are typically bad so I waited to power up until the caps and off-value resistors had been replaced. As usual, I connected my voltmeter to the B+ line at the first electrolytic so I could monitor B+ as well as the AC volts and wattage input as the isolated Variac was powered. With proper wattage draw, I expected B+ to increase to a normal level as the tubes warmed up. This time, nothing. Had I made an error in component replacement?

I checked my wiring. It finally dawned on me that a prior owner had removed the connection between pins 3 and 5 of the 35Z5 rectifier. Pin 5 is the plate connection that is wired to the filament tap of the 35Z5. Without that plate connection wire, there is no B+. I soldered in the jumper.

On the next power up, a satisfactory level of B+ appeared on the meter but no sound. I checked tube socket



Echophone EC-1 (KB8TAD photo)

voltages and found no plate voltage on the 50L6 audio output tube. The output transformer was open. The transformer is riveted to the chassis but the rivets were easily drilled out. I measured the distance between mounting hole centers (2 inches) and found an identical size replacement from a junk chassis. Although it did not have the extra secondary tap intended for use with high impedance headphones, I wired it so that the speaker-phone switch still worked as designed with the phone tip jacks on the back useful for an outboard speaker and either high impedance or modern low impedance headphones.

With a good output transformer in place, the chassis played on the next power up. With a clip lead for antenna, it picked up local stations, but the buzz from RFI sources in the house was noticeable. The bandspread section of the variable capacitor shorted to the stator when turned beyond about 50.

The rear single blade of the bandspread cap was bent slightly and touching the stator at that point. Alignment was also needed since the dial markings were off somewhat, but the radio was working. With clip leads, I connected my coax-fed 80-meter ham dipole to the radio, which then proved to be quite sensitive on the AM broadcast band. It was satisfying to be able to connect a grounded antenna right to the chassis without fearing sparks. I settled back for an hour or so to enjoy some good music from Zoomer 740 in Toronto. The sound was excellent through my 12-inch shop speaker.

The new isolation transformer stayed cold and the radio was happily playing even when the Variac was turned down to 100 volts, although I had to turn up the volume at that lower voltage. That settled my concern that the reversed isolation transformer might provide too low a voltage for the set.

The next day, I tackled the bent bandspread blade and the broken phenolic shaft on the bandspread control. By bending the blade gently and seeing how far it would travel before shorting again, I was able to finally straighten the

blade to eliminate the shorting problem. The broken phenolic shaft only needed about a half inch extension but the couplings from the well stuffed “boxe de junque” were too large given the space between the forward bearing and the cabinet. I finally found a piece that had apparently been part of a worm gear, having a spiral groove in the shaft section. It fit nicely. My other option would have been to epoxy a piece of phenolic onto the existing shaft but a mechanical solution would be stronger.

Alignment

The alignment is fairly straightforward; four adjustment screws at the top of the two IF transformers were easily peaked for 455 kHz. The other adjustments are all variable cap trimmers mounted on or adjacent to the antenna and oscillator coils. While the IF alignment had been close, the RF trimmers were well off the mark, especially the oscillator adjustments. For example, the highest band adjustment for 30 MHz was actually at 36 MHz.

I found it easier to simply use a frequency counter to adjust each oscillator trimmer at an IF frequency above the dial marking and then checking with a very low level signal from the signal generator for verifying the signal and adjusting the antenna trimmers. Most of the RF trimmer adjustments were near the tightest setting of the trimmer screws.

For the highest two bands, I literally removed the output coax from the generator and turned it all the way down since there was enough leakage for a low level signal to allowing tweaking of the trimmers. The signal level must be kept low enough to prevent AVC action. A weak signal only slightly above the band noise is the best. The little set was surprisingly sensitive given its simple “All-American Five” circuitry.

After alignment and attaching the bandspread shaft extension, it was time to button up the S-38B and play with it for a while. I did not have to worry about the insulation between the cabinet and chassis with the onboard isolation transformer and safety grounded chassis. I think UL would have approved of the safety changes.

Some years ago, while visiting the Lowell Observatory in Flagstaff, Arizona with its 24 inch Clark refracting telescope, I spotted a black S-38A or B on a shelf near the telescope. I wondered why it had been there. Then it dawned on me. It was there for accurate time synchronization from WWV, ticking off the time without the need for light while viewing the night sky, a rather clever use of an S-38. So what else could be done with an S-38B? Next month, I’ll be looking at another interesting radio that will shed some light on the reason for choosing the S-38B for restoration. Stay tuned. Comments and questions are welcome, kb8tad@gmail.com



The half-moon Loewy design for the S-38 series ended in 1955 with the introduction of the Hallicrafters S-38D. However, the design was “borrowed” by the Japanese in 1959 with the introduction of the Trio (Kenwood) or Jennen 9R-4J, also sold by Lafayette Radio as the HE-10 and the KT-200 kit version. The 9-tube Trio/Jennen/Lafayette radio was vastly superior to the S-38 series with its power transformer, a real BFO, an S-meter, a separate RF stage, separate oscillator and mixer, and dual IF stages. (KB8TAD photo)

Notes:

⁽¹⁾Hallicrafters S-38B manual

<http://bama.edebris.com/manuals/hallicra/s38b>

Sams Photofact on Hallicrafters S-38B

<http://bama.edebris.com/manuals/hallicra/s38bsams>

⁽²⁾Stancor P-6412 isolation transformer rated at 35VA

still in stock at

<http://www.alliedelec.com/stancor-p-6412/70213236>

⁽³⁾Triad N-68X isolation transformer 50VA datasheet

<http://www.mouser.com/ds/2/410/N-68X-781470.pdf>

Triad N-68X is \$16 from Mouser and \$12.74 from online components

<http://www.onlinecomponents.com/keywordsearch.aspx?text=N-68X>

ANTENNA CONNECTIONS

By Dan Farber AC0LW

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Sunspots Maybe, Part 2: Hey, Dan, What About Stealth?

Welcome back, my friends. I trust you all survived, and enjoyed, the holiday season. Any new radios out there? Beams on a tower, maybe? Yeah, me neither. And, Santa missed me again on the antenna analyzer. Ah, well...he did make me an early present of materials to build a big loop this winter.

Last month we talked about a future with fewer or no sunspots and how that might affect our HF operations. Primarily we're looking at a focus on the lower end of HF, since the bands above about 15 MHz are traditionally the bands shut down by low sunspot numbers. It's kind of feast or famine; when the bands between 15 and 30 MHz are open, they are really open, like "work the world on ten meters with five watts and a dipole" open; when they are not open, they are dead and vacant, and not even a kilowatt and a multi-element Yagi will bring them back to life.

The good news is that such conditions usually mean the bands below 15 MHz are much more effective. There's plenty of room to play around here; we're talking about 160, 80, 60, 40, 30 and 20 meters. Twenty meters is the real hero here, if DX is what you seek; over a period of many years' observation, twenty meters is the most consistent DX band, regardless of sunspots and other conditions. If you're a SWL, you'll notice a majority of broadcasters are on frequencies below 15 MHz as well.

The downside, of course, is a result of the laws of physics: the lower frequencies call for longer antennas and greater heights to be effective. This is the challenge we face this time around, friends—how do we make effective STEALTH antennas for the lower frequencies?

We have to be realistic, and accept that stealth operation at these lower frequencies is likely to mean short and/or low to the ground antennas, and this means reduced efficiency. The real issue with stealth is that we are trying to enable operation at all on the desired frequencies, and even poor or so-so operation beats no operation. Let's talk about some options.

Big Green

I hate to be like a broken record, but the best stealth option for the low bands that I have personally come up



Isotron antenna for 80 meters. Looks like a bird feeder, so Antenna Gestapo doesn't suspect it. (Courtesy: Bilal Isotron)

with is the Stealthy Green Jolly Loop on my roof (see my September 2015 column). The loop is laid out right on my green shingles, and being green insulated wire it is all but impossible to see at any angle. The loop is 105 feet long, so it is nearly a quarter-wave at 160 meters, and longer on 80 and up. The low sides of it are only twelve feet off the ground—my house is a single story. Fed with ladder line and my trusty tuner, this humble loop enables every band between 160 and 6 meters. Its performance on the low bands is really impressive since it is so low and short. If you live in a two- or three-story home you can make the loop much higher, and a larger house will enable a greater loop perimeter, which can only improve things. Pick a color of insulated wire that comes close to matching your shingles, and no one

will even know it's there—except, of course, all the other hams you work with it! It makes an excellent SWL antenna, too—it's nice and quiet on receive.

Space-Age Bird Feeders

Another option to consider is the trippy-looking antennas made by Bilal Isotron. The 160, 80 and 40-meter versions really do look like alien bird feeders. Placed somewhere on the roof, or if push comes to shove, in the attic, these antennas really work; I've worked a number of hams using them. They are not world-beaters—but they will enable you to operate the low bands. Remember, the idea is that any operating beats no operating. In a pinch, you could even enclose them on the roof or a balcony in a “doghouse” of some sort—use your imagination.

Old Glory

A popular idea, and one that pulls a fast one right under the Antenna Gestapo's noses, is the flagpole antenna. There are two schools of thought here: a regular metal flagpole, or a PVC pipe flagpole with a wire running down the center. In either case, a remote automatic tuner is waterproofed and buried at the base of the flagpole; radial wires are sunk in slits in the lawn cut with an edging tool. This is actually a pretty fierce antenna if you can arrange to have it; I've heard a number of them on the air. The tuner and radials will make a “short” flagpole into a real contender on the low bands. And the stealth factor is awesome; everyone admires your patriotism, flying Old Glory like that for all the world to see, while no one but a stealth-minded radio hobbyist imagines that it's anything but a flagpole.

Invisible End-Fed

A perennial favorite, because of its simplicity, is a length of wire hooked to “antenna” at the radio end and run as far and as high as one's available tree or other support makes possible—many of us started as SWLs with just such an antenna. (Such an antenna is often mistakenly called a “long wire” but a real long wire by definition is one or more wavelengths long.) It often works well as a ham antenna, too. The big drawback is that, since the antenna and “feed-line” are all one unbroken length of wire, a fair amount of RF radiation takes place right in the radio room, which, depending on how much power you are running, can give you some nasty RF burns when lips touch a metal windscreen on a mike or when fingers touch a key or paddles or other metal parts in the area. I once received a pretty good little RF burn this way when my non-keying hand brushed against metal trim on the old kitchen table I was using in the shack!

There's little technique, or mathematics, involved in such a wire; you make it as long, and as high at the far end, as possible. If it's long enough, and is supported by an adequate RF ground, a tuner will load it up, and off you go. You



The humble rain gutter—the ultimate “antenna hidden in plain sight.” (Courtesy of the author)

can think of it as a vertical, tipped far toward the horizontal; like a vertical, it tends to be noisy on receive, and tries hard to be omnidirectional, if the far end is high enough.

What makes it a good choice for stealth operation is that such an antenna can be made from really small wire, say even #30 or smaller—it thus becomes very hard to see against the sky or background. Some operators really up the ante here by using magnet wire as small as #40, which is even more invisible. The downside, of course, is that small-diameter wire will more easily break in the wind, meaning you may have to get used to re-hanging the antenna fairly often. To a stealth operator, this is a small price to pay in exchange for some operation versus no operation.

Another way to enable the “invisible end-fed” is to hang it out a window. This can be a high-rise dweller's ticket to real DX, depending on how high in the building you are. The wire is simply hung out a window with enough weight (a rubber ball is good) attached to the end to keep the wire straight, then one simply end-feeds the wire and employs the counterpoise ground. If you live on the sixth floor or higher you can actually have a wire a quarter-wave long on 80 meters! It's a good idea to keep the low end high enough above ground to avoid it being noticed, fiddled with, complained about, etc. More than fifteen or so feet above the ground, it's liable to just blend invisibly into the background, and that's what you want. Even from the top floor of a three-story house, you can hang a wire a quarter-wave long at 40 meters, which a good tuner may be able to load on 80 meters as well.

Mind in the Gutter

Another perennial favorite in the annals of antenna legends is the rain gutter. If you've never tried one, you may be inclined to think of the rain gutter antenna as an ironic joke.

Believe me, it's not. I once had an operating position on the third floor of a large house; I ran a few feet of insulated #12 wire from the tuner's "wire" output to the second-floor rain gutter, attaching it with a large alligator clip soldered to the wire. The very first QSO I made with it was with an operator in Slovenia; I was running about 35 watts on 20 meters. On some bands, the load was too crazy for the tuner to handle, but it worked well on several other bands, notably 160, 40, 20 and 10. Not bad for an urban legend.

The rain gutter has appeal for the stealth operator in several ways. It is one of the best examples of an antenna "hidden in plain sight"—houses tend to have rain gutters, and people tend not to notice them. All that is necessary is some artful concealment of the wire feeding it, and complete stealth is achieved. One variation I've seen several times is the gutter system being fed at the bottom of a downspout, sometimes even with coaxial cable as a feeder, with some sort of ground, either radials or ground rods, directly underneath or close by. If the ham shack is in the basement, and thus the coax can be kept fairly short, a tuner can often enable several bands; this is an iffy proposition, though, since coax usually hates loads that aren't close to 50 ohms. Your results may vary.

Do you live in a newer house that has plastic rain guttering? Not to worry. Insulated wire can be laid right in the gutter. This actually works pretty well. In fact to the electrically minded, a discrete length of wire looks more promising as a conductor than metal guttering, with its various joints and less-than-perfect-conductor material. Regardless, both variations are used, and they work, sometimes very well. Remember: stealth is about being able to operate at all, instead of expecting world-beater results. Earning DXCC with a rain gutter is a bit trickier than doing so with a big beam on a tower. The point is that being able to operate at all beats no operation, hands down.

Grounded in Fact

Since all of these stealth antenna ideas for the low bands are short and/or low to the ground, a good RF ground is essential. It's hard to beat the "stealth ground" I've mentioned a number of times—the bundled counterpoise ground.

This is a fancy way of saying that we cut a piece of insulated wire a quarter-wave long near the desired frequencies, strip one end of every wire and twist and solder them together, and connect the aggregate to the tuner's "ground" connection. The wires can now be bundled with tape or wire ties and simply thrown across the floor, even around corners and so forth. Recall that a quarter-wavelength conductor is a low impedance, so the tuner sees a low impedance ground when operating near each wire's resonant frequency. You may want more than one for each band. I have two for 160 and two for 80, one centered in CW land, the other up in the phone segment. On 40 and higher bands, a single wire resonant at the band center works pretty well—see my March 2016 column for more about this "indoor ground." Even if



MFJ's Model 931 Artificial Ground, one way to get a good RF ground for stealthy low-band antennas. (Courtesy: MFJ Enterprises)

stealth is not an issue at your QTH, I recommend this ground system highly; the tuner always sees a coherent ground that is unaffected by soil conductivity or ground rod length, for example.

If you prefer, you can use a single random length of insulated wire for a ground, and use it in conjunction with an artificial ground, such as MFJ's Model 931. Basically, this is a tuner that adjusts a random ground wire to resonance, much like a regular tuner resonating a random wire as an antenna. Whether running with the artificial ground, or with the bundle of individual quarter-wave wires, be sure to tape the far end of these insulated wires; there is a significant RF voltage present at the far end of the resonant wire when transmitting, enough to endanger children or pets who might come in contact with it. I've seen more than one cat hiss and spit at these sneaky devils!

Onward and Outward

These are a few workable ideas for low-band antenna stealth—there are no doubt many more. A little determination and cleverness (sneakiness?) will very often find a workable solution, regardless of where you live or how powerful the Antenna Gestapo is in your area. The Federal government issued us amateur radio licenses; it's our right as citizens to employ our license. There's a way to hide an antenna at your location and make it work. Find it, and enjoy your rights as a radio operator!

That's all for this month. Join me here in February for more antenna adventures. Be careful out there, and happy operating!

RADIO HORIZONS

Product Announcements of Interest to *TSM* Readers

International Shortwave Broadcast Guide

Winter 2016-17

Teak Publishing is pleased to announce the release of the Winter 2016-2017 International Shortwave Broadcast Guide (ISWBG) electronic book by Amazon best-selling author Gayle Van Horn W4GVH. This all important semi-annual information resource is your electronic guide to the world of shortwave radio listening.

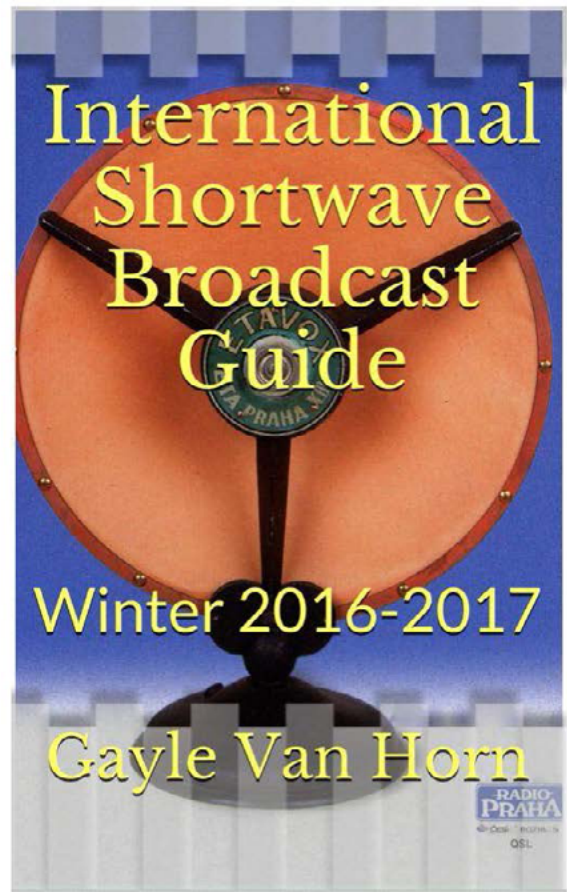
Shortwave radio listeners are routinely entertained with unique perspectives to events, music, culture, history, and news from other countries that you won't see or hear on your local or national broadcast channels. Shortwave radio broadcast aren't restricted by country borders or oceans, and can propagate thousands of miles, reaching millions of listeners worldwide, in over 300 different languages and dialects. These worldwide transmissions are monitored on internationally assigned radio frequencies between 1700 kHz and 30 MHz.

There are even broadcasts from the dark side, transmitted from broadcasters known as clandestine or "clanny" stations. Clandestine broadcasters are wrapped in mystery and intrigue, and they usually exist to bring about some sort of political change to the country they are targeting. Programming may largely be half-truths or sometimes even outright lies, but it is essentially propaganda for their cause.

Listeners who live in the United States can easily hear shortwave broadcast stations from Australia, Canada, China, Cuba, Egypt, France, Germany, India, Iran, Japan, New Zealand, North/South Korea, Saudi Arabia, Taiwan, Turkey, United Kingdom, United States, Vietnam, and many other counties if you have an inexpensive shortwave radio receiver, and you know when and where to listen!

If you want to get in on the action, then this Amazon electronic book is your ticket the travel the world via radio. The ISWBG is our exclusive 24-hour station/frequency guide to "all" of the known longwave, selected medium-wave and shortwave radio stations currently broadcasting at time of publication. This unique radio hobby resource is the "only" radio hobby publication that has by-hour station schedules that include all language services, frequencies and world target areas.

New in this seventh edition of the ISWBG is an Introduction to News and Entertainment Programming on Shortwave Radio by Fred Waterer, former columnist for *Monitoring Times* and currently shortwave columnist for



(Courtesy: Teak Publishing)

The Spectrum Monitor; a feature on Online Radio: The crossroads of old and new technology by former *Monitoring Times* columnist Loyd Van Horn W4LVH; and comprehensive radio listeners Crash Course on Shortwave Radio Propagation by Tomas Hood NW7US, contributing editor and columnist for *CQ* magazine *Popular Communications*, *Monitoring Times* and *The Spectrum Monitor*.

There is also an expanded special feature on Who's Who in the shortwave radio spectrum by former *Monitoring Times* editor and feature writer Larry Van Horn N5FPW. This story covers services and frequencies outside the regular broadcast and amateur radio bands, and includes our new, exclusive Hot HF 1000+ non-broadcast frequency list.

Also new in this edition is increased frequency and station coverage of longwave broadcasters, selected medium

0100 UTC - 8PM EST/5PM PST

0100 0105 Peru, R Chaski Quechua/Spanish 5960do
0100 0115 India, AIR External Svc Sinhala 7270as 11740as
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0100 0130 Bulgaria, End Times Coming R relay English 9400eu
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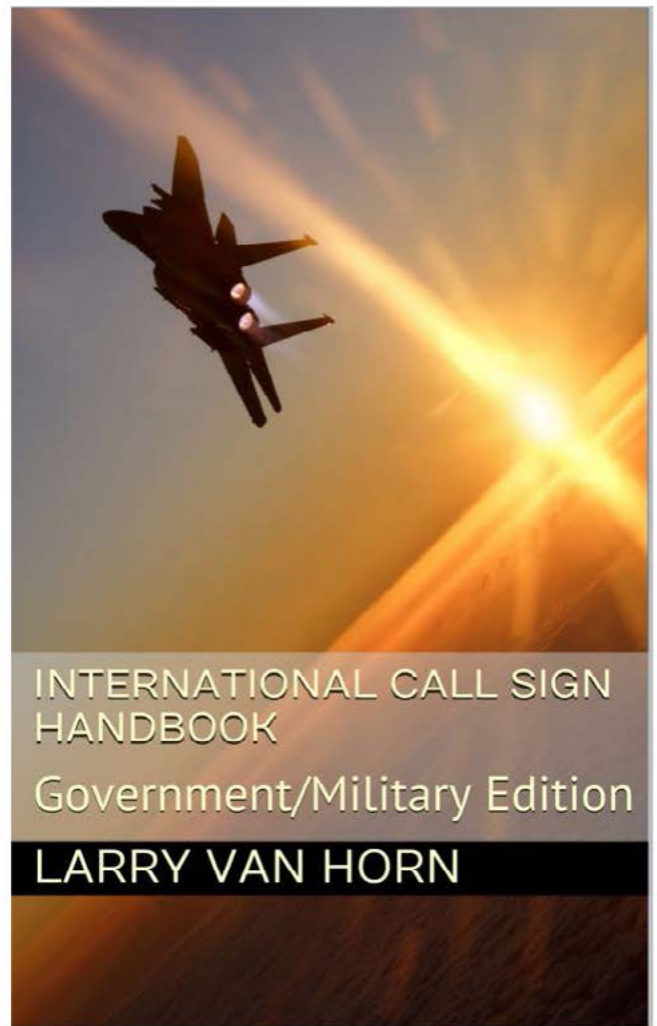
Actual page from the International Shortwave Broadcast Guide Winter 2016-17 shows easy to read format.

wave broadcast frequencies used by international broadcasters, and all known international standard time and frequency stations transmitting worldwide.

The International Shortwave Broadcast Guide (Winter 2016-2017 edition) is now available for purchase worldwide from Amazon.com at <http://www.amazon.com/dp/B01N-2RRXV2>. The price for this latest edition is \$7.99. Since this book is being released internationally, Amazon customers in the United Kingdom, Germany, France Spain, Italy, Japan, India, Canada, Brazil, Mexico and Australia can order this electronic book (e-Book) from Amazon websites directly servicing these countries. All other countries can use the regular Amazon.com website.

This new e-publication edition, now published twice each year to correspond with SW stations' seasonal time and frequency changes, is a much expanded version of the English shortwave broadcast guide that was featured in the pages of *Monitoring Times* for well over 20 years.

The Kindle app is available for most major smartphones, tablets and computers. This means with a free Kindle reading apps, you can buy a Kindle book once, and read it on any device with the Kindle app installed. You can also read that same Kindle book on a Kindle device if you own one. You can find additional details on these apps by checking out this link to the Amazon website at www.amazon.com/gp/feature.html?ie=UTF8&docId=1000493771.
[Text and graphics courtesy: Teak Publishing]



(Courtesy: Teak Publishing)

New International Call Sign Handbook 5th Edition Now Available

Ask any radio monitor what information they consider important during any monitoring session, and usually two items will top their list: frequencies and call signs. If you can hear activity on a particular frequency, unless you can fully identify the participants transmitting on that frequency, you can't fully appreciate or document the traffic you are hearing.

With millions of radio stations furnishing a variety of communication services throughout the world, it is necessary that their transmissions carry distinctive call signs or identifiers. Call signs have a four-fold purpose: They may identify the nationality of the station, the agency operating a particular station, the type of station, and the identity of each individual station being heard on the monitored frequency.

Teak Publishing is pleased to announce their latest Kindle e-book, the fifth edition of International Call Sign Handbook by Amazon bestselling author, Larry Van Horn N5FPW.

This e-book represents the most comprehensive collection of military and government station identifications ever published for the radio listening hobby. It is the result

of year's research, study and monitoring the HF/VHF/UHF radio spectrum, by the author. Many different radio monitoring disciplines have been used to compile the listings in this book. If you monitor the HF, VHF or UHF radio spectrum, there is something in this book for you.

The information presented in this book has also been gathered through personal correspondence, material published in the former *Monitoring Times* magazine, various radio publications, newsletters, public domain government and private Internet web sites, but most have been gathered the old fashioned way—via on-the-air monitoring and with generous support and contributions from many individuals in the radio hobby.

In addition to international and military/government tactical call signs, other types of identifiers such as Automatic Link Establishment (ALE) and Mode-S aircraft addresses have been included in this e-book. There is a chapter that has basic introductory material, as well as chapters devoted to call sign/words used by the Department of Defense including the US Air Force, U.S. Army, U.S. Navy and Marine Corps. There are sections that cover the various Military Auxiliary Radio Services and the U.S. Air Force Civil Air Patrol auxiliary service.

There is also a chapter that covers call signs and ALE identifiers for the U.S. Coast Guard service. Sections in that chapter include a Coast Guard aircraft fleet list, miscellaneous U.S. Coast Guard calls, and also their international call signs.

Another large chapter covers various U.S. Government call signs. Sections in this chapter include the U.S. Custom and Border Patrol COTHEN radio system and ALE address list, plus call signs from the following department and agencies - Department of Commerce (DOC), Department of Energy (DOE), Department of Homeland Security (DHS), Department of the Interior (DOI), Department of the Interior (DOI) Bureau of Indian Affairs, Department of Justice (DOJ), Department of State, Department of Transportation, Department of Veterans Affairs (DVA), Drug Enforcement Administration (DEA), Environmental Protection Agency, Federal Aviation Administration, Federal Bureau of Investigation (FBI), Federal Communications Commission, Federal Emergency Management Agency (FEMA), Federal Highway Administration (FHWA), General Services Administration (GSA), Health and Human Services, Housing and Urban Development Department (HUD), Miscellaneous Listings, National Aeronautics and Space Administration, National Communications System (NCS), and U.S. Marshal Service (USMS) service.

One of the larger chapters is devoted to an international/worldwide call signs list. We have a sampling of government and military call signs from 75 countries and international agencies.

The latest craze in aircraft military is decoding Mode-S/ICAO24 radio signals and is included in this book. Our list in this edition covers primarily government/military aircraft and introductory material on Mode-S monitoring.

using a diplomatically cleared call sign. Unit static/tactical call signs will still be used on training and JA/ATT missions. Tanker aircraft will continue to use their unit static/tactical call signs for training sorties and operational air refueling missions. Tanker aircraft will use the assigned call sign on cargo carrying legs when the REACH call sign is normally used.

Aircraft	Tail Number	Assigned Call Sign
KC-10A	83008076	REACH 8376
KC-10A	83008080	REACH 8380
KC-10A	83008081	REACH 8381
KC-10A	83008082	REACH 8382
C-141B	67000028	REACH 6728
C-17A	97000041	REACH 9741
C-17A	97000042	REACH 9742
C-17A	97000043	REACH 9743
C-17A	97000044	REACH 9744
C-17A	97000045	REACH 9745
KC-135T	58000049	REACH 5849
KC-135T	58000050	REACH 5850
KC-135R	58000051	REACH 5851
KC-135R	58000052	REACH 5852

NORAD Call Signs

Sector	Location	Static	Collective
East	Griffiss AFB NY	HUNTRESS	BACK BURNER
West	McChord AFB WA	BIG FOOT	DEER HUNTER
Alaska	Elmendorf AFB AK	TOP ROCK	TOP COVER
Canada East	Wenatchee Bay ON	SIDE CAR	BREW MASTER

C-17 Aircraft Air Force Reserve Command (AFRC)/Air National Guard (ANG) Unit Call Signs

Training Missions: Aircraft will use the unit static call sign prefix followed by a 2-digit suffix assigned by the parent unit.

Operational Missions: Use call signs assigned by OPORD, FRAG, or diplomatic clearance. If no call sign has been assigned, use unit static call signs. When flying AMC missions, and no other call sign had been assigned, use the REACH call sign followed by the last digit of the year the aircraft was built and the last 3 digits of the aircraft tail number (or as required by diplomatic clearance). To complete flight plans, put the letters RCH followed by the last digit of the year the aircraft was built and the last 3 digits of the aircraft tail number.

The REACH 01 and REACH 18 call signs are reserved for the AMC/CC and 18 AF/CC respectively.

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Sample page from 784 page International Call Sign Handbook 5th Edition is packed with information every monitor needs. (Courtesy: Teak Publishing)

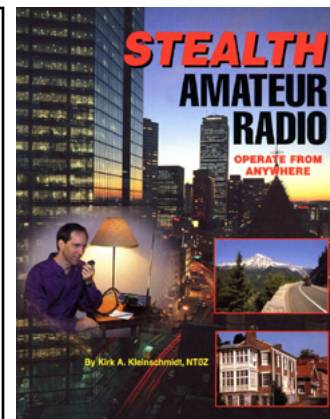
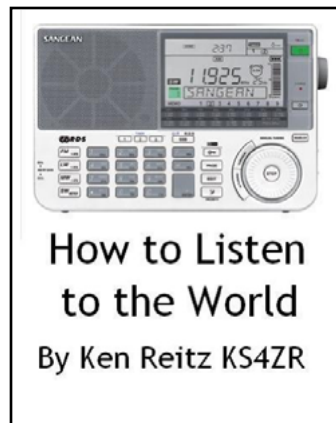
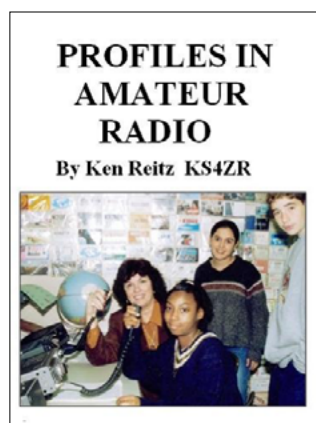
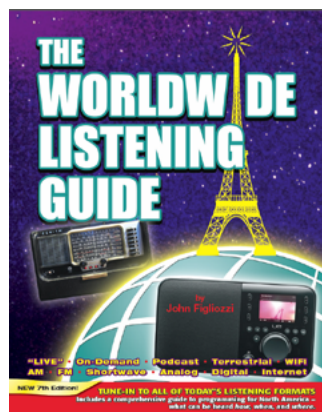
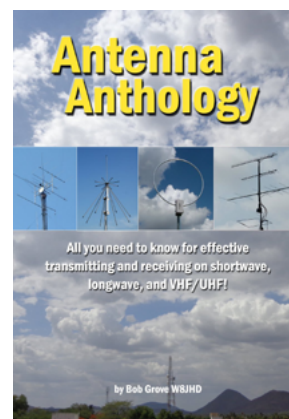
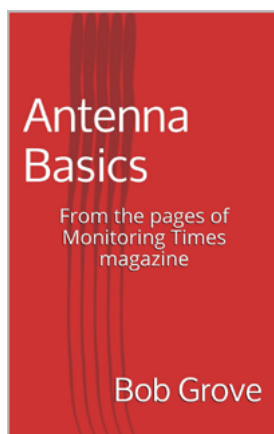
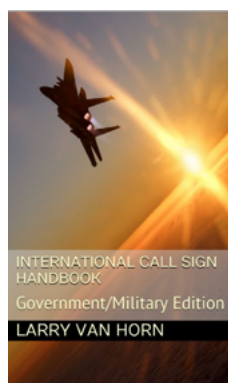
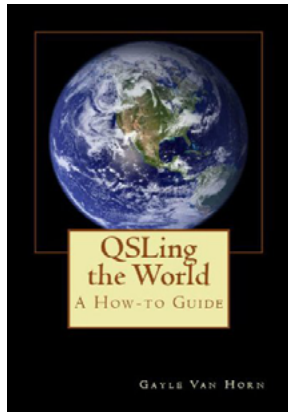
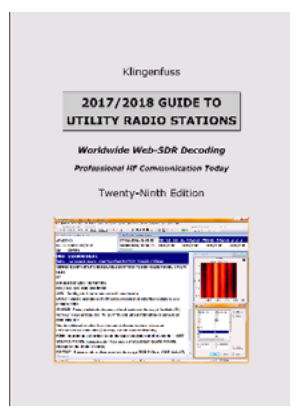
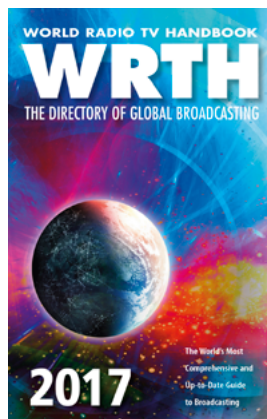
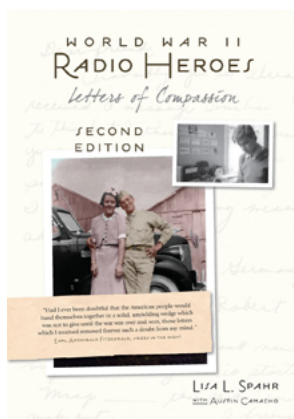
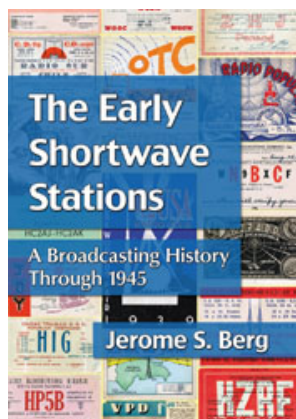
The last chapter of this book contains a large list of resource information, useful in interpreting the individual entries listed in the book. Sections on U.S. Navy ship/squadron classifications; U.S. Coast Guard cutter designators; a massive list of abbreviations and acronyms that appear in the book; a comprehensive country abbreviation list; and the latest Table of Allocations of International Call signs from the International Telecommunications Union (ITU) are included in the last chapter on the e-book.

The Teak Publishing 5th International Call Sign Handbook is now available for purchase worldwide from Amazon.com at <http://www.amazon.com/dp/B01MQWYDPX>. The price for this e-Book edition is \$7.49. You do not need to own a Kindle reader to read Amazon e-publications. You can read any Kindle book with Amazon's free reading apps. A Kindle e-book allows you to buy your book once and read it anywhere. You can find additional details on these apps at this link on the Amazon website at www.amazon.com/gp/feature.html?ie=UTF8&docId=1000493771.

[Text and graphic courtesy: Teak Publishing]

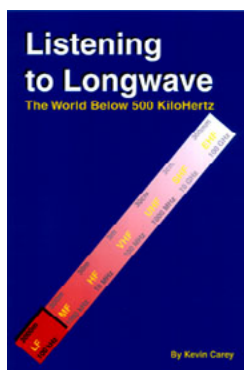
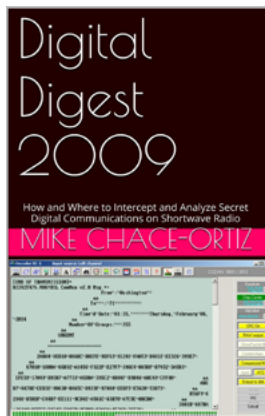
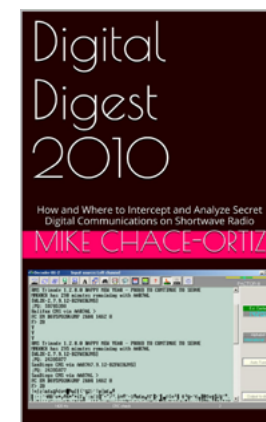
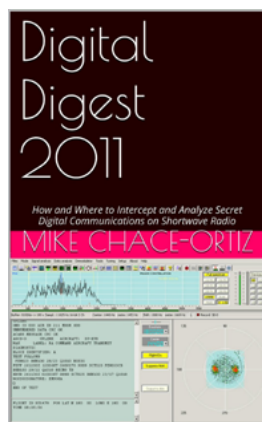
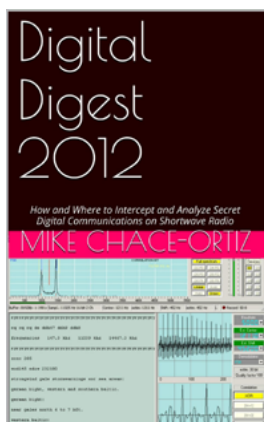
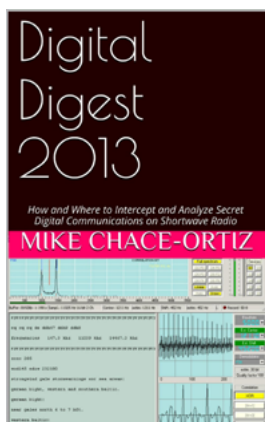
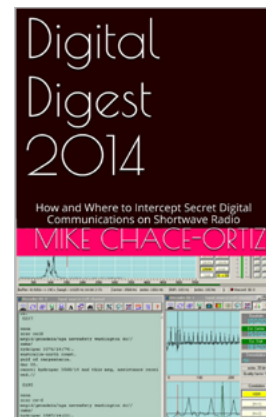
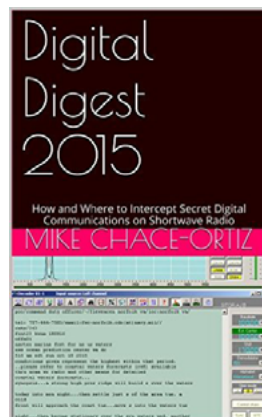
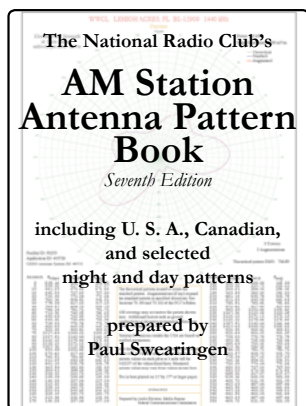
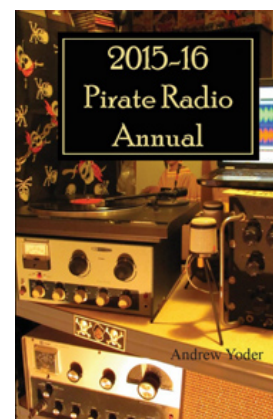
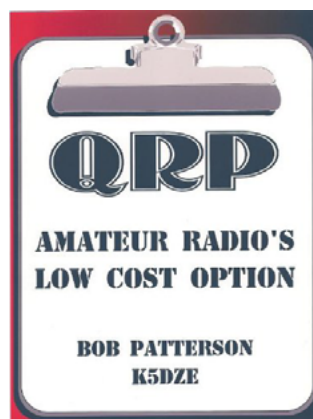
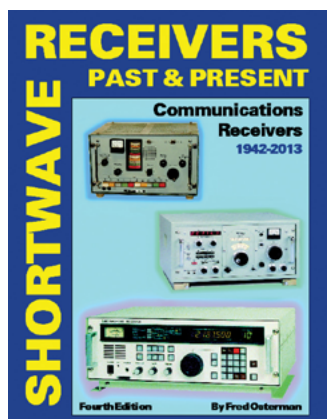
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ABOUT US

The Spectrum Monitor Writers' Group

The Spectrum Monitor is edited and published by Ken Reitz KS4ZR, former managing editor, features editor, columnist and feature writer for *Monitoring Times*. Former feature writer and columnist for *Satellite Times*, *Satellite Entertainment Guide*, *Satellite Orbit*, *Dish Entertainment Guide*, *Direct Guide*; contributing editor on personal electronics for *Consumers Digest*. Author of the Kindle e-books "How to Listen to the World" and "Profiles in Amateur Radio." E-mail: editor@thespectrummonitor.com

The Spectrum Monitor Writers' Group consists of former columnists, editors and writers for *Monitoring Times* and *Popular Communications* magazines. Below, in alphabetical order, are the columnists, their amateur radio call signs, the name of their column in *The Spectrum Monitor*, a brief bio and their websites and contact information.

Keith Baker KB1SF/VA3KSF, "Amateur Radio Satellites"

Past president and currently treasurer of the Radio Amateur Satellite Corporation (AMSAT). Freelance writer and photographer on amateur space telecommunications since 1993. Columnist and feature writer for *Monitoring Times*, *The Canadian Amateur* and the *AMSAT Journal*. kb1sf@hotmail.com www.kb1sf.com

Kevin O'Hern Carey WB2QMY, "The Longwave Zone"

Reporting on radio's lower extremes, where wavelengths can be measured in miles, and extending to the start of the AM broadcast band. Since 1991, editor of "Below 500 kHz" column for *Monitoring Times*. Author of "Listening to Longwave" (<http://www.universal-radio.com/catalog/books/0024u.html>). This link also includes information for ordering his CD, "VLF RADIO!", a narrated tour of the longwave band from 0 to 530 kHz, with actual recordings of longwave stations. E-mail: wb2qmy@arrl.net

Mike Chace-Ortiz AB1TZ/G6DHU "Digital HF: Intercept and Analyze"

Author of the *Monitoring Times* "Digital Digest" column since 1997, which follows the habits of embassies, aid organizations, intelligence and military HF users, the digital data systems they use, and how to decode, breakdown and identify their traffic. www.chace-ortiz.org/umc

Dan Farber AC0LW, "Antenna Connections"

Monitoring Times antenna columnist 2009-2013. Building ham and SWL antennas for over 40 years. E-mail: ac0lw@att.net.

Richard Fisher KI6SN

A veteran journalist with a 35-year career in daily newspapers, and an amateur radio operator living in Riverside, California, Richard has been an editor and writer for *Popular Communications*, *WorldRadio Online*, and *CQ Amateur Radio* magazines. Among his previous responsibilities have been the monthly "Emergency Communications," "Trail-Friendly Radio" and "Easy Does It" columns for *CQ*, and has written for several QRP publications, including *QRP Quarterly* and *QRPP* magazine. An avid homebrewer, he is a co-founder of The Adventure Radio Society. Write to him at ki6sn@aol.com.

Tomas Hood NW7US, "Radio Propagation"

An Extra Class operator since 1990, Tomas enjoys CW and digital modes on all HF bands. He is a contributing editor to *CQ Amateur Radio*, the former *Popular Communications* and *CQ VHF* magazines, an ARRL publication on QRP communications, and *Monitoring Times*. He runs the Space Weather and RadioPropagation Center at <http://SunSpotWatch.com>. Web site: <http://nw7us.us> Twitter: <https://twitter.com/NW7US>.

Kirk Kleinschmidt NT0Z, "Amateur Radio Insight"

Amateur radio operator since 1977 at age 15. Author of "Stealth Amateur Radio." Former editor, "ARRL Handbook," former *QST* magazine assistant managing editor, columnist and feature writer for several radio-related magazines, technical editor for "Ham Radio for Dummies," wrote "On the Ham Bands" column and numerous feature articles for *Monitoring Times* since 2009. Web site: www.stealthamateur.com. E-mail: nt0z@stealthamateur.com

Joe Lynch N6CL, “VHF and Above”

Currently Director of Religious Education for the Army at West Point, New York. He holds a Doctor of Ministry, Master of Divinity, an MBA and is an adjunct instructor for four colleges and universities and a retired United Methodist minister. He served as the editor of *CQ VHF* magazine for 12 years and the VHF editor for *CQ* magazine for 22 years.

Stan Nelson KB5VL, “Amateur Radio Astronomy”

Amateur radio operator since 1960. Retired after 40-plus years involved in mobile communications/electronics/computers/automation. Active in radio astronomy for over twenty years, specializing in meteor monitoring. He wrote the “Amateur Radio Astronomy” column for *Monitoring Times* since 2010. A member of the Society of Amateur Radio Astronomers (SARA). www.RoswellMeteor.com. E-mail: Stan.Nelson@RoswellMeteor.com

Chris Parris, “Federal Wavelengths”

Broadcast television engineer, avid scanner and shortwave listener, freelance writer on federal radio communications since 2004, wrote the “Fed Files” column for *Monitoring Times*. <http://thefedfiles.com> <http://mt-fedfiles.blogspot.com> Twitter: @TheFedFiles E-mail: cparris@thefedfiles.com

Rich Post KB8TAD, “Adventures in Radio Restorations”

As a teenager Rich Post repaired radios and TV sets. He passed the exam for a First Class FCC license when he was told he needed one to repair his CB. He later received his amateur radio license as KB8TAD. Rich now holds a University Emeritus title having retired from Ohio University as Assistant Dean and Director of the Instructional Media and Technology Services. One of his hobbies is collecting and restoring “boat anchors.” He maintains the web site Boat Anchor Pix at www.ohio.edu/people/postr/bapix.

Tony Roper, “Military Air and Naval Reception”

A Civil Air Traffic Controller in the UK as well as previously being in ATC in the Royal Air Force, totaling 25 years experience. He has worked as a part-time aviation photographer/writer and has been published worldwide. He also provides photos and research for IHS Jane’s, principally Jane’s Fighting Ships. His photography website is www.rogdabbitt.co.uk and his blog is <http://planesandstuff.wordpress.com>

Cory GB Sickles WA3UVV, “Digitally Speaking”

First licensed as a Novice over 40 years ago, he enjoys exploring various facets of amateur radio, from the latest state of the art technologies, to the elegant simplicity found with a one-tube transmitter and straight key. He has an extensive background with computers and likes to restore 8, 12 and 16-bit classics from the 1970s. He owns a television production company and creates series programming, as well as marketing and training videos. wa3uvv@gmail.com.

Hugh Stegman NV6H, “Utility Planet”

Longtime DXer and writer on non-broadcast shortwave utility radio. Former “Utility World” columnist for *Monitoring Times* magazine for more than ten years. Web site: www.ominous-valve.com/uteworld.html Blog: <http://mt-utility.blogspot.com> /email: mtutilityworld@gmail.com Twitter: @UtilityPlanet

Dan Veeneman, “Scanning America”

Software developer and satellite communications engineer writing about scanners and public service radio reception for *Monitoring Times* for 17 years. Web site: www.signalharbor.com E-mail: dan@signalharbor.com

Ron Walsh VE3GO, “Maritime Monitoring”

Retired career teacher, former president of the Canadian Amateur Radio Federation (now the Radio Amateurs of Canada), retired ship’s officer, licensed captain, “Boats” columnist and maritime feature writer for *Monitoring Times* for eight years. Avid photographer of ships and race cars. E-mail: marinecolumn@gmail.com.

Fred Waterer, “The Shortwave Listener”

Former “Programming Spotlight” columnist for *Monitoring Times*. Radio addict since 1969, freelance columnist since 1986. Fascinated by radio programming and history. E-mail: programming_matters@yahoo.ca